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Abstracts and Programme

EUROANAESTHESIA 2005

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EUROANAESTHESIA 2005

Annual Meeting of the European Society of Anaesthesiology

Vienna, Austria, May 28–31, 2005

ABSTRACT PRESENTATION PROGRAMME

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A-1

Effect of a protective-ventilation strategy on systemic inflammation after esophagectomy

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Background and Goal of Study: Esophagectomy is characterised by a marked postoperative inflammatory reaction. The mechanical ventilation (MV) including a prolonged period of one-lung ventilation (OLV) could influence the peri-operative systemic inflammatory response. The aim of this prospective, randomised study was to compare two ventilatory strategies on the systemic peri-operative pro-inflammatory response.

Materials and Methods: 50 patients undergoing a radical esophagectomy were randomly assigned into a conventional MV group [tidal volume of $9\,ml \cdot kg^{-1}$ during two and one-lung ventilation, no positive end-expiratory pressure (PEEP)] or a protective MV group [tidal volume of $9\,ml \cdot kg^{-1}$ during two-lung ventilation and $5\,ml \cdot kg^{-1}$ during OLV, PEEP 5 cmH_2O]. Successive arterial blood samples for IL-1 β, IL-6 and IL-8 levels were taken after induction of anesthesia (Time A), 15 minutes after the end of abdominal time (Time B), two (Time C) and 18 hours (Time D) after the end of surgical procedure.

Results and Discussions: Data (Mean ± SD) are shown in the table.

					ANOVA		
	T A	T B	T C	T D	Time	Ventilation	Interaction
IL-1 β pg/ml							
CV	0.12 ± 0.04	0.33 ± 0.34	1.14 ± 0.89	0.54 ± 0.18	$P < 0.001$	$P < 0.001$	$P < 0.001$
PV	0.14 ± 0.13	0.17 ± 0.13	0.39 ± 0.27	0.30 ± 0.21			
IL-6 pg/ml							
CV	0	70 ± 85	341 ± 243	222 ± 280	$P < 0.001$	$P = 0.002$	$P = 0.01$
PV	0	30 ± 19	149 ± 74	114 ± 80			
IL-8 pg/ml							
CV	7 ± 6	27 ± 19	92 ± 66	59 ± 40	$P < 0.001$	$P < 0.001$	$P = 0.003$
PV	5 ± 2	21 ± 13	52 ± 30	27 ± 18			

Conventional ventilation (CV), protective ventilation (PV).

Conclusion(s): In patients undergoing esophagectomy, a protective ventilatory strategy lead to a decrease in peri-operative systemic pro-inflammatory response.

A-2

Hypertonic saline/hydroxy-ethyl starch infusion during CPR from out-of-hospital cardiac arrest: a randomized preclinical trial

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Background and Goal of Study: Infusion of hypertonic saline (7.2%) during cardiopulmonary resuscitation (CPR) improved in animal models resuscitation success rate, and myocardial as well as cerebral blood flow (1–3). The concept of volume expansion during CPR was tested in a randomized, double-blinded, prospective preclinical trial.

Methods: 200 patients with out-of-hospital cardiac arrest (CA) of presumed cardiac origin, age 18–80 years, duration of untreated CA ⩽ 16 min, and body weight ⩽125 kg, either received 2 ml/kg/10 min HyperHAES® (7.2% NaCl in 6% hydroxyl-ethyl-starch [HES]; Fresenius Kabi, Bad Homburg, BRD) or HES 6% i.v. during CPR performed according to the AHA-guidelines. Endpoints of the study were return of spontaneous circulation (ROSC), hospital admission, and neurologic outcome at hospital discharge. Neurologic outcome was assessed using the cerebral performance category (CPC).

Results and Discussion: ROSC was achieved in 61/101 (60.4%) patients receiving HyperHAES® and in 59/99 (59.6%) receiving HES 6%. Hospital admission rates were 54.5% (HyperHAES®) and 48.5% (HES 6%). 23 (22.8%) patients in the HyperHAES®- and 22 (22.2%) in the HES-group were discharged from the hospital, and significantly more patients with favorable neurologic outcome (CPC 1 and 2) after volume expansion during CPR with HyperHAES® (12 vs. 5 [HES]; CPC 3 and 4: 11 vs. 17 [HES]; $P < 0.05$, Pearson's chi square test). Plasma sodium concentration increased to 175 ± 28 mmol/l during application of HyperHAES®, but already decreased to 146 ± 6 mmol/l at hospital admission.

Conclusion: Infusion of 2 ml/kg/10 min HyperHAES® during CPR is safe and might improve neurologic outcome after out-of-hospital CA. Improved neurologic outcome is presumably due to reduced postischemic cerebral reperfusion disturbances. A clinical multicenter study is required to prove that the concept of osmotic volume expansion during CPR is an effective measure to reduce neurologic damage after CA.

References:

1 Fischer M, Dahmen A, Standop J, et al. Resuscitation 2002; 54: 269–80.
2 Breil M, Krep H, Sinn D, et al. Resuscitation 2003; 56: 307–17.
3 Krep H, Breil M, Sinn D, et al. Resuscitation 2004; 63: 73–83.

A-3

Independent risk factors for postoperative shivering

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Background and Goal of Study: Postoperative shivering (PAS) is uncomfortable for patients and potentially risky (1). The aim of this observational trial was to identify independent risk factors for PAS after general anaesthesia (2).

Materials and Methods: The study was approved by the local ethics committee. Potential risk factors for PAS were recorded in 1,340 consecutive patients. Signs of shivering, peripheral and core temperature, and thermal comfort were recorded in the postanaesthetic care unit. The data were split into an evaluation dataset (n = 1000) and a validation (n = 340) dataset. The first was used to identify independent risk factors for PAS and to formulate a risk score using backward-elimination logistic regression analysis. The proposed model was subsequently tested for its discrimination and calibration properties using ROC-curve analysis and linear correlation between the predicted and the actual incidences of PAS in the validation group.

Results and Discussions: The incidence of PAS was 11.6%. There were three major risk factors: young age, endoprothetic surgery, and core hypothermia — with age being the most important. The risk score derived from this analysis had a reasonable discriminating power, with an area under the ROC-curve of 0.69 (95%-CI: 0.60−0.78; $P < 0.0001$). Furthermore the equation of the calibration curve ($y = 0.69x + 6$; $R^2 = 0.82$; $P < 0.05$) indicated a good and statistically significant agreement between predicted and actual PAS incidence.

Conclusion: Postoperative shivering can be predicted with acceptable accuracy using the four risk factors identified in the present study. The presented model may serve as a clinical tool to help clinicians to rationally administer prophylactic anti-shivering drugs.

References:

1 Buggy DJ, Crossley AW. Thermoregulation, mild perioperative hypothermia and postanaesthetic shivering. Br J Anaesth 2000;84:615–28.
2 Crossley AW. Six months of shivering in a district general hospital. Anaesthesia 1992;47:845–8.

A-4

Impact of omega-3 fatty acids on mortality and length of hospital stay in severely ill patients

A.R. Heller, S. Roessler, R.J. Litz, B. Gottschlich, S.C. Heller, T. Koch

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Background and Goal of Study: Supplementation with omega-3 fatty acids, exerts immune-modulating and organ-protective effects, even after short term infusion in both postoperative and critically ill patients (1,2).

Materials and Methods: After approval by the institutional Ethic Review Board we evaluated the effect different doses of fish oil (FO) emulsion (Omegaven-Fresenius-Kabi) on the clinical course of severely ill patients. Primary study end point was survival, secondary end points were length of hospital stay and use of antibiotics, with respect to the primary diagnosis. 661 Patients who received total parenteral nutrition (TPN) for at least 3 days from 82 German hospitals were enrolled in this prospective multicenter trial. The cohort was divided into 5 groups according to the administered FO dose.

Results and Discussions: The patients of this survey were 62 ± 17 years old (SAPS II 32 ± 14). TPN including FO had most favourable effects on survival, infection rates and length of stay when administered in doses between 0.1–0.2 g/kg/d. Diagnosis-related optimum FO doses are given in fig. The dose/kg/d of FO had 2 to 20 times higher impact on outcome parameters than the ratio of n3/n6 which is considered to be a major determinant of beneficial n3 effects in current literature.

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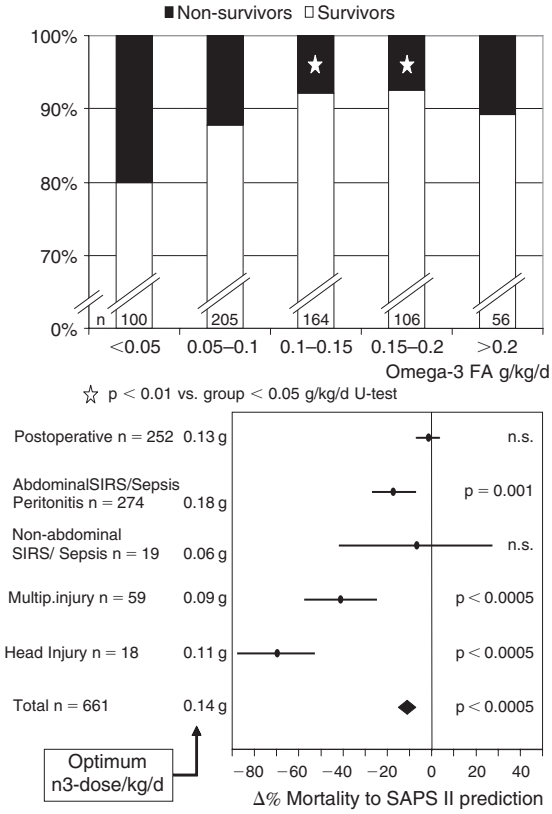

Conclusion: Fish oil administration may reduce mortality, antibiotic use, and length of hospital stay. Individual optimum FO doses and effect sizes are diagnosis-dependent.

Acknowledgements: The authors thank R. Koch and J. Novotny for their biomathematical advise.

References:

1 Gadeck JE, et al. Crit Care Med 1999.
2 Heller AR, et al. Int J Cancer 2004.

A-5

Modifying the baricity of local anaesthetics for spinal anesthesia by temperature adjustment – model calculations

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Background and Goal of Study: The baricity of local anaesthetics (LA) in relation to cerebrospinal fluid (CSF) determines LA distribution in the subarachnoid space (SAS). While LA are hyper- or isobaric at room temperature, baricity drops within minutes after administration in the SAS. LA become hypobaric and therefore lead to uncontrolled cranial extension during spinal anaesthesia (SPA). The aim of the study was to describe temperature-dependent changes in LA baricity using mathematical model analysis.

Materials and Methods: After institutional approval and written informed consent baricity of LA commonly used for SPA A = Bupivacaine 0.5%; B = L-Bupivacaine 0.5%, C = Ropivacaine 0.5%; D = Articaine 2%, as well as baricity of CSF of patients undergoing SPA (n = 7) were measured using a high precision densiometer (DMA 450 Paar, Graz, Austria, precision 0.00001 g/ml, 0.00001°C). Temperature was adjusted to 5, 20, 30, and 37°C. The density of aqueous solutions such as LA behaves in a temperature dependent non-linear manner which can be described by a 3rd degree polynomial equation. For clinical purpose, however, consideration of a simple quadratic equation is as applicable concerning precision ($p < 0.0005$; $r^2 = 0.999$).

Results: are depicted in the table below.

	Density 20°C [g/ml]	Density 37°C [g/ml]	Density-equation (T = temperature [°C])
A	1.004564 ± 0.000014	0.999546 ± 0.000014	$1.0068–5.28*10^{-6}*T^2$
B	1.005259 ± 0.000028	1.000112 ± 0.000028	$1.0075–5.28*10^{-6}*T^2$
C	1.004598 ± 0.000042	0.999526 ± 0.000042	$1.0068–5.34*10^{-6}*T^2$
D	1.006170 ± 0.000017	1.001011 ± 0.000017	$1.0084–5.35*10^{-6}*T^2$

Density of CSF was 1.000646 ± 0.000086 g/ml. Mathematical conversion of the calculated equation enables determination of the temperature in °C at which LA are isobaric (A) 35.08357; (B) 37.02509; (C) 35.08357; (D) 39.38092.

Conclusion: Baricity of CSF is just one of the factors affecting the cranial extent during SPA. Thus, the clinical impact of our findings e.g. on hemodynamic stability must be confirmed in clinical studies.

A-6

Functional imaging of the visual cortex during wakefulness and during intravenous anaesthesia

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Background and Goal of Study: Previous studies in primates and humans found a strong and reproducible visually induced functional magnetic resonance imaging (fMRI) signal in the visual cortex during mild isoflurane anaesthesia. Accordingly, we hypothesized that visual stimulation might also activate the human visual cortex during intravenous anaesthesia. The aim of this study was to assess the effect of propofol/remifentanil anaesthesia on visual-evoked activation of the visual cortex using fMRI-technique.

Materials and Methods: We studied four volunteers during wakefulness and eight patients during deep surgical anaesthesia maintained with propofol/remifentanil. For visual stimulation a binocular flash stimulus (1.7 Hz) was presented as a block design composed of 8 stimulation periods alternating with resting periods defined by the absence of the experimental stimulus with both periods lasting 25 s. Visual processing was analysed using cross-correlation analysis ($r > 0.4$; $P < 0.0001$, uncorrected). For data analysis the fMRI software tool BrainVoyager 2000 was used.

Results and Discussions: Mean propofol plasma target concentration was 4.21 ± 0.64 μg/ml and mean rate of remifentanil infusion was 0.31 ± 0.09 μg/kg/min during fMRI data acquisition. Binocular visual stimulation during wakefulness as well as during propofol/remifentanil anaesthesia produced a significant activation in the visual cortex including the striate (Brodmann's area (BA) 17) and the extrastriate visual cortex (BA 18, 19). The finding of activated areas in the anaesthetised brain indicates that the underlying mechanism of the fMRI signal is preserved during surgical concentrations of propofol and remifentanil.

Conclusions: (1) This study demonstrates that early visual information processing is preserved during general anaesthesia induced by the intravenous anaesthetics propofol and remifentanil. (2) The fMRI method may be appropriate for further investigating the effect of different anaesthetics on various neuronal networks.

Acknowledgements: This study was funded by KÖLN FORTUNE, 66/2001.

Evidence Based Practice and Quality Assurance

A-7

Price information at point of use reduces anaesthetic drug costs

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Background and Goal of Study: Some drugs used by anaesthetists are very expensive and greatly increase the cost of anaesthesia. Previous studies suggest cost awareness is limited (1,2). The aim of this study was to determine whether making drug prices available at point of use reduced costs.

Materials and Methods: In a 16 week prospective study, price information was supplied by 2 methods. A price gun was used to attach 'point of use price stickers' to the drug packaging. Price lists were also displayed on the theatre drug cupboard showing expensive drugs and cheaper alternatives. There were 2 equal measurement periods: a control period of drug use without cost information and a study period with cost information. Drug use was tracked by ascribe drug inventory system. A theatre book audit established

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activity (number of cases performed and total anaesthetic time). Weekly replicates of data were recorded to allow statistical analysis. Results calculated as mean cost in £ sterling (±SD) and compared with unpaired 2 tailed Student's t test ($p < 0.05$ significant).

Results and Discussions: Cost information led to a reduction in volatile costs of 40% with a decrease in sevoflurane use and an increase in isoflurane and desflurane use (Table 1). This is consistent with migration from the expensive drug to cheaper alternatives. There was no change in the use of propofol for infusion. Remifentanil cost reduced by almost 25% with no change in fentanyl and morphine use. No significant difference in theatre activity was demonstrated between the study periods.

Table 1. Results presented as mean cost per week (£).

Drug	Control period mean (±SD)	Study period mean (±SD)	p
Sevoflurane	740(110)	357(46)	0.01
Desflurane	54(6)	95(13)	0.032
Isoflurane	13.5(3.8)	26.9(4.2)	0.026
Remifentanil	270.5(23)	193.9(25)	0.038
Morphine	26.25(5.1)	20.5(3.9)	0.59
Fentanyl	25.25(4.7)	26.13(6.7)	0.98

Conclusion(s): A change in drug use patterns in response to cost information and a consequent reduction in drug spend is demonstrated.

References:

1 Schlunzen L et al Acta Anaes Scand 1999;43:202–205.
2 Bailey C et al Anaesthesia 1993;48:906–909.

A-8

Awareness of drug costs in anaesthetic practice

C.P. Gardiner, M. Sim, D.A. Varveris, N.G. Smart

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Background and Goal of Study: Anaesthetists must continually assess their choices in a cost containment environment (1). To make cost conscious decisions, the cost of each drug and its alternatives must be known but this knowledge may be lacking (2,3). This study examines cost awareness in a UK anaesthetic department.

Materials and Methods: 20 trainees and 30 consultants were asked by questionnaire to estimate the net price of 10 commonly used drugs. Estimated and true costs were compared thus: % *difference of correct cost* = *(estimate − true cost)/true cost* × 100.

Data presented as medians and ranges. Estimates for the 2 groups compared with Kruskal Wallis test ($p < 0.05$ significant).

Results and Discussions: Response rate was 84%. 39% of estimates were within 50% of the true price and 67% within 100%. Costs of some relatively expensive drugs such as sevoflurane were underestimated while less costly drugs like isoflurane were overestimated (see Table). Choice may depend on the perceived cost difference between drugs. Overestimation of the cost of a cheaper drug may then be important, especially if the price of the more expensive drug is at the same time underestimated.

DRUG	Consultants n = 27 (range)	Trainees n = 15 (range)
Isoflurane	1.13(−0.29, +13.18)	1.12(−0.57, +9.64)
Sevoflurane	−0.66(−0.90, +1.56)	−0.53(−0.96, +0.28)
Desflurane	−0.13(−0.68, +5.49)	−0.03(−0.13, +2.26)
Fentanyl	7.82(+0.18, +28.41)	7.28(+0.76, +32.53)
Morphine	−0.14(−0.79, +6.14)	0.19(−0.76, +3.76)
Remifentanil	1.46(−0.54, +9.90)	−0.09(−0.73, +8.09)
Ondansetron	0.07(−0.79, +3.54)	0.34(−0.76, +3.01)
Granisetron	−0.40(−0.89, +1.8)	−0.33(−0.87, +1.67)
Ketorolac	1.27(−0.54, +8.09)	0.36(−0.30, +10.81)
Diclofenac	1.73(−0.55, +11.73)	1.27(−0.09, +11.73)

Conclusion(s): Significant errors in cost estimations were observed. Overall this study shows that cost awareness is lacking among anaesthetists in a UK hospital setting.

References:

1 Kapur P. Anes Analg 1994;78:617–618.
2 Bailey C et al. Anaesthesia 1993;48:906–909.
3 Schlunzen L et al. Acta Anaes Scand 1999;43:202–205.

A-9

The contribution of nonsurgical time to session time depends strongly on total session time

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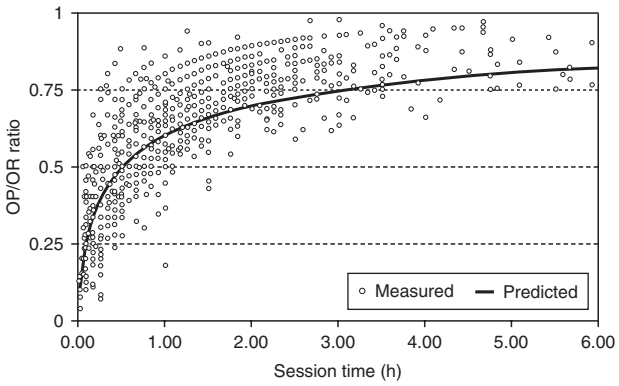
Background and Goal of Study: Reducing the time needed for induction of and emergence from anaesthesia and the turnover time between patients is considered an important factor for improving OR efficiency and productivity. Thus the ratio of surgical time (OP) to session time (OR) should be high. Since we assumed that the contribution of nonsurgical time to session time decreases with increases in surgical time, we studied the dependence of the OP/OR ratio on case length.

Materials and Methods: Throughout times were calculated of 8950 sessions undergoing surgery under anaesthesia (general or regional) in a university medical centre. Session times (OR), surgical times (OP) and the ratio OP/OR were calculated for each case. The relationship between the OP/OR ratio versus OR was modelled with the equation $OP/OR_{pred} = OR^{\gamma}/OR^{\gamma} + MOR^{\gamma}$ where MOR is the mean session time and γ a power value describing the steepness of the curve.

Results and Discussions: 31% of the OP/OR ratio's were 0.5 of less and 11% of these ratio's were higher than 0.8. There was a strong correlation between OR and OP ($r^2 = 0.938$). The OP/OR ratio was strongly dependent on OR ($r^2 = 0.783$). On average, if the OR is >0.28 h the OP/OR will be >0.5.



Conclusion(s): Improving OR efficiency by shortening nonsurgical time is relevant only if nonsurgical times have a significant contribution to session times. With the operating mix of a university hospital session times are long and OP/OR ratio's largely >0.5. In these cases efficiency measures should target surgical efficiency.

A-10

Utilization of allocated block time: analysis of different factors

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Background and Goal of Study: Allocation of block time and first starting times in operating rooms (OR) is a major challenge for OR managers and anesthesiologists (1). The aim of this study was to determine the utilization of allocated block OR time by surgical services with the inclusion of turnover time (TT).

Materials and Methods: Data were collected prospectively from OR schedule of five different surgical services between February 1, 2004 and March 31, 2004. Workday hours were identified from 8:00 AM to 4:00 PM (Monday through Friday) for forty days. Definitions of terminology are listed.

Total Case duration (TCD): The time when the patient is in the operating room.

Turnover time (TT): The period from previous patient out-rooms to the new patient in-room time.

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Total operation duration (TOD): Summing the total case duration and turnover time.
Anaesthesia time: The period when the patient was in-room to the completion of anaesthesia preparation till the skin disinfection.

Results and Discussions: We evaluated 728 surgical cases that were performed in five operating rooms on 19200 minutes for each. There were no differences between surgical clinics in respect of OR utilization. Mean TT was 9 ± 1.14 and mean AT was 8 ± 0.70 (min ± SD) for all clinics. Results are shown in Table 1.

Table 1. Data of surgical clinics in respect of OR utilization.

Clinics	No of cases	TCD (min)	TOD (min)	TT (min)	AT (min)	Ratio of TT/TOD (%)	Ratio of TT/19200 min (%)
A	136	17270	18620	1400	1215	7.49	7.20
B	162	15136	17505	2363	1330	13.49	12.30
C	155	18265	20645	2380	1155	11.55	12.39
D	132	13495	16505	3010	1405	18.23	15.60
E	133	15420	17590	2670	1560	15.17	11.30

Conclusion: As a conclusion, turnover time can be reduced by improving the hospital and personal equipment. On the other hand type of surgery and anesthetic management are the other factors that affect the OR utilization.

Reference:

1 Abouleish AE, Hensley SL, Zornow MH, Prough DS. Anesth Analg 2003; 96: 813–8.

A-11

Intraoperative event: a predictive indicator of post anesthesia care unit jam?

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Background and Goal of Study: The systematic collection and analysis of incidents is essential for risk management, but consequences of intraoperative events are often difficult to assess. Do they influence Post Anesthesia Care Unit (PACU) length of stay (LoS)?
Materials and Methods: From 01/2000 to 04/2004, every anesthesia is described with the patient features, the anesthetic technique and the occurrence of events (out of a list of 58), using a preformatted sheet then recorded in a data base. An univariate, then multivariate analysis were performed to assess associations between the occurrence of an intraoperative event and PACU LoS in Quartile (Q), taking into account age (Q), ASA physical status, surgery duration (Q), transfusion need, anesthetic technique.
Results and Discussions: All the anesthesia procedures have been analyzed (n = 19118). 22% are associated with incidents. PACU LoS is respectively 141 ± 100 min and 102 ± 110 min according to the occurrence of an incident or not ($p < 0.05$). As expected, patients who experience an intraoperative incident are older (53 ± 37 vs 46 ± 23) and suffer from a worse condition (ASA status) ($p < 0.05$). Odds ratio (OR) of associated factors are:

Incident associated factors	OR	CI 95%	p
Pacu [70–100] min (*vs <70*)	2.2	[1.9–2.5]	<0.001
Pacu [100–135] min (*vs <70*)	2.3	[2.6–3.5]	<0.001
Pacu ⩾ 135 min (*vs <70*)	3.0	[1.5–2.0]	<0.001
Age [30–45] (*vs <30*)	1.1	[1.0–1.2]	NS
Age [46–64] (*vs <30*)	2.4	[2.1–2.7]	<0.001
Age [65–98] (*vs <30*)	3.2	[2.8–3.7]	<0.001
ASA 2 (*vs ASA 1*)	1.1	[1.0–1.2]	NS
ASA 3 (*vs ASA 1*)	1.3	[1.1–1.5]	<0.001
ASA 4–5 (*vs ASA 1*)	1.5	[1.2–2.2]	<0.001
Surg [50–90] min (*vs <50*)	1.8	[1.5–2.0]	<0.001
Surg [90–145] min (*vs <50*)	2.3	[2.0–2.6]	<0.001
Surg ⩾ 145 min (*vs <50*)	3.6	[3.1–4.1]	<0.001
Transfusion yes (*vs no*)	1.2	[0.9–1.6]	NS
GA (*vs RA*)	1.3	[1.1–1.4]	<0.001

Reference group (OR = 1) is not displayed. The occurrence of an intraoperative incident is associated with an increase in PACU LoS, independently of age, ASA status, surgery duration, transfusion need and anesthetic technique.
Conclusion: The occurrence of an intraoperative incident is a predictive indicator of PACU stay lengthening that could be considered for PACU management.

A-13

Cost-effectiveness of neuromuscular blocking agents

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Background and Goal of Study: Neuromuscular blocking agents (NMBAs) represent a major component of anaesthesia costs (1). The aim of this study was to investigate the cost-effectiveness of commonly used NMBAs administered as equipotent boli or infusions.
Materials and Methods: Eighty ASA III patients undergoing thoracic surgery were randomly selected to receive atracurium, cisatracurium, mivacurium or rocuronium. The neuromuscular block was monitored by accelerography. During propofol and sufentanil induction 2 × ED95 was administered as a bolus. This was followed by a potency-adjusted infusion targeted towards maintaining the first twitch at 15 ± 5% of control until chest closure. Bolus and infusion costs were compared taking into account the number of entire vials used. Results are expressed as mean ± SD.
Results and Discussions: Groups were similar with regards to age (65 ± 10 yrs), weight (74 ± 13 kg), renal and hepatic function. For tracheal intubation of patients weighing up to 125 kg, mivacurium was the most cost-effective. For infusions lasting up to 1.72 hrs, mivacurium was the cheapest. The second best place was shared by atracurium (from 1.72 to 2.39 hrs and from 4.12 to 7.17 hrs) and cisatracurium (from 2.39 to 4.12 hrs and 7.17 to 8.24 hrs).

	Atracurium	Cisatracurium	Mivacurium	Rocuronium
Dose & price/vial, €	50 mg/5 ml, 5.55	20 mg/10 ml, 9.34	20 mg/10 ml, 4.85	50 mg/5 ml, 6.79
Max weight/vial for bolus, kg	100	111	125	83
Infusion rate μg/kg/min	2.37 ± 0.65	1.25 ± 0.42	3.35 ± 1.41	2.82 ± 0.89
Hrs/vial	2.39 ± 0.56	4.12 ± 1.94	1.72 ± 0.81	2.18 ± 1.94

Conclusion(s): The findings of this prospective, randomized, double blind study suggest that mivacurium is the most cost-effective NMBA for both tracheal intubation and continuous infusions lasting up to 1.72 h.

Reference:

1 DeMonaco HJ *et al.* J Clin Anesth 1994; 6: 383–7.

A-14

A quantitative systematic review on supplemental perioperative oxygen to reduce the incidence of postoperative nausea and vomiting

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Background and Goal of Study: Supplemental oxygen has been shown to decrease the incidence of postoperative nausea and/or vomiting (PONV). In order to estimate the efficacy of an increased (~80%) oxygen concentration versus routine oxygen administration (~30%) administered in the perioperative period we performed a quantitative systematic review.
Materials and Methods: Systematic search (MEDLINE, EMBASE, CENTRAL, bibliographies, all languages, up to October 2004) for randomised comparisons of supplemental oxygen versus routine oxygen in surgical patients. Relevant outcomes were the incidences of postoperative nausea (PN), postoperative vomiting (PV), PONV and rescue treatment. Combined data were analysed using relative risk (RR) with 95% confidence intervals (CI) calculated with a random effects model.
Results and Discussions: In 7 trials 742 patients received supplemental oxygen with 50–80% oxygen, balance nitrogen and 752 patients routine oxygen with 30% oxygen, balance nitrogen. These regimen were administered in the perioperative period and were maintained up to 2 hours in the postoperative period. Pooled RR for PN, PV and PONV with supplemental oxygen versus routine oxygen were 0.91 (95%-CI: 0.73–1.15), 0.78 (95%-CI: 0.62–0.98) and 0.90 (95%-CI: 0.71–1.15), respectively. RR for rescue treatment was 0.88 (95%-CI: 0.66–1.19). Due to considerable heterogeneity (I^2-Test ~ 70% for outcome "PONV") we performed a sensitivity analysis. The marginal effect on PV depends on the inclusion of 2 initial trials that were performed in patients undergoing abdominal surgery and gynecologic laparoscopy. Restricting the analysis to the remaining 5 trials with a total of 1.104 patients revealed RR for PN, PV and PONV of 1.08 (95%-CI: 0.95–1.23), 0.86 (95%-CI: 0.67–1.09) and 1.09 (95%-CI: 0.96–1.23).
Conclusion(s): In accordance with the IMPACT study (1) the perioperative administration of supplemental oxygen in order to decrease the incidence of

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PONV cannot be regarded as valid concept so far. Potential effects in abdominal surgery need further analyses.

Reference:

1 Apfel CC et al. *NEJM* 2004; 350: 2441–2451.

A-15

Comparative study between two different anesthetic techniques in living related hepatectomy

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Background: Living donor hepatectomy (LDH) is now widely used to meet the need for liver grafts due to the shortage of cadaveric livers. Donor safety and perioperative anesthetic management are our major concern; the aim of our study was to compare two anesthetic techniques for management of living donor hepatectomy.

Patients and Methods: After ethical committee approval and informed written consent, 20 donors ASA I physical status undergoing hepatectomy for living related liver transplant were allocated randomly to one of two groups. Group A where anesthesia was induced with fentanyl 2 ug/kg and propofol 2–3 $mg \cdot kg^{-1}$, and maintained with isoflurane 0.8–1.2% and fentanyl infusion 1–2 $mcg \cdot kg^{-1} \cdot h^{-1}$. In group B anesthesia was induced with sufentanyl 0.2 $mcg \cdot kg^{-1}$, and propofol 2–3 $mg \cdot kg^{-1}$, and maintained with propofol infusion 6–12 $mg \cdot kg^{-1} \cdot h^{-1}$ and sufentanyl infusion 0.2–0.4 $mcg \cdot kg^{-1} \cdot h^{-1}$. Atracurium was the muscle relaxant for intubation and maintenance in both groups.

Results: There were no perioperative mortality in both groups, no significant statistical differences between both groups as regard demographic data, duration of operation, hospital stay, intraoperative hemodynamics, blood loss, liver function tests (PT, AST, & ALT) measured in the first, third, and seventh days postoperative.

Conclusion: This study showed that both anesthetic techniques are comparable and well tolerated by the patients undergoing hepatectomy, and the most important is the overall perioperative hemodynamic & fluid management together with postoperative pain management.

A-16

Media disclosed sentinel events anaesthesiologist's views

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Background and Goal of Study: A growing number of sentinel events have been disclosed to the media. "A sentinel event is an unexpected occurrence involving death or serious physical or psychological injury, or the risk thereof" Some of the disclosed cases have direct involvement of anaesthesiologists. How did anaesthesiologists view the impact of those events.

Materials and Methods: Survey of media published sentinel events from 2000 to July 2004. Interviews with over 6.5% of the registered anaesthesiologists.

Results and Discussions: Media published news were conflicting. Only the more recent and publicized events were known to the majority of the anaesthesiologists. Most of the anaesthesiologists felt that patients were getting more insecure facing procedures. Anaesthesiologists felt that media published news were directed against the medical profession.

Conclusion(s): The need to create and enforce professional guidelines regarding media published events.

The importance of a clear and timely information of the professionals, as a whole, of the basic known facts. This must serve to minimize misinformation and speculation.

Reference:

1 To Err Is Human: Building a Safer Health System (2000), Institute of Medicine http://www.jcaho.org/accredited+organizations/ambulatory+care/sentinel+events/sentinel+event+statistics.htm

A-17

Influence of preoperative fasting times on the incidence of postoperative nausea and vomiting (PONV)

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Background and Goal of Study: Postoperative nausea and vomiting (PONV) still remains one of the final therapeutical challenges in anaesthesia with an ongoing inacceptably high incidence of 20 to 60% after general anaesthesia. With the introduction of the APFEL Score there is a way to screen patients preoperatively but therapeutical approaches are still not satisfyingly applicable. After the introduction of new guidelines on preoperative fasting times in many european countries there has been a discussion whether a prolonged preoperative fasting time itself could be a cause for PONV and consequently with applying the new guidelines incidence of PONV should be reduced.

Materials and Methods: 50 healthy women undergoing laparoscopic hysterectomy were randomly divided into two groups. Group I was fastened according to the "old scheme" (nil by mouth for at least 8 hours) and group II was kept nil by mouth for solids for 6 hours and fluids for 2 hours preoperatively. APFEL Score was calculated for every patient.

General anaesthesia was induced using propofol, fentanyl and rocuronium and then maintained using volatile anaesthetics and continuous infusion of remifentanil.

Results and Discussions: Demographical data of the patients did not significantly differ. There were no significant differences in duration of surgery or use of anaesthetics. Average APFEL Score in group I and II were 2.9 ± 0.9 and 3.1 ± 0.7, respectively. Incidence of PONV in group I was 52%. Incidence of PONV in group II was 61%.

Conclusion(s): Incidence of PONV in both groups was high but reflected the expected incidence calculated by the APFEL Score. Preoperative fasting time does not seem to influence the incidence of PONV. There has been hope that a reduced residual gastric volume achieved through drinking clear fluids could also reduce the incidence of PONV, but at least in this group of patients that does not seem to be the case. Since there are no studies on this topic so far, further research is certainly necessary.

Reference:

1 Spies CD, et al. Preoperative fasting. An update. Anaesthesist 2003; 52:1039–1045.

A-18

Preoperative oral carbohydrate administration in ASA physical status III–IV cardiac surgery patients

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Background and Goal of Study: Preoperative oral intake of carbohydrate-rich clear fluids in elective surgery patients (ASA I–II) is safe (1), improves preoperative well-being (2) and reduces postoperative insulin resistance (PIR) (3). This has not been tested in patients with higher ASA physical status.

Materials and Methods: Ethically approved 160 patients admitted for open heart surgery after giving written informed consent were randomly allocated to intake of a 12.5% carbohydrate drink (*CHO*, n = 56), flavoured water (*Placebo*, n = 60), or overnight fasting (*Control*, n = 44). CHO and Placebo were double-blinded and given to drink 800 ml during the evening before and 400 ml on the morning of surgery. Patients were monitored from induction of general anaesthesia (GA) until 24 hours postoperatively. Gastric fluid volume (GFV) was estimated according to intraoperative passive gastric reflux and subjective variables of preoperative discomfort were measured by 100 mm visual analogue scales. Blood glucose levels were equally controlled to $\leqslant$10.0 mmol/l by standardised insulin treatment. Exogenous insulin dosage was suggested a surrogate marker for PIR. *Statistics*: Kruskal-Wallis-Mann-Whitney-U-Test, Brunner's Analysis (ANOVA-type statistic).

Results: Thirst was significantly reduced in CHO [7 (0–75)mm] vs Control [30 (0–90)mm, $p < 0.01$] and in tendency compared to Placebo [8 (0–76)mm $p = 0.06$]. The groups did not differ in GFV [CHO 0 (0–80)ml vs Placebo 0 (0–150)ml vs Control 0 (0–200)ml, $p = 0.39$]. Regurgitation or aspiration were not observed in any of the cases. Blood glucose levels and insulin dosages did not differ between groups ($p = 0.49$ and $p = 0.65$). Subgroup analysis of non insulin dependent diabetes mellitus (NIDDM) patients (CHO n = 10, Placebo n = 14, Control n = 8) did not show differences in blood glucose levels and insulin dosages ($p = 0.28$ and $p = 0.47$).

Conclusions: Oral intake of carbohydrate rich fluids in ASA III–IV patients up to 2 hours before induction of GA does not seem to influence PIR; and particularly not in patients with NIDDM. Preoperative CHO can be recommended for patients up to ASA physical status IV.

References:

1 Spies CD, Breuer JP et al. *Anaesthesist* 2003.
2 Hausel J et al. *Anesth Analg* 2001.
3 Soop M et al. *Am Physiol J Endocrinol Metab* 2001.

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A-19

Supplemental oxygen reduce postoperative nausea but not vomiting after laparoscopic cholocystectomy

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Background and Goal of Study: Postoperative nausea and vomiting (PONV) is one of the problems feared by surgical patients. Supplemental intraoperative oxygen is found to be effective or ineffective for PONV in some studies. The mechanism by which supplemental oxygen reduces PONV remains unknown but may be related to hyperoxia ameliorating subtle intestinal ischemia secondary to bowel manipulation and/or compression. We therefore tested the hypothesis that supplemental perioperative oxygen does not reduce the risk of PONV.
Materials and Methods: Sixty seven patients (ASA I–II, age 27–60), undergoing laparoscopic cholocystectomy were enrolled in a double randomized study. Anesthesia was induced with midazolam 20 mcg kg^{-1}, fentanyl 2 mcg kg^{-1}, propofol 2.5 mg kg^{-1} and cis-atracurium 0.15 mg kg^{-1}. Patients were given sevoflurane–remifentanyl anesthesia. The patients were randomly assigned in two groups, group 1 received 40% oxygen balance air (n = 33), group 2 received 80% oxygen balance air (n = 34). The incidence and the severity of nausea (none, moderate, severe) and the episodes of vomits were evaluated before living the PACU and then every 6th hour. Pain score was assessed with VAS score. A rescue antiemetic tropisetron 5 mg i.v. was available where nausea persisted for more than 30 min or 2 episodes of vomits. Factors known to influence nausea and vomiting were comparable in two groups. We separately evaluate nausea and vomiting scores for 0 through 6 h and 6 h through 24 h. The results were compared with Pearson chi square.
Results: There were difference in the incidence of nausea the first 6 hours (P = 0.024), in total nausea (P = 0.036). There were no statistical difference in the results for the 6th to 24th hour for nausea, for vomiting the first 6 hours and for the 6th to 24th and in total vomiting (P > 0.05).
Conclusion: Supplemental intraoperative oxygen was effective in preventing nausea but not in preventing vomiting after laparoscopic cholocystectomy.
Reference:

1 Goll V, Akca O, Greif R, et al. Ondansetron is no more effective than supplemental intraoperative oxygen for prevention of postoperative nausea and vomiting. Anesth Analg 2001; 92:112–7.

A-20

The effects of pre-induction warming on preoperative anxiety in surgery patients

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Background and Goal of Study: Active warming of patients is not only able to improve thermal comfort, but has also been shown to reduce anxiety in a prehospital setting (1). We compared the efficacy of active warming with forced air in the preoperative holding area with passive insulation and/or midazolam.
Materials and Methods: 80 patients were randomized in 4 groups in the preoperative holding area:

1. passive insulation and placebo;
2. passive insulation and midazolam (30 μg/kg);
3. active warming with forced air and placebo;
4. active warming with forced air and midazolam (30 μg/kg).

After an initial set of measurements the designated treatment was instituted, a second set of measurements was performed in the OR, right before induction of anesthesia (30–45 min later). Thermal comfort and anxiety levels were assessed with VAS 0–100 (0 intense cold/no anxiety; 100 intense heat/severe anxiety) and patients' anxiety was additionally measured with the Spielberger State-Trait Anxiety Inventory (STAI).
Results and Discussions:

	$VAS_{thermal}$	$VAS_{anxiety}$	STAI-state
Passive/Placebo	29.0 ± 12.9	36.3 ± 22.4	46.0 ± 10.1
	16.5 ± 8.9	40.8 ± 26.3	48.4 ± 10.0
Passive/Midazolam	33.2 ± 17.4	28.8 ± 19.7	41.7 ± 5.1
	28.0 ± 18.2	14.0 ± 12.3*	39.1 ± 4.9*
Active/Placebo	31.3 ± 17.0	34.7 ± 21.2	42.4 ± 5.6
	43.5 ± 10.9*	30.0 ± 19.3	42.2 ± 5.8
Active/Midazolam	23.3 ± 9.5	46.5 ± 24.3	44.1 ± 7.8
	42.2 ± 10.4*	16.0 ± 13.9*	41.2 ± 8.6*

All results first/second measurement; mean ± SD.
*p < 0.05; ANOVA for repeated measurements.

Conclusions:
1. Prewarming with forced air provides better thermal comfort in the preoperative area.
2. It does not reduce preoperative anxiety adequately in comparison to midazolam.
3. A combination of prewarming and midazolam can be recommended.

Reference:

1 Kober A. *Mayo Clin Proc* 2001; 76: 369–375.

A-21

Prospective randomised controlled trial of combination antiemetic prophylaxis in patients undergoing breast surgery

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Background and Goal of Study: Post operative nausea and vomiting (PONV) are common adverse events following surgery and is very distressing to the patient. The concept of balanced antiemesis using combination of antiemetic drugs has gained popularity in recent years and has been successfully used in gynecological surgery (1). Our intention was to examine whether the same benefits extended to patients undergoing breast surgery.
Materials and Methods: Following ethics committee approval and written informed consent 90 patients undergoing elective breast surgery were included in the study. The patients were randomly allocated into 3 groups to receive either placebo or dexamethasone 4 mg + ondansetron 4 mg or ondansetron 4 mg + cyclizine 50 mg. The drugs were administered intravenously at induction of anaesthesia in a double blind fashion. A standardized anaesthetic technique was used. Diclofenac suppository and Bupivacaine 0.5% infiltration was used to supplement analgesia. Prochlorperazine 12.5 mg was used as the rescue antiemetic in the recovery room. Patients were asked if nausea or vomiting had occurred in three time periods (0–3, 3–12 or 12–24 hours postoperatively with only 2 possible answers (yes/no). Continuous data was analysed using Student's t test and ANOVA and other data was analysed using Chi-squared test.
Results and Discussions:

Incidence of nausea and vomiting. Values refer to number (%) of patients.

Placebo(P)	ond + dexa(OD)	ond + cycl(OC)
Nausea 15(50%)	3(10%)	10(33%)
	p < 0.05, OD *vs* OC & P	
Vomiting 12(40%)	1(3%)	6(20%)
	p < 0.05, OD vs OC & P	

Conclusion(s): The combination of dexamethasone and ondansetron significantly decreased the incidence of nausea and vomiting after breast surgery.
Reference:

1 Ahmed AB, Hobbs GJ, Curran JP. BJA 2000;85:675–82.

A-22

Optimizing the prediction of perioperative mortality in vascular surgery using a customized probability model

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Background and Goal of Study: This study aimed to revise and customize the Revised Cardiac Risk (Lee) index to estimate the probability of perioperative all-cause mortality in patients undergoing noncardiac vascular surgery.
Materials and Methods: We studied 2,310 patients (mean age, 67.8 ± 11.3 years; males 1,747) who underwent acute or elective major noncardiac vascular surgery between 1991–2000 at the Erasmus MC. In a total of 1,535 patients was assigned for model development, in which the association between predictor variables and mortality occurring within 30 days after surgery were identified to revise and customize the Lee-index, which was then evaluated in a validation cohort of 773 patients.
Results and Discussions: The perioperative mortality rates were similar in the development (n = 103, 6.7%) and validation populations (n = 50, 6.1%). The customized risk-prediction model for perioperative mortality identified and allocated scores to type of vascular surgery (acute abdominal aortic aneurysm rupture, +43; thoraco-abdominal and abdominal aortic surgery, +26; infrainguinal bypass, +15; carotid endarterectomy, 0), ischemic heart disease (+13), congestive heart failure (+14), prior stroke (+10), hypertension (+7), renal dysfunction (+16) and chronic pulmonary disease (+7) associated

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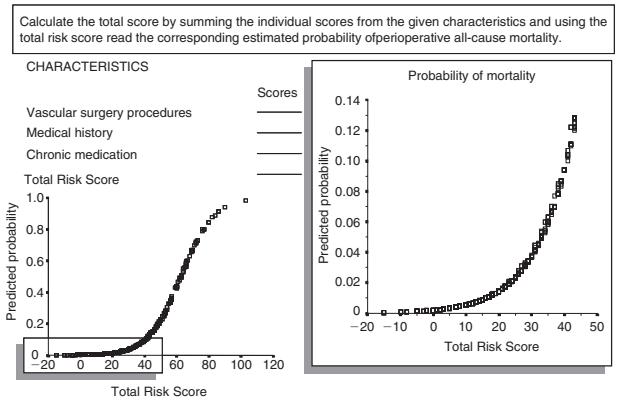
with increased risk, whereas beta-blocker (−15) and statin use (−10) with a lower risk of mortality.



Conclusions: The customized index provides more detailed information than the Lee-index about the type of vascular procedure, clinical risk factors and concomitant medication use.

A-23

Prevention of succinylcholine-related fasciculations and myalgia. A systematic review of randomized trials

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Background and Goal of Study: Succinylcholine is often used for rapid sequence induction (1). Fasciculation and myalgia are frequent succinylcholine-related adverse effects. The relative efficacy of pharmacological pretreatments to prevent these adverse effects remains unclear (2).
Materials and Methods: Extensive search for full reports of randomized trials (to 2.2004) that tested pretreatments vs. placebo for the prevention of succinylcholine-related fasciculation and myalgia. Dichotomous data on fasciculation, myalgia, and pretreatment-related adverse effects were combined using a fixed effect model.
Results and Discussions: 52 trials (5,318 patients) tested a large variety of pretreatments. In control groups, the average incidence of fasciculation was 95%, and of myalgia at 24 hours was 50%. No relationship between incidence of fasciculations and incidence of myalgia was found. Low-dose non-depolarizing myorelaxants, sodium-channel-blockers (lidocaine, phenytoin), and magnesium were most effective in preventing fasciculation (number-needed-to-treat, 1.5 to 2.5). Best prevention of myalgia after 24 hours was with low-dose rocuronium or gallamine and sodium-channel-blockers (number-needed-to-treat, 3), and with non-steroidal anti-inflammatory drugs (number-needed-to-treat, 2.5). With low-dose myorelaxants there was an increased incidence of blurred vision, weakness, and difficulty in swallowing and breathing.
Conclusion: Low-dose myorelaxants, magnesium and sodium channel-blockers may be used to prevent succinylcholine-related fasciculation. Non-steroidal anti-inflammatory drugs are most efficacious for the prevention of myalgia. With low-dose non-depolarizing myorelaxants, there is a finite risk of potentially serious paralyzing adverse effects.
References:
1 Hofmockel R. et al., *Anaesthesist* 2003; 52: 516–21.
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A-24

Recursive partitioning analysis provides a more patient-centric perspective on predicting adverse-event occurrence than logistic regression analysis

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Background and Goal of Study: To compare the usefulness of recursive partitioning (RP) to logistic regression (LR) analysis in studying the occurrence of unplanned hospital admission after outpatient surgery.
Materials and Methods: A case-control study had been conducted at a US university hospital and analyzed with LR. The data set was subjected to RP: 396 unplanned admissions (cases) and 396 patients not admitted (controls); data included age, gender, ASA physical status, anesthetic method, duration of anesthesia, surgical severity (5-point clinical-invasiveness scale), and whether anesthesia ended after 1600 h. RP algorithm CART (Classification & Regression Trees) was used to repetitively (recursively) divide (partition) the study population into subgroups in relation to the outcome; Fisher's Exact Test was used for hypothesis testing, with $P < 0.05$ considered to indicate statistical significance.
Results and Discussion: CART correctly classified outcomes of 80% of subjects, identifying a set of predictors for unplanned admission similar to those identified with LR: Anesthetic method (general or spinal/epidural anesthesia vs. alternate methods) and duration were the strongest predictors, with smaller contributions from age, gender, and surgical severity. General or spinal/epidural anesthesia was associated with a 5-fold higher rate of admission compared to alternate methods ($P < 0.0001$), which was influenced by duration of anesthesia. Even among shorter cases, admission was more likely for older men having higher severity surgery.
Conclusions: RP provided a more intuitive and patient-centric view of risk of unplanned hospital admission after outpatient surgery. Its tree-like output identified sources of unplanned admission as the method exploited lack of homogeneity among the population and interactions among risk factors. Indeed, different subgroups had somewhat different risk factors for the same outcome. While LR presents relative importance of risk factors succinctly (e.g., odds ratios), such a presentation inherently averages influence of risk factors over the entire population and ignores heterogeneity of the population and possibility of interactions among risk factors. RP and LR complement each other in providing a more comprehensive, informative perspective that is likely to be more helpful in quality improvement efforts.

A-25

Myasthenic crisis in patients after thymectomy – assessment of risk factors

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Background and Goal of Study: Thymectomy as a standard procedure in patients with myasthenia gravis (MG) may be responsible for postoperative exacerbation of symptoms of MG. Only few studies concerning this subject were published and their results are controversial. The aim of the study was to identify factors associated with the increased incidence of myasthenic crisis in the postoperative period.
Materials and Methods: We analyzed retrospectively the postoperative course in 67 patients (age 34.8 ± 13.7 y, 46 women and 21 men) after thymectomy operated on between 1995–2002. The following factors were evaluated: age, sex, grade of symptoms (MGFA Clinical Classification and Osserman classification), presence of bulbar symptoms, time from the onset of symptoms to thymectomy, anticholinesterase and steroid use, preoperative lung function (VC, FEV1, FEV1/VC), Leventhal scoring system, methods of anesthesia (TIVA or balanced anesthesia with inhalation agent, with or without TEA, use of myorelaxants) and surgery (sternotomy or video-assisted thoracic surgery), presence of thymoma and coexisting diseases. Statistical analysis was performed using chi-square test and $p < 0.05$ was regarded as significant.
Results and Discussions: Extubation after surgery was delayed in 23 patients (34.3%). Eight patients (11.9%) developed myasthenic crisis on 4 ± 1.4 postoperative day, 4 of them (50%) needed ventilatory support for 96 ± 8.5 h. Thymoma was found in 11 patients (16.4%). The statistical analysis showed that only MGFA clinical classification ⩾ IIIA and VC < 80% were significant factors for development of myasthenic crisis in the postoperative period ($p < 0.05$). We found no correlation of preoperative status, anesthetic type or surgical approach with delayed extubation. Leventhal scoring system had no predictive value in this group of patients.
Conclusion: More advanced clinical stage of MG according to MGFA Clinical Classification and decreased vital capacity were identified as the risk factors for myasthenic crisis in postoperative period after thymectomy.
References:
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2. Leventhal SR et al. Anesthesiology 1979;51:S151.

A-26

Adrenal function during pre and postoperative phase in elective abdominal surgery

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Background and Goal of Study: Few epidemiological data exist on the adrenal function in patients undergoing elective abdominal surgery. Therefore

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patients with pathological adrenal response were identified by a preoperative ACTH stimulation test and followed till discharge.
Materials and Methods: After approval of the ethics committee and informed consent of the participants, adult patients scheduled for major abdominal surgery were enrolled in this study. Patients with a history of glucocorticoid therapy, endocrine diseases, acute pulmonary or any other medical complaints were excluded. For the low-dose ACTH test, an intravenous bolus injection of 1 mcg (1–24)-corticotropin was given. Baseline and stimulated plasma cortisol were measured on the day before surgery (p1), immediately after surgery (p2), in the morning of the first postoperative day (p3) and the day of discharge (p4). A normal response to intravenous ACTH was defined as a stimulated plasma cortisol concentration >550 nmol/l (20 mcg/dl).
Results and Discussions: 99 patients were included in this cohort study and all patients were followed according to the protocol. *Pathological subgroup:* At p1, 41 of 99 patients had a formal pathological ACTH test. 26 (63%) of this group (n = 41) had also a deficient response to ACTH immediately after surgery. On the first postoperative and the discharge day, in 20 patients (48.7%) the test remained pathological. The other patients of this subgroup had a normal response to ACTH under the surgical stress (p2–p4). *Normal subgroup:* At p1 58 of 99 patients had a normal ACTH test. 36(61%) of them (n = 58) had also a normal response to ACTH immediately after surgery. In 33 patients of this group the low dose ACTH test on the first postoperative day was normal. At discharge day, 40 patients were normal. The summarised results of the ACTH tests for both groups were as following: 58.6% of 99 patients at p1, 51.5% (n = 51) at p2, 54.5% (n = 54) at p3 and 60.6% (60) had a normal response to all the low-dose ACTH tests performed pre- and postoperatively.
Conclusion(s): In a high proportion of these cohort partial adrenal insufficiency can be diagnosed. In the majority of these patients the adrenal response to ACTH remains deficient in the postoperative time.

A-27

Intraoperative events: four years of a systematic collection

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Background and Goal of Study: The systematic collection and analysis of incidents is highly recommended. The purpose of this study is to assess continuously collected events and to compare their associated factors.
Materials and Methods: From 01/2000 to 04/2004, every anesthesia is described with the patient features, the anesthetic technique and the occurrence of events (out of a list of 58), using a preformatted sheet then scanned and recorded in a data base. The herein analyzed events are bradycardia (brad), hypotension (hTA), hypoxemia $SpO_2 < 90\%$ (hO_2), bronchospasm (bronsp), unexpected difficult intubation (UDI), esophageal intubation (esint), regional anesthesia failure (RAf). A multivariate analysis was performed to assess the associations between these factors and age in quartile (Q), Post Anesthesia Care Unit length of stay (Q), surgery duration (Q), ASA physical status, emergency (versus elective surgery), number of spots on the responsibility of 1 anesthesiologist.
Results and Discussions: All the anesthesia procedures have been analyzed (n = 19118). The odds ratio (OR) are:

	brad	hTA	hO_2	bronsp	UDI	esint	RAf
Age 2nd Q	0.83	1.68	1.07	0.83	1.92	2.07	0.95
Age 3rd Q	1.17	5.64	1.33	1.08	3.87	3.54	0.78
Age 4th Q	1.67	8.56	0.82	0.49	1.94	1.82	0.84
Pacu 2nd Q	2.31	2.54	1.09	1.85	0.97	1.89	2.04
Pacu 3rd Q	2.37	2.75	2.48	2.06	1.02	1.39	1.86
Pacu 4th Q	2.46	3.69	3.33	2.21	1.72	1.84	1.77
Surg 2nd Q	1.52	2.14	0.96	0.85	1.99	1.99	1.76
Surg 3rd Q	1.77	3.30	0.61	0.83	2.37	1.85	1.57
Surg 4th Q	2.40	5.04	0.91	0.69	3.38	1.53	1.41
ASA 2	0.77	1.26	2.07	1.50	1.18	0.87	0.91
ASA 3	0.67	1.37	4.90	1.25	1.28	0.96	0.74
ASA 4	0.11	1.55	5.49				1.20
Emergenc.	0.47	0.79	1.15	1.45	1.33	1.39	2.03
An. > 1spot	1.06	1.11	1.50	1.35	1.17	1.17	1.15

Reference group (OR = 1) is not displayed. Age is strongly associated with hTA. OR are very dissimilar, some differences (hTA, brad vs the others) can be explained by the event collection method. May be organizational events could be better quality indicators in anesthesia practice.
Conclusion: Events should be studied separately (to adjust the size of the population exposed to the risk) and more clearly defined to become really relevant indicators.

A-28

Risk management valuing anaesthesiologist's experience

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Background and Goal of Study: Anaesthesiologists have an accumulated body of experience that can be used in risk management. How can one gather and systematise that lived experience in a way that can be useful in risk management.
Materials and Methods: Gathering and ranking of risk factors by means of a relation matrix filled in by senior anaesthesiologists (n > 43).
Results and Discussions: The information that emerged from the accumulated live experience of the senior anaesthesiologists points to a set of 3 groups of risk factors:
poor leadership; poor communication; lacking of clear tested procedures (1°group)
production pressure; long hours (2°group)
poor facilities; poor or missing equipment; shortage of trained professionals (3°group)
Conclusion(s): Relation matrix can be a useful method for acquiring and systematizing lived experience data into information relevant to risk management in anaesthesiology, providing a retrospective blame-free tool since it can be used anonymously.
References:
1 To Err Is Human: Building a Safer Health System (2000), Institute of Medicine.
2 Cooper JB, Newbower RS and all Preventable anesthesia mishaps: a study of human factors Quality and Safety in Health Care 2002;11:277–283.

A-29

Prediction and prevention of lethal outcomes after prolonged abdominal surgery

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Background and Goal of Study: The important goal of the intensive care is prediction and prevention of lethal outcomes after the surgery. The response to surgery stress is determined by the awakeness level (AL). Registration and analysis of the level of DC-potential (DCP) is one of the methods (Guinjoan SM et al., 1995) for assessing the AL. Depending the level of DCP defines the low, optimal or high awakeness level.
Materials and Methods: 1013 patients underwent elective prolonged abdominal surgery were studied. In an hour after the end of surgery registration of DCP was performed. In group 1 (DCP −15 to −25 mV) all the patients (n = 780) was managed only with the basic intensive care (pain management, antibacterial prophylaxis, correction of electrolyte disorders, proteine losses, coagulation disorders, parenteral/early enteral nutrition). In group 2 (n = 233) supplementary intensive care was added depending on AL. In case of low AL intensive care was directed on the central nervous system (CNS) activation and/or elimination of tissue hyperhydration, whereas in case of high AL intensive care was directed on the CNS inhibition and/or elimination of tissue dehydration. The severity of state was assessed by the APACHE III score. Statistical differences was assessed using the Mann–Whitney U-test.
Results and Discussions: Mortality (%) depending on APACHE III score:

APACHE III score	40–49	50–59	60–69	70–79	80–89	90–99	100–109	>110
Group 1	3.0	2.1	3.5	7.2	5.5	12.7	18.3	66.1
Group 2	0	0	0	0	0	0	6.2*	47.7*

* $p < 0.05$ using the Mann–Whitney test.

There were no lethal outcomes in all patients with APACHE III score less than 40 and in group 2 patients with APACHE III score less than 100. In group 2 using of supplementary intensive care result in less mortality in comparison with group 1.
Conclusion: Registration of DCP and correction of intensive care depending on AL can reduce the lethality rate in patients with a high risk of in-hospital death after prolonged abdominal surgery.
Reference:
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A-30

A survey of anaesthesia in Catalonia in 2003 (ANESCAT)

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Goal of Study: We conducted an extensive survey of anaesthetic activity in Catalonia in 2003 in order to know its impact on the general population, to quantify the workload and to describe common practices.

Methods: We designed a prospective, cross-sectional questionnaire survey asking anaesthesiologists to report every anaesthetic procedure performed on 14 randomised days in 2003. All public and private hospitals (131) practising anaesthesia around Catalonia (6,704,146 inhabitants) participated in the survey. This was a representative population sample and included data on characteristics of patients, anaesthetic techniques and type of procedure for which anaesthesia was required. We extrapolated anaesthetic activity according to demographics and calculated distribution of anaesthetic techniques and type of procedure. Data are expressed as medians (10–90%) or 95% confidence intervals.

Results: A total of 23,136 questionnaires were collected. This extrapolates to 603,189 anaesthetic procedures performed in Catalonia in 2003. Based on the current population, the annual rate of anaesthesia was 9% (95% CI: 8.6 to 9.4%). This rate ranged from 1.8% in girls aged 10–14 yr to 22% in men aged 75–79 yr. Fifty-eight percent of anaesthetic procedures were performed in women. The median patient age was 52 (21–78) yr. The percentage of cases assigned to ASA $\geqslant$3 was 26.8%, emergency 20.3% and outpatient 34.4%. Median duration of anaesthesia was 60 (20–175) min. Regional anaesthesia was the technique used most often (41.5%). Anaesthesia for orthopaedics was the most frequent procedure (18.7%) and anaesthesia was used for non-surgical procedures in 10.4% of the cases.

Conclusions: Our results show an annual rate of anaesthesia similar to figures found in other national surveys (1,2). However, substantial qualitative differences were found in relation to practices such as kind of anaesthetic techniques and procedures for which anaesthesia was used. We think that national and multinational surveys would be useful in order to foresee changes in the evolution of the anaesthetic practices and workload in Europe.

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A-31

Physical status and major adverse events in 36,313 anaesthetics at tertiary hospital

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Background: The anesthetics adverse events in a tertiary hospital in the Middle East have not been previously reported.

Aim of the Study: A prospective study of the major adverse anesthetic events and its relation to patient physical status.

Methods: Data from 36313 non-cardiac anesthetic were collected over 5 years (1994–1999) American Society of Anesthesiologist's Classification (ASA) was used for preoperative physical status assessment. Adverse events were recorded in the operating room by the anesthesiologist, Post-Anesthesia Unit (P.A.C.U) and postoperative within 24 hours by an anesthetist. Data were encoded using a customized database. Cardiac arrest, aspiration, neurological deficits, and death were analyzed using SAS software.

Results: ASA (3.4.5) were 29.9%, (2) was 39.6%, and (1) was 30.5%. Results were reported as rates/10,000 anesthetics. Cardiac arrest was encountered in (5.51). Intraoperative was (3.03) and PACU was (2.48) and its relationship to ASA was highly significant (p-value $<$ 0.001). Aspiration was encountered in 1.9 anesthetics: intraoperatively (1.38) and PACU (0.55). Neurological deficits occurred in (2.2). The peri-operative mortality rate was (4.13) intraoperative was (0.083) and PACU was (1.65) and postoperative within 24 hours was (1.65), its relations to ASA were highly significant ($p \leq 0.0001$). The percentage of aspiration and neurological events are related to the ASA classification but not statistically significant, because of the insufficient number of events. No major complication was recorded in caesarian sections.

Conclusion: The incidence of adverse events correlates with ASA physical status classifications. Preoperative identification and treatment of patient risk factors could improve anesthetic outcome.

A-32

The anaesthesiologist in Croatia: patient's view

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Background and Goal of Study: Anaesthesiology as a discipline is taking great steps forward in the last few decades, giving the anaesthesiologists the opportunity to move out of a shadow. Is a patient's perception of an anaesthesiologist accordingly changing?

Materials and Methods: On a sample of 111 patients operated in our General hospital we tried to establish their perception of our duties and ourselves and to compare our results with similar foreign investigations, since such investigation has not been conducted in Croatia so far. The data were collected using a questionnaire, distributed at the end of preoperative visit. We also examined the impact of an information booklet, provided only to the patients who preoperatively visited our preanestetic clinic (54), as well as the impact of the previous operation to their knowledge (66). The results were compared using Chi-square test.

Results: Only 60.4% of our patients knew anaesthesiologists are doctors, comparing to 100% for surgeons and 80.2% for internists, which is comparable to study from Netherlands (1). Patients who were previously operated (69.7% vs 46.7%), as well as those who got the information booklet (74.1% vs 47.4%) were signifficantly better informed about this basic fact ($p < 0.05$). Except painless delivery (patients who got the information booklet were signifficantly better informed, $p < 0.05$), we could not establish any difference in the knowledge between the investigated groups. The results of our study are corresponding with the results of the recent study from Finland (2), especially concerning the duties outside the operating room.

Conclusions: The knowledge of our patients is poor, confirming the fact that anaesthesiologist still works in shadow. We can also confirm allready established facts that previously operated patient does not mean well informed patient and the poor impact of the information booklet to the knowledge of our patients as well. Better knowledge about painless delivery is a bit surprising, since our study was not conducted in the obstetric department and we had more male examinees (60.4%).

References:

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A-33

Anaesthetic records – are we up to scratch?

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Background and Goal of Study: This project was undertaken to ascertain the quality of documentation associated with anaesthesia in Scotland. In 1996, recommendations as to the content of the anaesthetic record chart were published by the Royal College of Anaesthetists (RCOA)[1]. A 1997 study[2] in North West England concluded that no anaesthetic chart compiled fully with these guidelines and suggested a review of the design of their charts.

Materials and Methods: We have performed a similar exercise and examined charts from 27 of the 29 NHS departments administering anaesthesia in Scotland. We also audited 202 'completed' charts in two district general hospitals against the RCOA guidelines. This was in order to assess documented information, irrespective of printed data fields.

Results and Discussions: No Scottish anaesthetic chart was fully compliant with current guidelines, with the mean number of recommended fields present being 50% (23–80%). In the two hospitals studied the anaesthetist present was only recorded on 68% and 85% of occasions respectively and the timing of drugs and fluid administration in 69% and 97% of cases. The fields for '*name of patient*' and '*operation performed*' were not present on 100% of forms! These omissions of information could cause problems for future anaesthetics or make legal cases less defensible and accountable.

Conclusions: There has been little improvement in standards of documentation and certain fields are consistently omitted. The anaesthetic chart is not a legal requirement but it could be construed that a lack of documentation reflects inattention of the anaesthetist for the patient[3]. We have designed an anaesthetic chart that meets the RCOA criteria and could potentially be implemented throughout Scotland. It is available online at http://www.show.scot.nhs.uk/wlt/anaesthesia.asp

References:

1 Royal College of Anaesthetists. Newsletter 1996; 27: 8–9.
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A-34

Clinical sings of neuromuscular blockade recovery as guideline for safety reversal assessment

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Background and Goal of Study: Different clinical sings have variable values in predicting neuromuscular blockade (NMB) recovery (1,2). The goal of this study was to exam if clinical sings of NMB recovery could be used as guideline for safety reversal assessment in absence of adequate and objective NMB monitoring.
Materials and Methods: We have investigated 45 ASA I or II patients, during propofol–fentanyl anesthesia and pancuronium induced NMB. The patients were randomly allocated into 3 groups of 15, based on reappearance of the second (Group I), third (Group II), or fourth (Group III) TOF response in each anesthesia. NMB was evaluated by electromyography at the adductor pollicis muscle using a Datex Relaxograph® (T1, TOFr, number of TOF responses). Before neostigmine was administered, we evaluated the quality (poor, medium, good) of clinical sings that suggest NMB recovery such as: eye opening, tongue protrusion, ability to sustain arm lift >15 sec and head lift >5 sec.
Results and Discussions: Data are shown in Table.

		Clinical answer		
		Poor	Medium	Good
Eye opening	Group I	4/15*#	1/15*	0/15*#
	Group II	0/15	3/15	12/15
	Group III	0/15	0/15	15/15
Tongue protrusion	Group I	9/15*#	6/15#	0/15*
	Group II	0/15	10/15	5/15†
	Group III	0/15	1/15	14/15
Arm lift >15 sec	Group I	15/15*	0/15	0/15
	Group II	9/15†	6/15†	0/15
	Group III	1/15	13/15	1/15
Head lift >5 sec	Group I	15/15	0/15#	0/15
	Group II	15/15†	0/15†	0/15
	Group III	5/15	7/15	3/15

*$p < 0.05$ I vs. II; #$p < 0.05$ I vs. III; †$p < 0.05$ II vs. III.

Conclusion(s): Eye opening and tongue protrusion might be used as guideline for safety reversal assessment.
References:
1 Hayes AH. et al. Anaesthesia, 2001; 56: 312–8.
2 Debaene B. et al. Anesthesiology, 2003; 98: 1042–8.

A-35

How clean are we? – an audit studying hand washing for aseptic procedures amongst anesthetists

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Background and Goal of Study: Anesthetists perform procedures aseptically e.g. central line insertion, epidural and spinal anesthesia. Infectious complications are rare but we should always strive to reduce the risk of adverse consequences. The purpose of this audit is to examine our hand-washing technique. A literature search has revealed no similar studies.
Materials and Methods: 20 anesthetists and 20 scrub nurses (controls) were studied. Once the subject had scrubbed they were asked to imprint their dominant hand onto a horse blood agar plate. These were incubated for 24 hours. The numbers of colony forming units (CFU) were then counted and the two cohorts compared.
Results and Discussions:

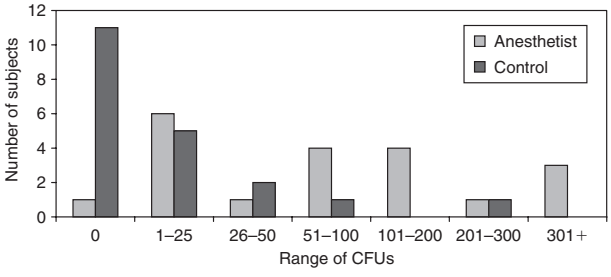

Figure. Graph of the number of CFU grown after 24 hours incubation on a horse blood agar plate.

Statistical analysis
Anesthetists: Mean no. CFU 116.3, S.D. 134.2
Controls: Mean no. CFU 23.7, S.D. 56.2
Mann Whitney U Test: U 71.5, $p < 0.01$

The results show that the hands of anesthetists are significantly less sterile than the controls. Hand hygiene is important in preventing infection and it is our responsibility to take every reasonable precaution to reduce the risk of harmful sequelae.
Conclusion: This audit highlights our current poor practice. We must aim to improve upon our present hand washing technique. I suggest the best way we can do this is to follow the guidelines set by our own association[1].
Reference:
1 Association of Anaesthetists of Great Britain and Ireland. *Infection Control in Anaesthesia*. London: AAGBI, 2002.

A-36

Are patients in Croatia as satisfied with anaesthesia service as elsewhere?

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Background and Goal of Study: Published papers on patient satisfaction with anaesthesia service reported high levels of patient satisfaction (1). However, all of these studies came from high developed countries. Croatia belongs to the group of developing countries so we wanted to find out the level of patient satisfaction with anaesthesia service in Croatian hospital settings and compare it with the published results (2,3). We hypothesized that the level of country's economic development is a predictor of satisfaction with anaesthesia.
Materials and Methods: We studied 220 consecutive patients having elective surgery during a 2-month period. Perioperative variables were gathered and patient satisfaction was assessed using our own developed questionnaire completed by the patient within 24 h of surgery. For the collection of perioperative data, written informed consent was not required by the ethic committee. Patient written informed consent was obtained for the postoperative questionnaire.
Results and Discussions: Table shows our results compared to published papers.

Level of satisfaction	Our study	Myles et al. (2)	Tong et al. (3)
Satisfied	98.0%	96.8%*	98.9%*

Compared to the published papers, there is no significant difference in reported level of satisfaction (*$p < 0.05$).

Conclusion(s): Patients in Croatian hospital settings are as satisfied with the delivery of anaesthesia care as the patients in high developed countries. Country's economic status has no impact on patient satisfaction with anaesthesia.
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A-37

Perioperative complications correlate with acid–base balance in elderly trauma patients

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Background and Goal of Study: The Fencl–Stewart approach to acid–base disorders, simplified by Story et al.,[1] estimates the base excess (BE) effects of strong ion, albumin (A) and unmeasured anions (UA). It has been suggested that the UA component of BE is a clinical marker for mortality in an Intensive Care population.[1] We examined the importance of each of the BE effects on perioperative complications in a population of elderly trauma patients.
Materials and Methods: Arterial blood gas analysis, plasma albumin and electrolyte levels were measured at hospitalization in consentient consecutive patients aged >70 scheduled for femur fracture repair. BE was determined by a blood gas machine. BE effects were defined as[1]: Na-Cl effect = $[Na^+]$-$[Cl^-]$ − 38; A effect = 0.25 × [42-albumin]; UA effect = BE – NA-Cl effect – A effect. Patients were blindly observed during surgery and for 7 postoperative days. Total number of complications (hypotension, cardiac symptoms, respiratory failure, oliguria, anemia [Hb < 10 mg/dl], infections and cognitive deterioration) was correlated with each BE effect using linear regressions. Predictive values (PV) of significant BE effects on complications were tested using Chi-square and Fisher's Exact Test.
Results and Discussions: 38 patients (81 ± 7 years, 22 were ASA3, 16 ASA2) were studied. Number of complications significantly correlated with standard BE and UA effect (both $p = 0.003$) but not with Na-Cl or A effects. BE and UA values < −2 were associated with occurrence of >2 complications

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(both $p < 0.01$) with similar positive PV (BE: 100%; UA: 85%) and better negative PV for UA (BE: 64%; UA: 75%).

Conclusion(s): In elderly trauma patients, at risk for undetected hypovolemia and hypoperfusion[2], a simplified analysis of acid–base balance identifies patients who will develop perioperative complications. The hypothesis that UA effect may guide fluid therapy, leading to improved outcome, requires further evaluation.

References:

1 Story DA, Morimatsu H, Bellomo R. *Br J Anaesth* 2004; 92: 54–60.
2 Venn R, Richardson P, Ploniecki J et al. *Br J Anaesth* 2002; 88: 65–71.

A-38

Quality survey of pre-operative assessment: influence of a standard questionnaire

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Introduction: Pre-operative assessment, allowing exchange of essential medical information between patient and anesthesiologist, is the best guarantee for not only a safe anesthesia procedure, but also for a high patient satisfaction. Since recently, we introduced an electronic standard questionnaire, available for all patients, as guide to our pre-operative assessments. In the present paper, we surveyed a one-week period, for all pre-operative assessments for all elective procedures in our hospital.

Materials and Methods: We prospectively surveyed all pre-operative data of all patients scheduled for week 22-2004. A resident, not involved in daily anesthesia care, collected all data from the questionnaire, from the pre-operative assessment and from the medical record of the patient. An important issue was to analyse the role of the standard "yes-no" questionnaire in the whole pre-operative assessment process.

Results: A total of 425 patients were scheduled for an elective surgical procedure in week 22. 134 pts were admitted to hospital the day before surgery. All 134 pts underwent pre-operative assessment on the day before surgery. For these pts, the use of a standard questionnaire did add very little relevant information, as well for the patient as for the anesthesiologist, as most of the information was found in the medical record of the patient.

For the 291 pts admitted on the day of surgery (day clinic or short stay), the standard questionnaire revealed to be a very usefull intake for pre-operative screening. Especially for not-ASA I (52) pts, the questionnaire provided essential information (in 47 of 52 pts), as well for the patient (e.g. instructions for discontinuation of some specific medication) as for the anesthesiologist (e.g. latex allergy, …).

Conclusion: A first survey of the quality of our pre-operative assessment supported the use of electronic standard questionnaires, especially for pts admitted on the day of surgery …. Patient satisfaction with anesthesia seems indeed largely dependent on the information given by the anesthesiologist before surgery.

A-40

Patient preferences for desired post-anaesthesia outcomes – a comparison with medical provider perspective

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Background and Goal of Study: Intra-operative and post-operative adverse outcomes have been identified as the major causes of dissatisfaction with anesthesia. The aim of this study was to identify patient preferences for post-operative anaesthesia outcomes in our population.

Materials and Methods: 100 pre-operative adult patients were given standardized preoperative information about anaesthesia. Each patient was asked to prioritize 11 possible anesthesia outcomes using a relative value scale (willingness to pay out of a total of 100 Euro). Each outcome was described in simple language. Peri-operative management was at the discretion of the anaesthesia provider. 26 medical and paramedical staff members also completed the survey.

Results and Discussions: 100 patients (mean age 44.77 ± 18.01) responded. 87 were undergoing elective and 13 emergency surgery. Patient rankings (from highest to lowest avoidance priority) were; vomiting, pain, breathing tube sensation, nausea, disorientation, bladder fullness, sore throat, shivering, thirst, itch, drowsiness. Broad variation was seen. Staff rankings for perceived patient preferences were; pain, vomiting, nausea, breathing tube, bladder fullness, disorientation, shivering, thirst, drowsiness, sore throat and itch. Willingness to pay was similar except for nausea (Staff vs. Patient, €16.7 ± 12.4 vs. €8.7 ± 18.8, $p = 0.008$).

Conclusion(s): There is broad correlation between medical staff and patient perceptions of desired outcomes. Individualized approaches to patient care are mandated by the wide variation is patient preferences.

Reference:

1 Macario A, Weinger M, Carney S, Kim A. Which clinical anesthesia outcomes are important to avoid? The perspective of patients. Anesth Analg. 1999 Sep;89(3):652–8.

A-41

Measuring patient dissatisfaction with anethesia care

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Background and Goal of Study: Current measures of patient satisfaction in anesthesia care show an incorrect high satisfaction. In our study we tried to develop and validate a questionnaire that ought to detect patient dissatisfaction correctly.

Methods: Following the protocol of the psychiometric design 192 items concerning the process of care could be identified. These were reduced to 72 anesthesia relevant items by excluding redundant and not anesthesia related items using sumscores of questionnaires and interviews. After a pilot questionnaire consisting of 57 questions, reduction of items was made using a missing value analysis and probing questions. The final questionnaire was refined after a re-presentative test using statistical methods like Split-Half-, Chi^2-, T-Test/Transformation, Cronbachs-α, Pearson-, Spearmans-Correlation etc. The final instrument consists of 39 questions, 32 concerning anesthesia related care in 5 dimensions. The questions are answered using a 4 scale likert response format and are presented in chronological order of anesthesia care.

Results and Discussion: Until today, the final questionnaire was given to more than 350 patients 36 hours after discharge of the recovery room or ICU respectively. 84% of patients returned the questionnaire of which 77% were completed. Patients female:male ratio was 51:49, mean age was 52 (15–92). The mean time for answering the questionnaire was 12 (8–23) minutes. Assessment of internal testreliability using cronbachs-α was 0.82 for the questionaire, the dimension information gain was the only below 0.7 Cronbachs-α (0.67). Younger Patients (<50 years) were significant more dissatified ($p < 0.0005$). Unsatisfied patients complained mosty about somatic disturbances (pain, thirst) and anxiety. Significant confounder were fear and the delay of the procedure in the dimension of anxiety ($p < 0{,}005$). The more satisfied group of patients reached a total sumscore of 77% while the more dissatisatisfied group only 49%.

Conclusion: Compared to the previously used instruments with our psychometric designed questionnaire were found a lower satisfaction which more likely represent the "true patient satisfaction", leaving room for improvement of perianesthesia care even in the group satisfied patients.

References:

1 Bauer M, Bach A. Anästh Intensivmed 1999; 40: 627–637.
2 Fung D, Cohen MM. Anaesth. Analg. 1998; 87: 1089–1098.

Ambulatory Anaesthesia

A-42

The prophylactic antiemetic effects of ondansetron, propofol, and midazolam in female patients undergoing sevoflurane anaesthesia for ambulatory surgery

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Background and Goal of Study: The use of volatile anaesthetics may be the main cause of early (0–2 h) postoperative vomiting but not delayed (2–24 h) postoperative vomiting (1). Midazolam may have effect in decreasing postoperative nausea and vomiting (PONV) incidence following general anaesthesia (2). We compared the prophylactic antiemetic effects of ondansetron, propofol, and midazolam for ambulatory surgery patients.

Materials and Methods: In this prospective, randomized, placebo-controlled trial, we studied 180 female patients scheduled for ambulatory surgery under inhalation (sevoflurane) induction and maintenance of anaesthesia with laryngeal mask airway (LMA). The patients received ondansetron (Ond) 4 mg, propofol (Prop) 0.5 mg/kg, midazolam (Mid) 0.04 mg/kg, or saline (Sa) IV 30 min before the end of surgery. Our primary efficacy end point was

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complete response (CR; no PONV, no rescue antiemetic) 0–2 h or 2–24 h postoperatively. Sample size calculation was performed before starting the trials by using a statistical power analysis (N = 40). Data were analyzed using Fisher's exact test, Chi square test with Yates' correction, Mantel–Haenszel test and Wilcoxon's ranked sum test as appropriate.

Results: Data [mean (SD) or number (%)] are shown in the Table:

	Ond N = 43	Prop N = 42	Mid N = 44	Sa N = 42
Age (yr)	52(11)	50(12)	49(14)	53(10)
Weight (kg)	52(7)	53(6)	54(7)	53(6)
0–2 h Nausea	17(40)*	15(36)*	7(16)	17(41)*
Vomiting	1(2)**	2(5)**	1(2)**	9(21)
CR	25(58)*	25(60)*	36(82)	16(38)*

*P < 0.05 vs Midazolam; **P < 0.05 vs Saline.

Conclusion(s): After using sevoflurane for induction and maintenance of anaesthesia with LMA:

1 midazolam group has a lower incidence of nausea and a higher complete response rate than other groups (0–2 h);
2 the anti-vomiting effects (0–2 h) and the incidence of PONV (2–24 h) were no difference among groups.

References:

1 Apfel CC, Kranke P, Katz MH, et al. *Br J Anaesth* 2002; 88:659–68.
2 Bauer KP, Dom PM, Ramirez AM, et al. *J Clin Anesthesia* 2004; 16:17–83.

A-43

Can we define patients, which are at risk for post-operative pain after day case surgery?

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Background and Goal of Study: Despite an ongoing increase of ambulatory surgery, we know little which patients are at risks to have more pain after day case surgery. Postoperative pain not only causes discomfort and suffering, but also prevents the patient from resuming his daily activities. Severe postoperative pain may even have a negative impact on perioperative morbidity. These are important reasons for measuring post-operative pain. But most of the published papers on pain after ambulatory surgery lack a reasonable time for follow-up or did only measure a sub-group of this patient population. For future quality improvement, predictive factors, and course of post-operative pain is of the utmost importance. The purpose of our study was to assess the prevalence and intensity of postoperative pain during the first four days after the operation.

Materials and Methods: During a four-month period we enrolled 648 patients having ambulatory surgery at the day care unit of the university hospital of Maastricht, the Netherlands. A wide variety of operations were performed (general surgery, orthopedics, ophthalmology, gynecology, plastic surgery, ear-nose-throat, urology). Exclusion criteria were: age below 18 years, acute surgery, limitations of self-expression, and severe visual dysfunction. Using a visual analogue score (VAS) we evaluated postoperative pain before and up to four days postoperatively. Evaluations were made by direct questioning in hospital and using a pain diary after discharge from hospital.

Results and Discussions: Logistic regression analysis revealed that patients having pain with VAS >40 mm on the day of the operation were more likely to have pain with VAS >40 mm during the following days. The younger age group (18–45 years) was more prone to have a VAS >40 mm than older patients. Preoperative presence of pain and preoperative expectation of pain were other predictive values for postoperative pain in our population.

Conclusion(s): In conclusion, special attention should be given to operations which are more likely to cause postoperative pain.

A-44

Continuous popliteal sciatic nerve block for postoperative pain control at home

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Background and Goals: Research suggests that perineural local anaesthetic infusion is generally well tolerated by ambulatory patients (1). The aim of this case series was to evaluate the effectiveness of regional analgesia using a sciatic popliteal perineural catheter and portable infusion pump in ambulatory patients, undergoing foot surgery.

Material and Methods: Preoperatively 20 patients received a sciatic nerve block and perineural catheter in the popliteal fossa. After surgery, the plexus catheter was conected to a disposable elastomeric infusion pump containing 100 mls of ropivacaine 0.2% infusing at a rate of 2 mls per hour. Patients were contacted by telephone on days 0, 1 and 2. Scores were recorded for pain: VAS (0–10), satisfaction: (Yes/Neutral/No) and motor function normal: (Yes/No). Difficulty and pain during catheter removal was also recorded.

Results:

	Day 0	Day 1	Day 2
Pain (VAS) mean	1.3	1.6	1.5
Satisfied (Y/Neutral/N)	19/1/0	19/1/0	19/1/0
Motor normal (Y/N)	17/3	19/1	20/0

No patients reported difficulties with catheter removal. 100% would recommend the technique.

Conclusions: Continuous perineural local anaesthetic infusion pumps provide effective analgesia with a high patient satisfaction score in patients after ambulatory foot surgery.

Reference:

1 Ilfeld BM. Reg Anesth Pain Med. 2003 Sep–Oct;28(5):418–23.

A-45

The effects of remifentanil and dexmedetomidine on recovery in ambulatory gynecologic laparoscopies

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Background and Goal of Study: Facilitating recovery after ambulatory anesthesia is still contentious (1,2,3). We aimed to compare dexmedetomidine with remifentanil with regards to their effects on recovery and postoperative side effects in ambulatory gynecologic laparoscopic surgeries.

Materials and Methods: After obtaining ethical approval we recruited 20–40 aged, 60 ASA I–II patients and randomized them into two groups. After induction with 2 mg $\cdot$ kg^{-1} propofol, 0.05 mcg $\cdot$ kg^{-1} $\cdot$ min^{-1} remifentanil infusion was started following 1 mcg $\cdot$ kg^{-1} bolus, in Group R. In Group D, 0.4 mcg $\cdot$ kg^{-1} $\cdot$ h^{-1} dexmedetomidine infusion was started following 1 mcg $\cdot$ kg^{-1} bolus. 1 MAC desflurane in 35% N_2O–65% O_2 was used for maintenance. Infusions were titrated to keep BIS $\leqslant$ 50. Postoperative pain, nausea and vomiting were evaluated using VAS. First analgesic requirement, severity of pain, satisfaction with anesthesia and recovery were asked on phone 24 hours after discharge. Data were analyzed using Kolmogorov–Smirnov, *t*-test, Mann-Whitney U test, analysis of variance and p-values of $<$0.05 were considered to be significant.

Results and Discussions: Among all groups demographic and hemodynamic data were similar. Extubation (6.1–7.3 min.), recovery (9.1–10.5 min.), and orientation times (16.1–21.2 min.) were lower in group R. Patients in Group R were in hospitalized for a shorter time (88–124 min.). Postoperative pain scores were similar, but nausea scores were higher in Group R. In Group D, antiemetic requirements were lower compared to Group R. The patients in Group R needed more analgesics at home.

Conclusion(s): Although faster recovery is obtained with remifentanil infusion, dexmedetomidine infusion may be an alternative since it provides similar haemodynamics and lower incidences of postoperative nausea and vomiting and a decrease in analgesic requirements.

References:

1 Coloma M, Chiu JW, White PF, et al. *Anesth Analg* 2001; 92: 352–7.
2 White PF. *Anesth Analg* 2000; 90: 1234–5.
3 Song D, Vlymen JV, White PF, et al. *Anesth Analg* 1998; 87: 1245–8.

A-46

No differences between low dose of dexametasone and ondansetron in the prevention of postoperative nausea and vomiting in patients who undergo ambulatory laparoscopic gynaecological surgery

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Background and Aim of study: Postoperative nausea and vomiting is a frequent complication of laparoscopic surgery. Several randomised trials have demonstrated that a single i.v. dose of 5–8 mg of dexamethasone is as effective as 4 mg of ondansetron. The efficacy of lower doses of dexamethasone has not yet been explored. We present the preliminary results of a clinical trial in women undergoing ambulatory laparoscopic gynaecological surgery.

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Materials and Methods: We designed a prospective, double blind and randomised study were 99 women ASA I–III undergoing ambulatory laparoscopic gynaecological surgery under general anaesthesia received during the induction: Group D (n = 54): 4 mg dexamethasone, Group O (n = 42): 4 mg ondansetron. Patients suffering of diabetes or morbid obesity were considered non eligible. Both groups were comparable for age, weight, smokers, surgery's duration, other risk factors for post-operative nausea *and* VAS of postoperative pain. T-test was used to compare quantitative variables, Fisher's Exact test for qualitative variables, variables found significant at a level of $p < 0.2$ were considered in the multivariate model (logistic regression). Variables with a p-value <0.05 were considered significant.
Results: We did not found significative differences in the global incidence of nausea, vomiting and the need of anti-emetic rescue in between the two groups: nausea D = 27%, O = 36%, p = 0.38; vomiting D = 11%, O = 14%, p = 0.75 and need of rescue D = 16%, O = 21%, p = 0.61. No differences were found when the incidence of nausea, vomiting and need of rescue was analysed within the following time intervals: <1 hour from surgery, between 1 and 6 hours and between 6 hours after surgery and discharge (data not shown).
Conclusion: In this randomised study, we have not found differences between 4 mg of ondansetron and 4 mg of dexamethasone in the incidence of nausea, vomiting or the needs of anti-emetic rescue. Therefore dexamethasone should be recommended as the most cost-effective alternative.

A-47

Multimodal prophylaxis of postoperative nausea and vomiting in day-case anaesthesia

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Background and Goals: Incidence of postoperative nausea and vomiting (PONV) is still in the range of 25–30%. Risk scores for predicting them and a multimodal prophylaxis have been proposed to reduce the overall incidence (1). We compare the effectiveness of combined therapy in presence of sevoflurane or propofol anaesthesia in ambulatory surgery.
Materials and Methods: 330 patients with low to moderate risk factors (RF) were randomly assigned to sevoflurane or total intravenous anaesthesia (TIVA). The antiemetic regimen was zero RF – no prophylaxis, one RF – 1 antiemetic, two RF – 2 antiemetics, three RF – 3 antiemetics. The drugs used were: ondansetron 4 mg, droperidol 0.625 mg and dexamethasone 8 mg. Statistical tests used was t-Student and χ^2. A p value <0.05 was considered significant.
Results and Discussions: There were no differences in RF between groups. There was a higher proportion of maxillofacial surgery on sevoflurane group ($p < 0.005$).

	Sevoflurane	TIVA	p
Age (years)	30 ± 14	37 ± 14	0.0001
Female (%)	58	55	0.57
PONV			
PACU I (%)	11	2.4	0.003
PACU II (%)	4	3	0.59
Surgery (min)	64 ± 23	70 ± 40	0.3
Discharge (min)	189 ± 59	175 ± 108	0.51

Conclusion: The multimodal approach to PONV is associated with a higher proportion of patients with a complete response in TIVA with propofol than sevoflurane anaesthesia.
Reference:
1 Habib AS, Gan TJ. Can Anesth 2004; 51:326–341

A-48

Improved postoperative analgesia with additional IFB in hernia repair

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Background and Goal of Study: Since 2004, inguinal hernia repair must be done as day case in Germany. Yet it is one of the most painful procedures in ambulatory general surgery (1).
Materials and Methods: We studied 40 patients undergoing open hernia repair (20 with inguinal field block (IFB) and 20 without (w/o); age 55 ± 18 yrs). All patients received general anesthesia with Propofol/Remifentanil infusion and a PCA–i.v.-system with Piritramid. The block was performed pre-incisional after induction with 40 ml Bupivacain 0.25%. We recorded pain (VAS 1–10) in rest and-activity, Piritramid consumption (PC), patients satisfaction (PS), side-effects and recovery (PONV, dizziness, tiredness) (−2 to +2; worse-best), delayed discharge (DD), anesthetic and surgical time.
Results: Data (mean) are shown in the Table.

	Rest		Activity	
Pain (VAS 1–10)	W/o IFB	With IFB	W/o IFB	With IFB
PACU	5.4	2.0	6.5	2.5
After 4 h	3.3	1.9	5.7	2.9
Night	1.8	1.5	4.3	3.2
Next morning	1.8	2.1	4.1	3.7
After 14 days	0.3	0.2	0.6	0.6
PC in mg/h				
PACU	10.8	2.7		
First 4 h	5.0	1.3		
PS (−2 to +2)				
Until morning	0.9	1.0		
After 14 days	1.3	1.8		
PONV until morning	1.9	1.8		
Surg. time (min)	52	49		
Anesth. time (min)	74	75		
DD (days)	5	1		

Conclusion(s): The IFB combined with general anesthesia is effective against pain and comfortable for the patient in ambulatory surgery. There is no extra time consumption nor are there any extra side effects. Without IFB, there is a higher risk of delayed discharge.
Reference:
1 Chung F. *Anesth Analg* 1997; 85: 808–16.

A-49

The effects of the lidocaine or fentanyl pretreatment on inhalation induction with sevoflurane

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Background and Goal of Study: Sevoflurane has been widely used for inhalation induction and intubation in children and adults.[1,2] There are some reports about hemodynamic instability and respiratory effects during inhalation induction. We evaluated the effects of fentanyl, lidocaine, or both on inhalation induction and intubation using sevoflurane without neuromuscular blocking agents.
Materials and Methods: Sixty healthy adult female patients, 20 to 60 years old, premedicated with midazolam 3 mg were randomly received i.v. saline (Group A), lidocaine 1 mg/kg (Group B), fentanyl 1 μg/kg (Group C) or both lidocaine 1 mg/kg and fentanyl 1 μg/kg (Group D). Anesthesia was induced with 8% sevoflurane inhalation and intubation was done without muscle relaxant. A blind observer recorded the change of blood pressure, heart rate, BIS score, and the time needed for induction and intubation.
Results and Discussions: The mean times for BIS score below 40 were 87 ± 34 seconds and there were no significant difference among group. The mean times for loss of self respiration and intubation in Group A were significantly longer than those of other groups. The heart rates during induction and intubation of Group A were significantly greater than those of other groups. There was no significant difference in blood pressure and side effects during intubation among groups.
Conclusion(s): Pretreatment with fentanyl or lidocaine make smoother and faster induction and intubation during vital capacity rapid inhalation induction with sevoflurane.
References:
1 Anaesthesia 2000; 55: 774–8.
2 Anesthesiology 1996; 85: 536–43.

A-50

Monitored anaesthesia for ERCP in prone position using a target-controlled propofol infusion BIS-titrated

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Background and Goal of Study: Propofol is a short-acting, intravenously administered agent with a rapid recovery profile and good amnesic effects.

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Use of a target-controlled infusion (TCI) system for administration of propofol allows rapid induction and safe maintenance of the desired level of sedation, thereby making it ideal for technically demanding procedures (1). The aim of this study was to determine whether administration of propofol with a target-controlled infusion system BIS titrated could improve the sedation of patients undergoing ERCP.

Materials and Methods: We studied 150 consecutive patients undergoing ERCP in prone position. The patients were sedated by using a propofol target-controlled infusion system (Alaris Diprifusor) BIS-titrated. All patients were spontaneously breathing an oxygen-enriched mixture through the nasal cannula. The target plasma concentration of propofol ranged from 2 to 5 mcg/mL with a target BIS value ranged from 40 to 65. A bolus dose of fentanyl (50–100 mcg) was administered if signs of insufficient analgesia were observed at the maximum target concentration of propofol allowed, and always after sfinterotomy.

Results and Discussions: The mean dosages of propofol and fentanyl administered were 560 mg and 60 mcg, respectively. No severe complication was observed; mean time to discharge was 20 minutes. Time to discharge was not influenced by the difficulty of ERCP or by the total dose of propofol administered.

Conclusions: A target-controlled infusion system BIS titrated for administration of propofol provides safe and effective sedation during ERCP. Further studies are needed to determine the cost-effectiveness and the safety profile for infusion of propofol with a target-controlled infusion system by a non-anaesthesiologist during ERCP.

Reference:

1 Fanti L. Gastrointest Endosc 2004;60:361–6.

A-51

Propofol auto coinduction can aid laryngeal mask insertion. A prospective, randomised controlled trial

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Background and Goal of Study: Currently, common coinduction agents with propofol to aid LMA insertion include midazolam, fentanyl and alfentanil. In this study, we use small doses of propofol as an auto coinduction agent with propofol during anesthesia induction and LMA placement.

Materials and Methods: 44 ASA 1 & 2 patients scheduled for surgical or orthopaedic procedures under GA were recruited. The study group (PP) received 0.5 mg/kg propofol 2 minutes before induction and the control group (SP) received 3 ml saline. Propofol was infused at 50 mg/kg/h until loss of eyelash reflex. LMA was inserted when patient was relaxed. We compared the time taken for induction and LMA placement, total dose of propofol consumed, haemodynamics changes during induction and conditions for LMA placement.

Results and Discussions: There is a significant reduction in the dose of propofol required for LMA insertion (100 ± 32.6 mg vs. 166 ± 41.1 mg, $p = 0.00$) and in the time taken for completion of LMA insertion (98.9 ± 19.3 mg vs. 139 ± 42.1 mg, $p = 0.00$) in the PP group. There was a higher proportion of patients in whom the jaw opening (90.95 vs. 63.6%, p =) and the ease of LMA insertion (95.5% vs. 59.1%, p =) were described as good in the PP group. The LMA was inserted within the first attempt in 90% of the patients in the study group. However the incidence of side-effects was similar. There were significant decreases in mean arterial pressure within each group compared to baseline values during induction, but the magnitude of decrease was not different between the 2 groups. Mean heart rate remained stable during the induction process.

Conclusion(s): Small doses of propofol (0.5 mg/kg) given as a pre-dose can be used to augment the induction of anesthesia with propofol and smoothen the process of LMA insertion. Additional drugs need not be used when coinduction is desired, thus reducing the incidence of side effects associated with them. The process of co induction is also simplified by using the same agent.

References:

1 Djaiani G, Ribes-Pastor MP. *Anaesthesia* 1999: 54: 63–67.
2 Anderson L, Robb H. *Anaesthesia* 1998: 53: 1117–1129.

A-52

Comparison of dexmedetomidine and propofol in shockwave lithotripsy

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Background and Goal of Study: Various sedative and analgesic medication has been used for shockwave lithotripsy (SWL). The aim of this study was to compare dexmedetomidine and propofol during SWL in terms of haemodynamic, analgesic and sedative effects.

Materials and Methods: After institutional review board approval and written patient permission had been obtained, 40 patient of ASA physical status I and II, ranging in age from 18 to 60 years, who were scheduled for elective SWL were studied. The patients were randomly divided into two groups of 20. In group I, sedation induction was done dexmedetomidine 6 $\mu g\,kg^{-1}$. iv (infused in 10 mins) and infusion was started as 0.2 $\mu g\,kg^{-1}\,h^{-1}$, whereas in groups II, induction was done with propofol 100 $\mu g\,kg^{-1}$ iv (infused in 10 mins) and infusion was started as 40 $\mu g\,kg^{-1}\,h^{-1}$. All the patients received fentanyl 1 $\mu g\,kg^{-1}$ iv 10 minutes before SWL. Pain intensity was evaluated on a 0 to 100-mm visual analog scale (VAS). The level of sedation was determined using the Observer's Assessment of Alertnes/Sedation (OAS/S). The OAS/S was measured just before treatment, and the OAS/S and VAS were measured at the first minute and every 5 minutes. Hemodynamic and respiratory parameters were measured before SWL session, after sedation and during the SWL procedure at 5-minute intervals started at the first minute of SWL. Hemodynamic and respiratory parameters were evaluated post-SWL 45, 60, 90 and 120 minutes.

Results and Discussions: The two groups were similar with respect to demographic characteristics. There were no significant changes in intergroup mean blood pressure and heart rate, but respiratory rate was higher (except 120 minute) in the propofol group after treatment. O_2 saturation values at 5 to 35 minutes were found to be significantly higher in group I. OAS/S and VAS values at 25 to 35 minutes were found to be significantly higher in group II.

Conclusion(s): Dexmedetomidine can be used during SWL and because of advantage of no loss of respiratory drive, good analgesia and sedation it may be a good alternative to propofol.

A-53

Patient-controlled dexmedetomidine sedation for day-case ophthalmic surgery

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Background and Goal: Dexmedetomidine is a specific $\alpha 2$ adrenoreceptor agonist with sedative, analgesic and anesthetic-sparing effects (1). This prospective, randomized study evaluated the effects of dexmedetomidine during patient controlled sedation (PCS) in ophthalmic surgery.

Material and Methods: After obtaining ethic committee approval and patient permission, 40 patients (ASA I–II) were randomized to receive dexmedetomidine PCS (Group D, $n = 20$) or no intraoperative sedation (Group C, $n = 20$) during ophthalmic surgery performed under peribulbar block. The PCS solution contained dexmedetomidine 2 μg/ml. The PCS parameters consisted of a loading dose of 1 $\mu g kg^{-1}$, a PCS dose of 5 μg and a lockout interval of 10 minutes. The study groups were compared with respect to intraocular pressure, hemodynamic parameters, perception of pain during peribulbar block with numerical rating scores (NRS), anxiety and discomfort NRS, intraoperative Ramsay Sedation Scale (RSS), Aldrete Scores in postoperative first 30 minutes, incidence of intraoperative complications, patient and surgeon satisfaction. Chi-square and Mann-Whitney U tests were used for statistical analysis. P value of 0.05 was considered significant.

Results: Patients in the Group D were administered a mean dexmedetomidine dose of 66.4 ± 3.7 μg with a mean duration of 48.7 ± 3.2 min. Mean arterial pressure, heart rate, intraocular pressure, and NRS value during peribulbar block were lower in the Group D ($p < 0.05$). Patient satisfaction and RSS scores, incidences of dry mouth, and bradycardia were higher in the Group D ($p < 0.05$). Other intraoperative complications, surgeon satisfaction, anxiety and discomfort NRS and Aldrete Scores of the study groups were similar. In the PCS group none of the patients needed additional PCS dose after loading dose except two patients.

Conclusions: These results suggest that PCS with dexmedetomidine may be a useful technique in day-case ophthalmic surgery.

Reference:

1 Jaakola ML, Ali-Melkkila T, Kanto J, et al. Br J Anaesth 1992; 68:570–5.

A-54

Muscle relaxants for outpatient otorhinolaryngeal surgery: recovery pattern and home-readiness

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Background and Goal of Study: The use of muscle relaxants in outpatient anaesthesia is controversial, some authors recommend an induction regimen

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including propofol and opioids without muscle relaxants (1). This study evaluated the intubating conditioning in otorhinolaryngeal (ORL) ambulatory surgery with and without muscle relaxant and the immediate and intermediate post operrative recovery.

Methods: We examined in three groups (n = 20 for each) of ASA I–II patients the intubating conditions four minutes after induction of anesthesia with remifentanil 0.5 mcg/kg/min, propofol 2 mg/kg without muscle relaxant (A) or with rocuronium 0.6 mg/kg (B) or with cisatracurium 0.15 mg/kg (C). The time course of neuromuscolar block was determined by TOF Guard® using train of four stimulation (TOF). Anaesthesia was maintained with remifentanil 0.25 mcg/kg/min and propofol 6–8 mg/kg/h. Residual block was antagonized at T1 recovery of 25% with neostigmine 50 mcg/kg and atropine 15 mcg/kg. We have evaluated the intubating conditions with and without muscle relaxant; the onset time as maximal suppression of T1; time to 25% T1 recovery (duration of action), TOF ratio ⩾0.9 recovery, postoperative recovery in phase I (Aldrete's score ⩾9) and II (PADDS ⩾ 9) (2,3).

Results: Intubating conditions were good or excellent in group B and C, in group A they were good only in 50% of patients because of cough and movements after orotracheal tube positioning.

Conclusions: Rocuronium and cisatracurium do not influence the discharge times in ambulatory surgery. The post anesthetic discharge scoring system (PADDS) show that the use of non depolarizing muscle relaxant has no influence on the recovery and home-readiness. 70% of patients were discharged 2 h and 3% 3 h after surgery.

References:

1 Schlaich N, Mertzlufft M, Soltész S et al. Acta Anaesth. Scand 2000; 44: 720–726.
2 Chung F et al. Anesth. Analg 1995; 80: 896–902.
3 Aldrete JS et al. Anesth. Analg 1970; 49: 924–934.

A-55

The comparison of lornoxicam–propofol and fentanyl–propofol combinations on ESWL

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Background and Goal of Study: Extracorporal shockwave lithotripsy (ESWL) represents the initial treatment modality in approximately 90% of patients with urinary tract. Various sedative and analgesic medication has been used for ESWL[1]. The aim of this study was to compare the analgesic and side effects of propofol in combination with fentanyl or lornoxicam in ESWL.

Material and Methods: After approval of the local ethics committee and written informed consent were obtained, 23 patients (ASA class I–II, aged 25–59 yr) undergoing elective ESWL (using Siemens Lithostar ESWL lithotriptor) were included in the study. After arriving in the anaesthetic room and insertion of an i.v. cannula, baseline assessments of heart rate (ECG), noninvasive arterial pressure and pulse oximetry (SpO_2), were performed. In all patient, 0.5 mg kg of propofol was administered intravenously before ESWL. The patients were randomly allocated to receive either a bolus of 1 μg kg^{-1} fentanyl followed by a continuous infusion of propofol at a rate of 1 mg $kg\,h^{-1}$ (Group PF; n = 12) or a bolus of 8 mg lornoxicam followed by a continuous infusion of propofol at a rate of 1 mg $kg\,h^{-1}$ (Group PL; n = 11). Pain intensity was evaluated on a 0–100-mm visual analog scale (VAS). A supplemental analgesia with intravenous fentanyl 25 μgr or 8 mgr lornoxicam was given when inadequate analgesia occurred (VAS > 3). Pain intensity (using VAS), the level of sedation (using the four-point score) and analgesic requirement were recorded. Respiratory depression during the procedure is treated with oxygen supplementation. Statistical analysis were the performed by using Independent Simplest test, Chi-square test and Mann Whitney U test. $p < 0.05$ was considered at statistically significant.

Results: There was no statistical differences between two groups in the demographic data, duration of ESWL procedure and hemodynamic parameters during ESWL In group PF, the sedation scores were significantly higher than group PL ($p < 0.05$). The requirement of additional analgesic was higher in group PF than in group PL (5 versus 1 patients, $p < 0.05$). The incidence of oxygen supplement was lower in PL group (n = 1; 9% patient) compared with that of PF group (n = 8; 66.7%) ($p < 0.05$).

Discussion and Conclusion: *In conclusion*, propofol–lornoxicam combination was found to be a better alternative for ESWL patients since this combination caused less respiratory depression and decreased the analgesic necessity.

Reference:

1 Br J Of Anaesth 2002 Oct; 89(4):567–571.

A-56

The effects of dexmedetomidine infusion on intra-ocular pressure and sedation in outpatient cataract surgery

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Background and Goal of Study: We studied the effects of dexmedetomidine, a new α- agonist, on intra-ocular pressure (IOP), haemodynamic parameters, sedation and anxiolysis in day-case cataract surgery under periocular anaesthesia.

Materials and Method: After ethic committee's approval and informed consent, 44 ASA physical status I–III patients scheduled for elective day-case cataract surgery were randomly assigned into two equal group (n = 22). In group I, sedation induction was done with dexmedetomidine 1 μg/kg/h. iv (infused in 10 mins) and infusion was started as 0.2 μg/kg/h, whereas in group II, placebo group, was done an equal dose of saline. Infusion rates were adjusted according to sedation scale in group I.

Intraoperative heart rate (HR), systolic (SBP) diastolic (DBP) and mean (MBP) blood pressure, peripheric oxygen saturation (SpO2), visual rating scale (VAS) and sedation scale (Ramsay sedation scale) were recorded every 5 min before and during surgery and at 15 min intervals thereafter. IOP was measured before infusion and surgery and immediately after surgery.

At the end of operation Aldrete scores were evaluated.

Results and Discussion: In general, dexmedetomidine was well tolerated and no serious side or adverse effects were observed in the present study. The groups did not significantly with regard to age, weight, height, sex or duration of the operation ($p > 0.05$).

HR and MBP values were significantly reduced with dexmedetomidine in group I ($p < 0.05$). IOP was significantly reduced in the dexmedetomidine group. IOP was decreased at most by 28% with the dose of 0.2 μg/kg/h when measured after operation. Aldrete scores at 20 min was lower in group I than placebo group ($p < 0.05$). Postoperative VAS values were found to be significantly lower in group I ($p < 0.05$).

Conclusion: Our results suggest that dexmedetomidine 0.2 μg/kg/h produce sedation and a reduction of IOP with minimal haemodynamic changes in cataract surgery under periocular anaesthesia.

Reference:

1 Virkkila M. Anaesthesia, 1993, 482–7.

A-57

Is Remifentanil effective in single bolus anaesthesia during the testing of implanted automatic cardioverter-defibrillator and ordinary cardioversion?

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Background and Goal of Study: Cardioversion (CA) is a single painful stimulus and anaesthesia in these cases must be effective and short. The perfect analgesic drug seems to be Remifentanil (RE), with quick acting short activity, being non cumulative μ-1 receptor agonist. In this study we estimated the usefulness of RE in single bolus anaesthesia (AN).

Materials and Methods: After written consent obtained from 27 patients, ASA II/III they were anaesthetised for CA. Anaesthesia was maintained with Hypnomidat 0.1 mm/kg and RE 0.9 μg/kg in single intravenous bolus for 45 secs. Immediately after induction CA with stimuli of 3 J/kg was performed. During the procedure we registered systolic arterial pressure (SAP), diastolic arterial pressure (DAP), mean arterial pressure (MAP), heart rate (HR), respiratory rate (RR) and saturation (SaO_2) before a AN (I), 2 mins after induction (II) and after recovery (III). We measured the time to consciousness, then pain with 0–3 point VAS scale.

Results: The average time to awareness was 4.7 min. In 18.5% of the cases we had to ventilate patients with a facial mask. In 14.8% HR was less then 50 beats/min. We observed hypotension <90 mmHg in 14.8% of cases. On average patients estimated their pain to be at 1point. The rest of the parameters are shown as mean and SD in table.

	HR (f/min)	MAP (mmHg)	RR (f/min)	SaO_2 (%)
I	73.07 ± 23.42	95.17 ± 13.38$^{\#}$	16.19 ± 3.91$^{\Delta ?}$	96.93 ± 1.0$^{!}$
II	67.48 ± 18.6*	84.87 ± 13.87$^{\#@}$	10.48 ± 4.95$^{\Delta ®}$	92.56 ± 10.9$^{!}$
III	63.52 ± 10.7*	94.51 ± 15.52$^{@}$	13.30 ± 3.41$^{?®}$	96.04 ± 1.81

$^{*}p < 0.005$ II vs III; $^{\#}p < 0.01$ I vs II; $^{@}p < 0.01$ II vs III; $^{\Delta}p < 0.01$ I vs II;$^{®}p < 0.005$ II vs III; $^{?}P < 0.05$ I vs III; $^{!}p < 0.05$ I vs II.

Conclusion: Anaesthesia with Remifentanil is safe, gives hemodynamic stabilisation and allows efficient spontaneous ventilation in the majority of patients. After the procedure patients regain consciousness quickly and without pain.

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Monitoring: Equipment and Computers

A-58

Changes in transcutaneous PCO_2 on earlobe represent hypoperfusion characterized by systemic increase in lactate

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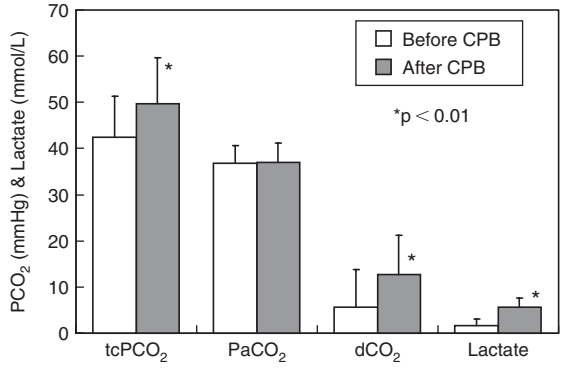
Background and Goal of Study: It has been shown that the increase in lactate and the reduction of inramucosal pH during cardiac surgery are due to hemodynamic instability which induces splanchnic and peripheral hypoperfusion (1,2). This study evaluated the change in transcutaneous PCO_2 ($tcPCO_2$) on the earlobe to test whether $tcPCO_2$ reflects the peripheral hypoperfusion during cardiopulmonary bypass (CPB).
Materials and Methods: 20 adult patients undergoing cardiac surgery using CPB were enrolled. Plasma lactate concentration and $PaCO_2$ were measured before and after CPB, along with $tcPCO_2$ on an earlobe (TOSCA, Linde, Switzerland). Peripheral blood flow on the earlobe was also measured using laser Doppler method. Relationship between lactate and PCO_2 difference ($dCO_2 = tcPCO_2 - PaCO_2$) was evaluated by using Chi square and ROC analysis, where p value and AUC were calculated.
Results and Discussions: 138 measurements were evaluated in 20 patients.



Lactate > 2 mmol/L was significantly associated with $dCO_2 > 5$ mmHg ($p < 0.01$, AUC 0.634). The significant relationship between lactate and dCO_2 indicates that $tcPCO_2$ at the earlobe represents the systemic hypoperfusion which sacrifices peripheral circulation.
Conclusion(s): $tcCO_2$ at the earlobe could represent such hypoperfusion that induced systemic increase in lactate during CPB.
References:

1 Eur J Cardiothorac Surg. 2003; 23: 917–24.
2 Paediatr Anaesth. 2003; 13: 777–84.

A-59

Minute ventilation required to maintain the normocapnia in laparoscopic bariatric surgery

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Background and Goal of Study: Resorption of CO_2 during laparoscopic surgery may have detrimental cardiovascular effects, especially in morbidly obese patients (MOP). The aim of this study is to determine the increase in minute ventilation (MV) required to maintain the normocapnia in MOP undergoing laparoscopic bariatric surgery.
Materials and Methods: 15 ASA physical class 2 MOP (BMI > 40) were studied. Furthermore 10 normal weight patients (control group = c) undergoing laparoscopic cholecystectomy was enrolled. The anaesthetic regimen was standard. All the patients were ventilated with a tidal volume 8–10 ml/Kg (ideal body weight). Respiratory rate (RR) was adjusted to maintain an $ETCO_2$ near 35 mmHg. The measurements of arterial blood gas tensions were made after tracheal intubation (1), 15′ after the beginning of pneumoperitoneum (PNP) (2), and then every 30′ until desufflation. RR was increased after abdominal insufflation in order to maintain $ETCO_2$ and $paCO_2$ at or near baseline values. Abdominal pressure was setted at 12 mmHg. Statical analysis was performed by ANOVA for repeated measures.
Results and Discussions: Main intra-operative data are presented in Table.

	1	2	3	4
$EtCO_2$ c	31 ± 1.0	36 ± 1.77*	32 ± 1.1	32 ± 1.1
$EtCO_2$ MOP	32 ± 1.2	37.6 ± 1.2*	31.7 ± 1.2	32.7 ± 1.2
$PaCO_2$ c ccgg	35 ± 1.2	41 ± 1.1*	36 ± 1.2	37 ± 1.2
$PaCO_2$ MOP	36 ± 1.4	42 ± 1.4*	37.8 ± 1.4	39 ± 1.4
Paw c	21.2 ± 3.1	27 ± 1.4*	26.1 ± 2.2*	27 ± 2.1*
Paw MOP	22.8 ± 3.8	26 ± 3.9*	29 ± 3.8*	30.8 ± 3.8*
VM c	4.5 ± 0.2	4.7 ± 0.2	5.2 ± 0.31*	5.1 ± 0.3*
VM MOP	7.9 ± 0.3	8.1 ± 0.3	9.0 ± 0.3*	9.4 ± 0.3*

*$p < 0.05$ compared to time 1.

Conclusion: Although possible detrimental changes in respiratory function, MOP doesn't require higher increase in VM to maintain normocapnia compared to normal-weight patients (18.5% ± 2 vs 16% ± 1.5); furthermore this ventilatory setting allowed to avoid high airway plateau pressures (paw), even if the gradient between $paCO_2$ and $ETCO_2$ showed a moderate increase.
Reference:

1 Sprung J "The impact of morbid obesity, pneumoperitoneum, and posture on respiratory system mechanics and oxygenation during laparoscopic" Anest. Analg 2002; 94: 1345–50.

A-60

A comparison of pre- and postoperative transcutaneous carbon dioxide tensions and oxygen saturations in spontaneously breathing patients with TOSCA monitor

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Background and Goal of Study: Postoperative (po) hypoventilation leading to hypercarbia and hypoxaemia is associated with the use of opioid analgesics and may cause potentially serious side effects (1). The TOSCA monitor (Linde, Basel, Switzerland) combines transcutaneous estimations of arterial carbon dioxide tensions (CO_2 [kPa]) measured electrochemically and oxygen saturations (SaO_2 [%]) measured photometrically. It correlates well with arterial partial pressures of both gases (2). The aim of this observational, prospective study is to evaluate preoperative (pr) and po CO_2 and SaO_2 in non-ventilated patients with no cardiopulmonary morbidity.
Materials and Methods: We enrolled nine patients (ASA 1–2, m = 5, f = 4) scheduled for laparotomy under general anaesthesia. Postoperative pain relief was standardised to patient controlled analgesia (PCA) and patients were given 4 L min^{-1} O_2 via oxygen mask. We recorded total Morphine until 06:00 hours on the first po day (M24, [mg]). Data were collected from 22:00–06:00 hours on both the pre- and postoperative nights and analysed with Download 2001 for Linde TOSCA.
Results and Discussions: Descriptive data are shown.

	Mean	SD	Med	LQ	UQ	Min	Max
M24	–	–	55	52	64	32	205
BMI	25.3	3.5	–	–	–	20	33
Age	57.8	13.5	–	–	–	33	74

	Med	LQ	UQ	Min	Max
$poSaO_2$	98.01	97.00	98.98	91.85	99.98
$poCO_2$	6.98	5.79	7.23	5.59	8.35
$ÄSaO_2$	3.13	2.79	6.00	2.00	11.18
$ÄCO_2$	0.83	0.36	1.78	−0.72	2.39

Ä = changes post-/preoperative, med = median, LQ = lower and UQ = upper quartile. BMI = Body Mass Index.

Conclusion: In nine spontaneously breathing patients on PCA and 4 L min^{-1} O_2 post laparotomy we found relevant hypercarbia but no hypoxaemia using transcutaneous estimations of CO_2 and SpO_2 with Linde TOSCA.
References:

1 Yentis SM. Oxford: Butterworth-Heinemann, 2000.
2 Rohling R. *J Clin Monit* 1999; 15: 23–27.

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A-61

Comparison of two systems for measurement of pulmonary capillary blood flow by partial CO_2 rebreathing

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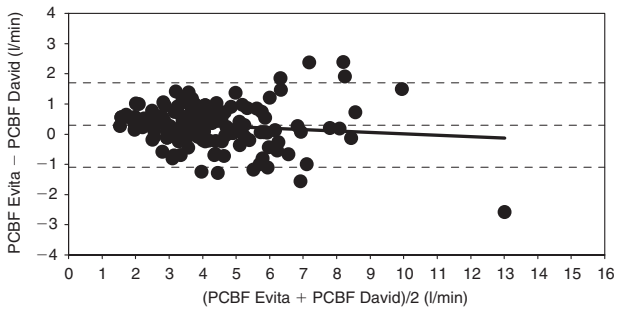
Background and Goal of Study: The pulmonary capillary blood flow (PCBF) can be measured by short periods of impairment of the CO_2 elimination rate (VCO_2), which lead endtidal CO_2 partial pressure ($P_{ET}CO_2$) to increase (1). We compared two systems for measurement of PCBF that use different degrees of partial CO_2 rebreathing.

Materials and Methods: Sixteen adult sheep were anesthetized and mechanically ventilated with the Evita 2 mechanical ventilator (Drägerwerk, Lübeck, Germany). PCBF was estimated noninvasively as VCO_2/S. $P_{ET}CO_2$ (S = CO_2 dissociation curve) with the DAVID Monitor (MedServ, Leipzig, Germany) ($PCBF_{David}$), which has a rebreathing deadspace of 200 ml, and by the Evita 2, which was modified to permit rebreathing maneuvers with a deadspace of 1000 ml and calculate PCBF ($PCBF_{Evita}$). Measurements were performed at normal and impaired conditions of hemodynamics (variation of cardiac output) and gas exchange (variation of alveolar deadspace and shunt).

Results and Discussions: In total 144 pairs of measurements were obtained. Bias and precision calculations showed a tendency for $PCBF_{Evita}$ to overstimate $PCBF_{David}$ (0.3 ± 0.7 ml/min, $p < 0.001$).



Conclusion(s): The modified Evita 2 tends to overestimate PCBF values as measured by the DAVID Monitor. This is most probably explained by a nonlinear relationship between VCO_2 and $P_{ET}CO_2$ in the presence of alveolar deadspace, which leads PCBF values estimated by almost total CO_2 rebreathing to be higher than by minimal CO_2 rebreathing.

Reference:

1 Gama de Abreu et al. *Crit Care Med* 1997; 25: 675–683.

Acknowledgements: We acknowledge Drägerwerk AG for financial support.

A-62

Gravity influences accuracy and precision of pulse oximetry during simulated +1 Gz, 0 Gz, and −1 Gz

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Background and Goal of Study: Pulse oximetry is a reliable technique to determine functional oxygen saturation (SpO_2) with high accuracy and precision in the arterial blood. Multiple factors can influence the measurement; especially low perfusion [1] or venous congestion may severely decrease reliability. Reliability of pulse oximetry is poorly investigated under the influence of changes in gravity and acceleration.

Materials and Methods: After informed consent, five volunteers were investigated on a tilting table. One pulse oximeter (FRED, Brucker Medical, sensor BCI) was attached at the left earlobe ($^{EAR}SpO_2$) to evaluate gravity effects. Another pulse oximeter (Digit™, BCI) at the middle finger of the right hand at heart level ($^{F}SpO_2$) served as reference (no gravity effect). Bias for oxygen saturation ($^{F}SpO_2 - ^{EAR}SpO_2$) and heart rate were calculated in upright standing position (simulation of +1 G_z for 4 min, 20 values each), in lying position (0 G_z, 4 min, 20 values), and head down position (−1 G_z, 4 min, 20 values). Wilcoxon-test was used for statistical analysis, a $P < 0.05$ was considered to be significant.

Results and Discussions: All investigated volunteers were male with an average age of 26 ± 5 years and a BMI of 22.5 ± 2.1 kg m^{-2}. Bias during simulated +1 G_z (−0.9 ± 0.4%, range −0.2% to −1.3%) and simulated 0 G_z (−1.0 ± 0.7%, range +0.2% to −2.0%) changed not significantly ($P = 0.67$). With simulated −1 G_z in head down position bias increased to +1.7 ± 1.0% (range +0.3% to +3.7%, $P < 0.001$). Bias for the heart rate decreased from +3.3 ± 6.2 min^{-1} vs. −3.6 ± 5.6 min^{-1} (+1 G_z vs. 0 G_z) to −10.1 ± 3.7 min^{-1} during −1 G_z ($P < 0.001$).

Conclusion(s): Reliability of pulse oximetry determining functional oxygen saturation and heart rate at the earlobe is significantly lower during simulated −1 G_z compared to the reference measurement at heart level or during +1 G_z and 0 G_z. The reason may be venous congestion under negative G_z-gravity, which should be investigated further.

Reference:

1 Hinkelbein J et al. Aviat Space Environ Med 2004; 74(4): B91.

A-63

Accuracy of three different techniques to determine pCO_2 in a pig model

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Background and Goal of Study: Arterial blood gas analysis (ABGA) remains the gold-standard to determine carbon dioxide partial pressure (p_aCO_2). End-tidal techniques ($p_{et}CO_2$) are easy to establish, but may be inaccurate. A new transcutaneous monitor ($p_{tc}CO_2$) allows continuous measurement of CO_2. Accuracy and precision are evaluated in an animal model.

Materials and Methods: After approval of the local ethics committee for animal research $p_{et}CO_2$ (Datex Ohmeda, Helsinki/Finland), p_aCO_2 (ABL500, Radiometer/Denmark), and $p_{tc}CO_2$ (TCM4, Radiometer/Denmark) were determined simultaneously in six intubated and ventilated house pigs during normo-, hyper-, and hypoventilation. The bias for the measurement was calculated as $B_{et} = p_aCO_2 - p_{et}CO_2$, and $B_{tc} = p_aCO_2 - p_{tc}CO_2$. T-test was used for statistical analysis, $p < 0.05$ was considered significant.

Results and Discussions: 61 data sets ($p_{et}CO_2$, p_aCO_2, and $p_{tc}CO_2$) were acquired in six female house pigs (30 ± 3 kg). During normoventilation (respiratory rate 13 min^{-1}, tidal volume 10 ml kg^{-1}, $p_aCO_2 = 40.0 \pm 4.0$ mmHg, n = 27) bias for the end-tidal ($B_{et} = +3.0 \pm 2.3$ [−0.2 to +10.0] mmHg) and transcutaneous measurement ($B_{tc} = -4.5 \pm 6.0$ [−16.1 to 3.1]) of p_aCO_2 were comparable. During hypoventilation (respiratory rate 6 min^{-1}, tidal volume 6 ml kg^{-1}, $p_aCO_2 = 55.8 \pm 5.7$ mmHg, $B_{et} = -1.7 \pm 6.8$ mmHg, $B_{tc} = -3.8 \pm 4.9$ mmHg, n = 17) and hyperventilation (respiratory rate 21 min^{-1}, tidal volume 12 ml kg^{-1}, $p_aCO_2 = 28.7 \pm 4.3$ mmHg, $B_{et} = +2.6 \pm 0.9$ mmHg, $B_{tc} = -4.1 \pm 4.8$ mmHg, n = 17) no difference in bias could be found.

Conclusion(s): In this trial in an animal model a good correlation between the three different techniques to determine p_aCO_2 was found during normoventilation as well as during hypo- and hyperventilation. Transcutaneous and end-tidal monitoring allow reliable and comparable readings of p_aCO_2.

A-64

The resistance of current anaesthetic breathing systems

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Background: When a patient breathes through an anaesthetic breathing system an extra resistance is imposed on their respiratory muscles. This extra resistance may be overcome or may lead to hypoventilation and reduced gas exchange. A simple means of assessing breathing system resistance is to measure the pressure drop (PD) at a specified flow. The International Standard for breathing systems defines this flow and states that the PD at the patient connection port should not exceed 0.6 kPa (1). This study aims to determine the PD, and hence resistance, of various breathing systems and to compare it with the requirement of the standard.

Methods: We tested 5 samples each of 10 1.6 m breathing systems (4 Bain's coaxial, 3 Mapleson A [Map A] and 3 parallel systems) using a fresh gas flow of 10 L min^{-1} and a sine-wave pump, to simulate spontaneous breathing, set to 1 L tidal volume at 20 min^{-1}. Pressures and flows were measured using a Datex AS/3 monitor. All data were recorded onto a laptop using LabVIEW software.

Results:

	Mean (SD) max PD (kPa) [no. of samples < 0.6 kPa]		
Manufacturer	Bain	Map A	Parallel
Armstrong	0.87 (0.13) [0/5]	0.68 (0.18) [2/5]	0.78 (0.03) [0/5]
Flexicare	1.43 (0.14) [0/5]	1.43 (0.14)[0/5]	0.77 (0.02) [0/5]
Intersurgical	0.91 (0.12) [0/5]	0.56 (0.10)[3/5]	0.77 (0.01) [0/5]
Mallinckrodt	0.40 (0.03) [5/5]		

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Conclusion(s): Similar breathing systems from different manufacturers showed very different pressure drops and therefore resistance. Only 10 of the 50 systems tested complied with the requirements of the standard.

Reference:

1 BS ISO 8835–2:1999.

Acknowledgements: Flexicare, Intersurgical, Armstrong and Mallinckrodt for the samples.

A-65

Real time dependency of subcutaneous tissue oxygenation on inspired oxygen concentrations

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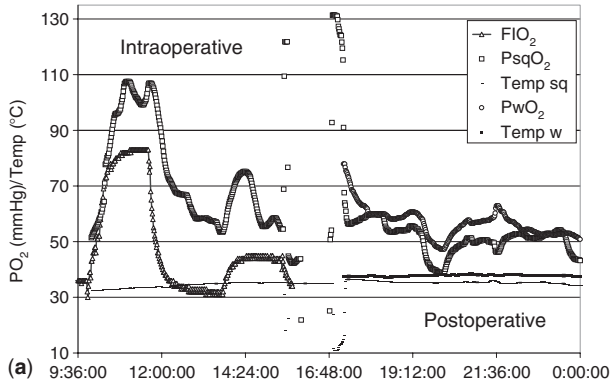
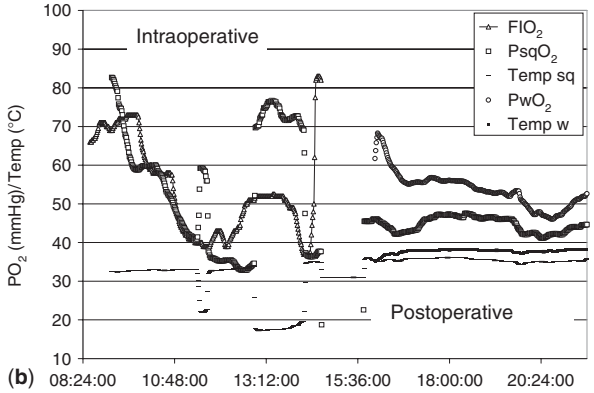
Background and Goal of Study: Supplemental peri-operative oxygen administration increases subcutaneous tissue oxygenation. The exact correlation over time between tissue oxygenation and FiO_2 is unknown. Consequently we evaluated subcutaneous tissue oxygen tension of the upper arm ($PsqO_2$) and of the wound (PwO_2) in relation to inspired oxygen concentrations (FiO_2).

Materials and Methods: So far we have evaluated data in two patients (A, B). Intraoperatively $PsqO_2$ was measured, whereas postoperatively $PsqO_2$ and PwO_2 in the subcutaneous tissue adjacent to the surgical wound were obtained. Additionally we recorded hemodynamic and respiratory data (e.g. CO, FiO_2). All data were recorded online.

Results: Our preliminary results show that there is a close relationship over time between $PsqO_2$ and FiO_2. Furthermore tissue oxygenation at the wound is well reflected by subcutaneous tissue oxygenation in the upper arm.



(a)



(b)

Conclusion: Inspired oxygen concentration is an important factor of subcutaneous tissue oxygenation. With our data we can show the real time dynamic dependency of $PsqO_2$ on FiO_2.

A-66

Duration and extent of the decline SpO_2 after low-dose injection of methylene blue

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Background and Goal of Study: With regard to previous studies (1) reporting of artifactual low readings of functional oxygen saturation (SpO_2) after injection of methylene blue (MB), this study was designed to indi-vidually evaluate duration and extent of the spurious de-crease in SpO_2 of four pulse oximeters, each representing the newest technology.

Materials and Methods: After IRB approval and in-formed consent, SpO2 of 20 patients (58–92 yrs) under-going transurethral vesical surgery and receiving 50 mg MB intraoperatively to localize the urethral orifices was simultaneously measured with four pulse oximeters (Philips IntelliVue M3001, Masimo Radical, Dolphin Medical 2100, Nellcor N-595) via four randomly placed sensors (digit II–V). Minimum SpO_2 (t_2) as well as be-ginning (t_1) and end (t_3) of the decline of SpO_2 were marked offline and $\Delta t_1 = t_2 - t_1$, $\Delta t_2 = t_3 - t_2$ and $\Delta SpO_2 = SpO_2(t_1) - SpO_2(t_2)$ were calculated.

Results and Discussions: Data (mean ± SD) are shown in the table:

	Philips IntelliVue	Masimo Radical	Dolphin Medical	Nellcor N-595
Δt_1 (s)	23.6 ± 5.2	19.4 ± 7.0	20.5 ± 7.2	24.7 ± 6.3
Δt_2 (s)	128.1 ± 43.2	105.4 ± 33.0	143.5 ± 45.0	112.6 ± 32.4
ΔSpO_2 (%)	37 ± 10	51 ± 14	46 ± 11	37 ± 7

There are only slight statistical differences of Δt_1 with all pulse oximeters. Dolphin Medical shows the largest recovery time and as well as Masimo Radical the deepest decline of SpO_2, significantly differing from Nellcor N-595 and Philips IntelliVue.

Conclusion: Variably differing SpO_2 readings with newest generation pulse oximeters after MB injection do not allow to conclude on pathophysiological alterations of oxygen delivery. Further investigations are needed to de-termine whether or not the decline in SpO_2 may correlate to a change in arterial oxygen saturation (sO_2).

Reference:

1 Morell RC et al. *Anesthesiology* 1993; 78: 363–364.

A-67

IV Injection of low-dose methylene blue causes a decrease in pO_2

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Background and Goal of Study: Due to its peak absorption at 609 and 668 nm, methylene blue (MB) is known to cause transient, but artifactual low readings (1) of the functional oxygen saturation (SpO_2). This study was designed in order to determine whether or not this spurious decrease in SpO_2 is associated with a concurrent alteration of the arterial pO_2 after MB injection.

Materials and Methods: After institutional approval and informed consent, SpO_2 data of 16 patients (58–92 yrs) undergoing transurethral vesical procedures and receiving 50 mg of MB intraoperatively to visualize the urethral orifices, were assessed by means of four fourth generation pulse oximeters. An arterial line was placed into the contralateral radial artery and arterial blood gas samples were taken to determine the pO_2 (Radiometer ABL700) prior to the IV injection of MB (t_1: $pO_{2\,(1)}$), at minimum SpO_2 (t_2: $pO_{2\,(2)}$), and after SpO_2 having returned to its baseline (t_3: $pO_{2\,(3)}$). The differences between $pO_{2\,(1)}$ and $pO_{2\,(2)}$ ($\Delta pO_{2\,(1-2)}$) and $pO_{2\,(2)}$ and $pO_{2\,(3)}$ ($\Delta pO_{2\,(3-2)}$), respectively, were calculated for each patient. Additionally, the interval between t_1 and t_2 ($Ät_1$) and t_2 and t_3 ($Ät_2$) was determined.

Results and Discussions: Data (mean ± SD) are shown in the table.

	Mean	SD
$\Delta pO_{2\,(1-2)}$ (mmHg)*)	48.4	±20.1
$\Delta pO_{2\,(1-2)}$ (%)*)	33.3	±8.6
$\Delta pO_{2\,(3-2)}$ (mmHg)*)	33.4	±13.6
$\Delta pO_{2\,(3-2)}$ (%)*)	25.7	±7.6
Δt_1 (s)	23	±6
Δt_2 (s)	123	±38

*) $p < 0.001$.

Average pO_2 appears significantly reduced by 15 mmHg approximately, although SpO_2 has already returned to its initial level.

Conclusion: The IV injection of low-dose MB causes a significant drop in pO_2, therefore further research is required to investigate the underlying pathophysiology.

Reference:

1 *Anesthesiology* 1989;71:791–794.

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A-68

Cerebral oxymetry versus mixed venous oxymetry during hypothermic hemodilutional cardiopulmonary bypass

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Principle and Goal of study: During cardio-pulmonary bypass (CPB), mixed venous oxygen saturation (S_vO_2) has been traditionally used as an indicator of whole body oxygen supply/demand. Recently, the INVOS monitor has been used for non-invasive and direct assessment of cerebral blood oxygen saturation (R_sO_2). This study was undertaken to compare R_sO_2 and S_vO_2 during hypothermic hemodilution CPB.

Materials and Methods: Fourteen patients undergoing elective cardiac surgery using hypothermic hemodilution CPB were included in the study. During CPB, R_sO_2 and S_vO_2 were continuously monitored with a cerebral oximeter (INVOS 5100B) via a surface electrode placed on the patient's forhead and with the mixed venous oximeter (Bently Oxy-Sat meter) integrated in the cardiopulmonary bypass machine (Sarns 5000) respectively. Mean ± SD of R_sO_2, S_vO_2, P_aCO_2, Hct, and CO were determined during prebypass and during CPB at 31°C and 35°C. Statistical analysis were performed with the analysis of variance (ANOVA) and level of significance was considered at $p < 0.05$.

Results: Data (Mean ± SD) are shown in the table:

	Pre- bypass	Cooling 31°C	Rewarming 35°C
R_sO_2 (%)	76.0 ± 9.6	58.9 ± 6.4*	67.1 ± 8.7*¶
S_vO_2 (%)	78.6 ± 3.3	84.9 ± 3.6*	74.1 ± 5.6*¶
P_aCO_2 (mmHg)	43.5 ± 8.9	T. Corrected: 26.8 ± 3.1* T. Uncorrected: 38.9 ± 3.7	37.9 ± 3.1§
Hct (%)	38.2 ± 5.1	27.7 ± 4.1*	28.5 ± 3.8*
CO (l/min)	4.6 ± 0.9	N/A	N/A
Pump Flow (l/min/m^2)	N/A	2.4	2.4

*$p < 0.05$ vs. Pre-bypass, ¶$p < 0.05$ vs. Cooling, §$p < 0.05$ vs. Cooling (Temp. Corrected)

Conclusions: During hypothermic CPB, there was a significant increase of S_vO_2 associated with a paradoxical decrease of R_sO_2. The decrease in R_sO_2, despite the decreased cerebral oxygen consumption during hypothermic CPB, may be attributed to the possibility of decreased cerebral oxygen supply secondary to the α-stat strategy of CO_2 management which decreased temperature-corrected P_aCO_2 during hypothermia down to 26.8 ± 3.1 mmHg.

References:

1 Baraka A. et al. J Cardio Anesth 1990; 1: 35–38.
2 Holzschuf M. et al. Neuro Res 1997; 19: 246–248.

A-70

Orbital ultrasound monitoring during cardiopulmonary bypass and neuropsychological function following cardiac surgery

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Background and Goal of Study: Cerebral dysfunction following cardiopulmonary bypass (CPB) remains a major source of morbidity and mortality in cardiac surgery, with early diagnosis required for the prevention of neurological complications. Orbital ultrasound (OUS) monitoring can provide useful information regarding intracranial blood flow during a CPB procedure (1). The objective of the present study was to evaluate the clinical significance of quantitative OUS findings during cardiac surgery in terms of their relevance to postoperative neurological events.

Materials and Methods: We studied 30 adult patients scheduled for coronary artery bypass grafting or valve replacement surgery. A mini-mental state examination (MMSE) was performed 2 days before, and 7 and 14 days after the operation. OUS observations were made before, 20, 40, and 60 minutes after the start, and after the end of CPB. Maximal flow velocity (V_{max}) in the central retinal artery (CRA) and MMSE scores after the operation were compared using regression analysis. Further, V_{max} and the occurrence of postoperative neurological events were compared using a chi-square test.

Results and Discussions: MMSE scores were significantly decreased 7 days after the operation and then returned to preoperative levels by 14 days. No significant correlations were seen between Vmax at any time point during CPB and postoperative MMSE scores. Delirium occurred in 5 cases (17%), whereas no major complication, such as stroke, occurred. Each of those patients showed significantly lower MMSE scores after the operation as compared to the other patients, and OUS monitoring detected CRA blood flow during CPB. We considered that the absence of significant correlations between V_{max} and postoperative neurological events may be due in part to the absence of major neurological complications in the present cases.

Conclusion(s): The V_{max} of CRA blood flow obtained by OUS monitoring could not predict postoperative neurological events. Additional studies for quantitative evaluation of OUS monitoring during CPB when used as an indicator of postoperative minor neurological dysfunction are needed.

Reference:

1 Orihashi K, Matsuura Y, Sueda T, et al. *Ann Thorac Surg* 2001; 71: 673–677.

A-71

P_uO_2 as a marker for renal blood flow in laparoscopic versus open donor nephrectomy

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Background and Goal of Study: Laparoscopic donor nephrectomie (LDN) is performed more often because of reduced postoperative morbidity and shorter hospital stay. Animal studies have shown however a reduced renal blood flow (RBF) during pneumoperitoneum [1]. To measure RBF, invasive techniques should be used, however earlier investigators suggested that urine oxygen tension (P_uO_2) is related to renal medullar blood flow (RmBF) [2]. This study is the first prospective randomised study where RBF is measured and comparing LDN and open donor nephrectomy (ODN) patients.

Materials and Methods: 32 patients in the LDN en 33 in the ODN group, were included. Anaesthesia was performed with a fixed protocol and continuos FiO_2 of 40%. High dosage of morfomimetica and liberate fluid regime of colloids and crystalloids starting before operation was used. P_uO_2 samples were obtained on 2 moments.

Results and Discussions: 9 patients from the ODN and 3 patients from the LDN group had to be excluded. Both operation techniques cause an equivalent and a significant ($p < 0.05$) increase in P_uO_2 after two hours of operation. No difference is found in P_uO_2 between LDN and ODN.

P_uO_2 (kPa)	ODN	LDN	p-value
After induction of anaesthesia	12.9 (2.9)	13.3 (3.9)	0.64
2 hours laparoscopic or open operation	17.4 (3.0)	16.6 (2.6)	0.34
p-value	<0.05	<0.05	

Mean urine oxygen tension (P_uO_2) (kPa) with (sdv) in the ODN versus LDN group.

Conclusion(s): We concluded that provided there is an adequate anaesthesia technique with liberate fluid supply and IAP is maintained at 12 mmHg, the intra operative RmBF is not dependent on surgical procedure. The increase in P_uO_2 during surgery can be explained by redistribution of the RBF in the kidney from cortex to medulla.

References:

1 Cisek LJ, Gobet RM, Peters CA, *Journal of Endourology.* 1998; **12**(2): 95–100.
2 Kainuma M, Kimura N, Shimada Y, *Crit Care Med*. 1990; **18**(3): 309–12.

A-72

Single transpulmonary thermodilution during off-pump coronary artery bypass grafting

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Background and Goal of Study: An off-pump modification of coronary artery bypass grafting (OPCAB) is intended to avoid complications related to cardiopulmonary bypass, but can be accompanied by severe changes in hemodynamics requiring advanced monitoring (1). The transpulmonary single thermodilution (STD) is a novel method for cardiovascular monitoring allowing the simultaneous evaluation of myocardial preload and contractility as well as quantification of lung edema (2). However, the role of STD in off-pump cardiac surgery is still unsettled. Thus, our aim was to evaluate the use of STD in OPCAB.

Materials and Methods: We studied 11 patients who underwent elective OPCAB during total intravenous anesthesia (propofol and fentanyl). Before surgery, a 5F thermodilution catheter (Pulsiocath PV2014L20) was inserted into the femoral artery. Heart rate (HR), cardiac index (CI), cardiac function index (CFI), stroke volume index (SVI), stroke volume variations (SVV), global ejection fraction (GEF), left ventricular contractility index (dP_{max}), systemic vascular resistance index (SVRI), and other hemodynamic parameters were assessed by STD and continuous pulse contour analysis (PiCCO*plus*, Pulsion Medical Systems, Germany). The measurements were performed after

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induction of anesthesia, during and at the end of surgery, and at 2, 4, and 6 hrs postoperatively. The data were analyzed using the test of contrasts.
Results and Discussions: After induction of anesthesia, HR, CI, CFI, SVI, GEF, and dPmax declined in concert with an increase in SVRI ($p < .05$). During revascularization, dPmax and SVRI decreased transiently by 25% ($p < .05$) that necessitated administration of ephedrine in 8 of the patients. After the OPCAB, HR, CI, CFI, and SVV increased significantly in parallel with fluid resuscitation and intravenous infusion of nitroglycerin. These changes, as well as a decrease in SVRI by 20% ($p < .05$), were also observed postoperatively.
Conclusion: During OPCAB, STD is a valuable tool for monitoring of the volume status, myocardial performance, and vascular tone that might help in providing an adequate goal-directed hemodynamic management.
References:
1 Ngaage DL. *Med Sci Monit* 2004; 10: RA47–54.
2 Boldt J. *Crit Care* 2002; 6: 52–59.

A-73

Correlation of peripheral venous and central venous pressures after major surgery in the postanaesthesia care unit

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Background and Goal of Study: Correlation of central venous pressure (CVP) and peripheral venous pressure (PVP) in ASA II–III patients after major surgery.
Materials and Methods: A prospective repeated measures study was performed on 16 patients in our postsurgical intensive care unit (ICU). All patients had peripheral venous lines and required CVP monitoring. CVP and PVP were measured pairwise every hour during the first 5 hours after surgery. If typical sinusoidal wave forms were not seen on PVP tracings, the patient was excluded from the study ($n = 4$). All patients were spontaneosly breathing and reclining with the head at 30°. The CVP was placed at the superior vena cava. The peripheral venous catheter were standard peripheral over-the-needle catheter of different sizes (20 to 14 gauge), and were placed at the forearm or hand.
Results and Discussions: All patients were ASA II–III required a postsurgical ICU because of major surgery and patient comorbidity.This preliminary results showed a good correlation during the first 5 hours after surgery: $r_1 = 0.8$, $r_2 = 0.9$, $r_3 = 0.85$, $r_4 = 0.86$, $r_5 = 0.88$ respectively ($p < 0.01$).

The mean values and SD of PVC and PVP during the first 5 hours were: 1st: 6,69 (3) and 9,5 (3.8), 2nd: 7,25 (3.2) and 9.88 (3.5), 3rd 7,13 (3.8) and 9.13 (3.7), 4th 6.44(2.8) and 9.19(3.3), 5th 6.19(2.6) and 8.56 (2.8) respectively.

The bias (mean difference between CVP and PVP) during the first 5 hours was 2.5 (SD1.5) mmHg.
Conclusion(s): PVP measurement may be a noninvasive alternative for estimating PVC at the PACU, in spontaneously ventilating ASA II–III patients without significant cardiac dysfunction undergoing major surgery.
Reference:
1 Amar et al. J Cardiothorac Vasc Anesth 2001; 15: 40–3.

A-74

Could central venous oxygen saturation be an attractive alternative to mixed venous oxygen saturation in cardiac surgery with cardiopulmonary bypass?

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Background and Goal of study: Central venous oxygen saturation ($ScvO_2$) may be an interesting alternative to mixed venous oxygen saturation (SvO_2) in patients without a need of a pulmonary artery catheter (1). The aim of this study was to evaluate the relation between SvO_2 and $ScvO_2$ in patients scheduled for cardiac surgery with cardiopulmonary bypass (CPB).
Materials and methods: 33 patients (10 patients with coronary artery bypass grafting (CABG), 7 patients with valve replacement and CABG, 16 patients with valve replacement) after written and informed consent were included in this prospective study. A TCI remifentanil – propofol – cisatracurium anaesthesia was used. Tip placement of the catheters in the pulmonary artery (Swan-Ganz®, 7,5F, American Edwards Lab) and in the superior vena cava (7F triple lumen, Arrow®) was controlled by Transesophageal Echocardiography. Blood samples were drawn at induction (T1), 10 minutes after CPB (T2) and after arrival in the intensive care unit (T3). The blood samples were immediately analysed for oxygen saturation by Instrumentation Laboratory 682 CO-Oximeter. Statistical analysis was performed by linear regression, Pearson correlations and the method of Passing and Bablok (2).
Results: Mean values ± SD, correlations (R) and confidence limits of 95% for SvO_2 and $ScvO_2$ at T1, T2 and T3:

	SvO_2 (%)	$ScvO_2$ (%)	R	95%
T1 (n = 33)	74.5 ± 8.7	77.5 ± 6.8	0.82*	(0.67–0.91)
T2 (n = 33)	73.5 ± 6.5	78.5 ± 6.7	0.71*	(0.49–0.85)
T3 (n = 33)	68.6 ± 5.8	71.4 ± 7	0.59*	(0.31–0.77)

*$p < 0.0003$.

The test of Passing Bablok shows that $ScvO_2$ overestimates SvO_2 during the 3 sample times.
Conclusions: $ScvO_2$ can not be substituted for SvO_2 in cardiac surgery with cardiopulmonary bypass.
References:
1 Rivers EP, et al. NEJM 2001; 345:1368–77.
2 Passing H. J.Clin.Chem.Clin.Biochem.1983; 21: 709–20.

A-75

Activated clotting time in patients undergoing cardiopulmonary bypass: evaluation of a new aprotinin-insensitive ACT test using sonoclot

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Background and Goal of Study: The kaolin-based activated clotting time assessed by the HEMOCHRON system (HkACT) is a clinical standard to monitor heparin therapy alone and combined with aprotinin during cardiopulmonary bypass (CPB). However, aprotinin is known to prolong not only celite-based ACT measurements but also kaolin-based ACT (1). Overestimation of ACT implies a potential hazardous risk of subtherapeutic heparin anticoagulation and must be avoided. Recently, a so-called aprotinin-insensitive ACT has been developed for the SONOCLOT Analyzer (SaiACT; Sienco Inc., Wheat Ridge, CO). The aim of our study was to evaluate and compare SaiACT with HkACT and anti-Xa activity in patients undergoing CPB.
Materials and Methods: 44 patients scheduled for elective cardiac surgery were studied. Heparin therapy was guided by HkACT. Blood samples were taken at baseline (T0), after heparin administration (200 U/kg, 100 U/kg; T1,2), on CPB, before (T3) and 15, 30, 60 min after administration of aprotinin (2 Mio KIU; T4,5,6), and after protamine infusion (T7). HkACT, SaiACT and anti-Xa activity were measured at each time point, both ACT were measured in duplicate. Statistical analysis was done using Bland-Altman analysis, linear regression with Fisher's z-transformation and ANOVA with post-hoc Bonferroni-Dunn correction.
Results: A total of 352 blood samples were analyzed. Administration of heparin/protamine induced a significant increase/decrease of HkACT, SaiACT and anti-Xa. Compared to HkACT, SaiACT was significantly lower at T0–7: mean bias (SaiACT-HkACT) was −55 ± 113 sec (−11 ± 17%; $p < 0.01$). Correlations of HkACT-anti-Xa ($r2 = 0.41$) and of SaiACT-anti-Xa ($r2 = 0.48$) were significantly different ($p < 0.01$). After administration of aprotinin (T4–6) 8% of SaiACT readings were <480 sec, whereas all HkACT measurements were >480 sec. Coefficient of variation was comparable for HkACT and SaiACT (HkACT = 7.9 ± 11.6%, SaiACT = 7.5 ± 7.9%).
Conclusion: These data indicate that SaiACT may be a valuable alternative to HkACT for guiding heparin therapy during CPB when aprotinin is used. The use of SaiACT may result in an increased administration of heparin.
Reference:
1 J Extra Corpor Technol 2004; 36: 51–7.

A-76

Dumping coefficient and natural frequency are incomplete dynamic response parameters of pressure monitoring line

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Background and Goal of Study: The damping coefficient and natural frequency are standard parameters for anesthesiologists to evaluate the dynamic responses of pressure monitoring lines. But in fact, under the lumped constant model described by the second order ordinary differential equation the dumping coefficient can be derived from amplitude gain at

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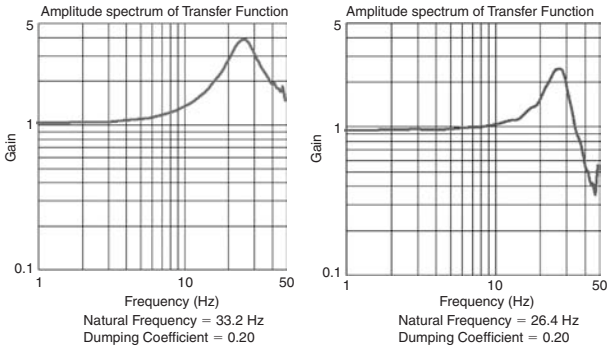
natural frequency. We demonstrated the defectiveness of the dumping coefficient and natural frequency with our high-precision frequency response measurement method (step-response analysis).

Materials and Methods: A blood pressure wave converter (Biotek 601A) connected to a function signal generator, 2 channeled-pressure amplifiers and personal computer were used. After introducing a square wave into the blood pressure monitoring line, proximal (input) and catheter-end (output) pressure waves were recorded with pressure amplifiers. Frequency response curves (amplitude and phase), the dumping coefficient and natural frequency were displayed after analysis with our original computer program.

Results and Discussions: There were discrepancies between dumping coefficients and natural frequencies, and frequency response characteristics.



Two curves (Fig. 1) had the same dumping coefficient (0.20). The natural frequency of the left curve (33.2 Hz) was higher than that of the right one (26.4 Hz), so the dynamic response of the left monitoring line seemed better than that of the right one. But in fact the right frequency response curve had an excellent dynamic response with a wide, flat, low frequency range and without pressure wave distortion.

Conclusion(s): The dumping coefficient and natural frequency cannot elucidate the shape of frequency response curves. Therefore these parameters became less useful for dynamic response evaluation.

A-77

Changes in cerebral oximetry during carotid endarterectomy

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Background and Goal of study: Cerebral oximetry is a simple method of measuring regional cerebral oxygen saturation (SrO_2) (1). During carotid endarterectomy (CEA), carotid clamping causes a decrease in the ipsilateral SrO_2 (2). The goal was to study the effect of carotid clamping on SrO_2 depending on the grade of stenosis of the contralateral carotid artery.

Materials and methods: We studied 27 patients who underwent CEA under general anaesthesia. Patients were divided into two groups: contralateral carotid stenosis of less than 70% (G I), and more than 70%, severe stenosis or occlusion (G II). The INVOS- 4100 cerebral oximeter was used for measure SrO_2 at several times: baseline (t1), after induction of general anaesthesia (t2), before carotid clamping (t3), one and five minutes after clamping (t4 and t5), and after declamping (t6). At the same times, direct median arterial pressure (MAP), end-tidal carbon dioxide ($PetCO_2$), pulse oximetry (SpO_2) and entropy were recorded. We used for analysis ANOVA test.

Results: In both groups, induction of anaesthesia (t2 vs t1) caused no changes in SrO_2. Carotid clamping (t4 vs t3) induced a significant fall in the ipsilateral SrO_2 from 61.4% to 57.4%, mean difference: 4.07 CI (1.24–6.91) and on declamping (t6 vs t5) ipsilateral SrO_2 raised from 57.78% to 62.48%, mean difference: 4.70 CI (1.45–7.96); there were no significant changes in the contralateral SrO_2 at the same times.

No correlation was found between the changes in $SrCO_2$ and the severety of the stenosis.

Conclusions: During CEA, clamping of the carotid artery results in a significative drop of the ipsilateral SrO_2, that recovers after declamping. In our study there were no significant differences in SrO_2 in patients with contralateral severe stenosis or carotid oclusion compared to patients with a lesser degree of stenosis.

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A-78

Quantitative assessment of left ventricular function using tissue doppler imaging in intraoperative transesophageal echocardiography in patients undergoing coronary revascularization

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Background and Goals: Tissue Doppler Echocardiography (TDE) is a novel echo technique that may quantify regional LV function. Previous reports have established transthoracic tissue Doppler imaging (TDI) for noninvasive assessment of ventricular function, but the technique has not been validated for assessment of LV function during cardiac surgery especially in patients undergoing coronary revascularization procedure. The purpose of this study is to assess the clinical feasibility of TDI in the intraoperative transesophageal echocardiography (TEE) during coronary revascularization.

Material and Methods: A total of 20 patients undergoing coronary artery bypass were studied using intraoperative TEE combined with TDI. All the data of TDI including systolic velocities, isovolumic contraction time (IVCT), isovolumic relaxation time (IVRT), early diastolic (Ea), atrial contraction (Aa) were measured before and after coronary revascularization.

Results: The data of DTI in regional segment of left ventricle had been recorded successfully in 18 segments of all patients. Compared with pre and post revascularization, the systolic velocities, mean Ea and Aa wave were significantly higher and the IVRT was significantly shortening after coronary revascularization. There was no significant difference in the IVCT before and after revascularization.

Conclusions: Pulse wave DTI is a feasible non-invasive technique that allows for the assessment of regional functional performance and dynamics of the left ventricle myocardium in the intraoperative TEE examination during coronary revascularization.

A-79

Impedance cardiography: noninvasive measurement of hemodynamics and thoracic fluid content during endoscopic thoracic sympathectomy

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Background: Endoscopic thoracic sympathectomy (ETS) is a minimally invasive procedure for treating palmar hyperhidrosis (PH). Hemodynamic changes occurs with CO insufflation during ETS (1,2). In the present study hemodynamic changes were examined during ETS under general anesthesia using impedance cardiography (ICG).

Patients and Methods: 17 adult patients(15 males) scheduled to undergo elective unilateral ETS for treatment of PH were randomly enrolled in the study. Patients with cardio-respiratory disease were excluded from the study. Their age, and weight mean values were 26.5 ± 5 yr, 71.9 ± 11.5 kg respectively. Besides routine monitoring, ICG monitor was used to measure cardiac output (CO), cardiac index (CI), stroke volume (SV) and total fluid content (TFC) (3). For statistical analysis, three phases were defined for data collection: A, prior to CO insufflation, B (at 10, 5 and 2 mmHg IPP), during and C, after gas deflation. ANOVA was used for statistical analysis.

Results:

Variable	A	B10	B5	B2	C
CO	5.7 ± 1	4.5 ± 1*	4.8 ± 1*	5.4 ± 0.9	5.9 ± 1.1
CI	3.2 ± 0.4	2.6 ± 0.3*	2.7 ± 0.4*	3.1 ± 0.3	3.3 ± 0.6
SV	74.8 ± 19.5	60.8 ± 16	65.3 ± 17	66.4 ± 10.6	64.3 ± 16.7
TFC	33 ± 5	30.6 ± 3.5*	31 ± 3.4*	31.6 ± 3.3*	32.5 ± 6.8

*$P < 0.05$.

Conclusions: Significant reduction of CO, CI and SV were detected in the present study, but they were of no clinical significance. Of interest was the significant reduction of TFC during CO insufflation. Whether reduced TFC correlates to magnitude of compression, with subsequent hemodynamic changes, exerted on the closed hemithorax by CO insufflation, yet to be further studied.

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A-80

Calibration method used by Colins tonometry results in significant errors in blood measurement

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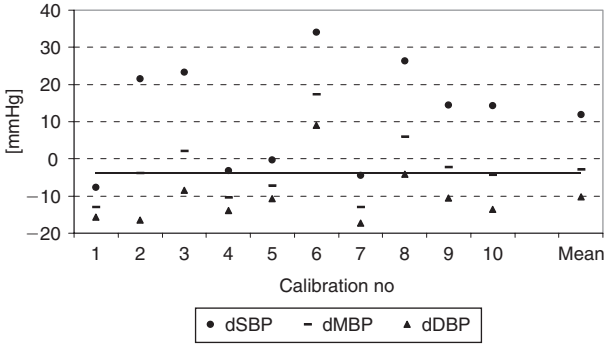
Background and Goal: Colin tonometry module provides a non-invasive alternative to intra-arterial blood pressure (BP) measurement (1). Calibration of the tonometry module relies on an oscillometric method. Our aim was to look at the effect of the calibration on module accuracy.
Materials and Methods: Ten conscious patients with an indwelling arterial catheter were studied. The Colin monitor performed ten calibration cycles firstly with the oscillometric cuff on the same arm as the tonometry module and secondly on the opposite arm. Simultaneous recording of BP wave forms from the intra-arterial BP transducer and the Colin monitor allowed comparison of beat-by-beat systolic, diastolic and mean BP.
Results and Discussions: There were considerable inter- and intra-patient variations. In the worst case, error range was 41 mmHg over ten calibrations. Analysis of variance (ANOVA) showed that contra- and ipsi-lateral calibrations gave a significantly different bias ($P < 0.001$ for systolic BP), while the multiple calibrations accounts for a significant proportion of the variability in systolic BP error ($P < 0.03$). The figure shows BP difference (tonometry vs intra arterial) in one patient following 10 calibrations.



Conclusions: Colin Tonometry is not accurate enough to be used with confidence in clinical practice. The main reason for this is its reliance on an oscillometric method for calibration of the tonometry module. Single BP measurements, using either manual or semiautomatic instruments, may vary considerably from the "true" blood pressure due to short-term perturbations of BP.
Reference:
1 Kemmotsu O, Yokota S, Yamamura T et al. *Anesth Analg* 1989; 68: 145.

A-81

Breath by breath, non-invasive measurement of cardiac output by pulmonary capnodynamics: comparison with aortic flow probe

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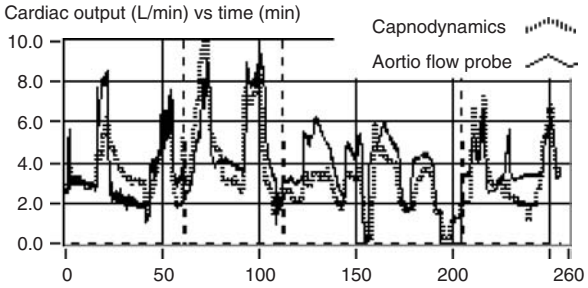
Background and Goals: Techniques based on the Fick principle using pulmonary gas exchange measurement are among the oldest methods for non-invasive measurement of cardiac output (Qt), but do not allow truly continuous monitoring. The capnodynamic method utilizes CO_2 elimination by the lungs during alternating levels of alveolar ventilation to automatically measure effective pulmonary capillary blood flow (Qc) with every breath.
Materials and Methods: Accuracy and precision of the method to measure wide changes in Qt were tested by simultaneous comparison with an ultrasonic ascending aortic flow probe in four ventilated sheep, anesthetized with isoflurane in oxygen-air. Qt was manipulated using dobutamine infusion with esmolol boluses. Qc was adjusted by estimation of shunt fraction from pulse oximetry, to obtain systemic Qt. The theoretical basis and prototype measurement system design are described in detail. Mean difference and standard deviation [sd] of the difference between capnodynamic and aortic flow probe measurements were calculated for i) Qt with each breath, and ii) change in Qt between successive 30 sec periods.
Results and Discussions: Aortic flow probe Qt varied between zero and 9.4 L/min (mean 3.9 L/min). Overall mean bias [sd] for Qt (capnodynamic – aortic flow probe) was: –0.47 [1.27] L/min; for change in Qt: 0.00 [0.51] L/min. Two cardiac arrest events were clearly identifiable by capnodynamics within 30–60 sec of occurence.



Conclusion(s): A prototype measurement system using capnodynamics accurately tracked sudden dramatic fluctuations in Qt in real time in an animal model. The method has potential for continuous non-invasive cardiac output in patients during anesthesia and critical care.

A-82

Minimally invasive system to measure cardiovascular dynamic performance

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Background and Goal of Study: Significant haemodynamic information can be estimated by signal processing systemic arterial pressure (Pas) (1–2). A such approach allows a more accurate monitoring during anaesthesia or in ICU without introducing new measurement lines.
Materials and Methods: The maximum value of time derivative of Pas, max (dPas/dt), has been studied in order to correlate its value to CO trends and, more generally, to obtain information on the efficiency of cardiovascular system. The study has been divided in two parts. In the first phase 86 measurements on 10 (age 75 $\pm$ 7) patients admitted to surgery for abdominal aorta aneurysm in epidural anaesthesia were performed (2). max (dPas/dt) and CO were measured during different phases of the surgery. In the second part study 10 measurements on a single patient (age 42) using bi-ventricular assist circulation devices (Thoratec) VAD were performed. Here CO was settled by console controls and changes in haemodynamic parameters (including dPas/dt) were measured. For both phases the relationship between target parameters has been studied computing r (the correlation coeff. of linear regression during the experiment on a single patient).
Results and Discussions: In epidural anaesthesia the within subject correlation between max (dPas/dt) and CO measured with thermodilution method is excellent (2). In all patients r (Mean $\pm$ SD) is 0.94 $\pm$ 0.04. Therefore in epidural anaesthesia (i.e. in fixed condition of other haemodynamic parameters – SVR, HR, etc.) the CO depends essentially on the component of heart contractility given by max (dPas/dt). Conversely using bi-VAD the value of max (dPas/dt) remains constant due to the characteristics of the device. Short-term changes (to consider SVR constant) imposed to CO are reflected only by changes in the heart rate imposed by the control algorithms of the VAD (CO vs. HR, $r = 0.93$).
Conclusion: max (dPas/dt), crossed with other parameters, can be profitably used as a sign of efficiency of the cardio circulatory system.
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A-83

Comparison of transoesophageal echocardiography and pulse contour analysis for real-time measurement of cardiac output

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Background and Goal of Study: Continuous measurement of cardiac output (CO) is of great importance in the critically ill. However, pulmonary arterial

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thermodilution has been questioned for possible complications associated with right heart catheterization [1]. Furthermore, measurements are delayed in the continuous mode during rapid haemodynamic changes [2]. To date, only ultrasound based methods and pulse contour analysis enable real time update of measurements [3]. We compared CO values obtained with transoesophageal echocardiography (TCO) with pulse contour analysis (PCCO) in patients scheduled for minimally invasive coronary artery bypass grafting.

Materials and Methods: After IRB approval, 16 patients ASA physical status II–III were enrolled in the study. Following standardized induction of anaesthesia, a transoesophageal echo probe was inserted in the oesophagus and a catheter for pulse contour analysis was introduced in the right femoral artery. At 4 event related operative stages (baseline after induction of anaesthesia, before clamping of the left anterior descending coronary artery [LAD], after LAD clamping and finally after clamp release) paired CO measurements were taken.

Results and Discussions: A total of 64 measurements were obtained at the different operative stages. TCO ranged from 2.9 to 8.5 liter $\cdot$ min^{-1} (mean 5.6 liter $\cdot$ min^{-1}), and PCCO ranged from 3.3 to 7.9 liter $\cdot$ min^{-1} (mean 5.3 liter $\cdot$ min^{-1}). CO measurements were analyzed using a Bland-Altman Plot. Bias between echocardiography derived cardiac output and pulse contour cardiac output was (mean $\pm$ 1 SD) 0.31 $\pm$ 0.81 liter $\cdot$ min^{-1}. Mean relative error was 12.9%, and limits of agreement were smaller than the recommended $\pm$30% of mean CO.

Conclusion(s): Agreement between TCO and PCCO was clinically acceptable. PCCO derived CO determination therefore has proved to be a valuable tool for real-time haemodynamic monitoring.

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A-84

Accuracy of a new automated device to assess difference in pulse pressure (dPP) continuously during surgery

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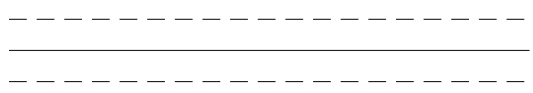
Background and Goal of Study: Fluid optimisation is a major contributor to improved oxygen delivery and thus improved outcome in patients [1,2]. Using difference in pulse pressure (dPP), assessed by the analysis of the arterial pressure wave forms (via arterial catheter) during a complete respiratory cycle has been shown useful to discriminate between volume-responders and non-responders [3]. However, the traditional assessment of dPP manually is not suitable for an OR environment. Consequently, we have developed a monitoring device for automatic assessment of dPP.

Materials and Methods: With IRB approval data from 8 ASA 1–3 patients, aged 18–80 years, scheduled for elective neurosurgical or major abdominal procedures were enrolled. Patients with cardiac, pulmonary, or renal disease were excluded. An arterial catheter was inserted at the wrist. Airway pressures and arterial blood pressure was recorded continuously. The assessment of dPP was done both continuously online by the monitoring device (Monitor), and offline after surgery by computing dPP manually from printouts of the arterial pressure wave form (Manual). Data pairs were analyzed using linear regression and Bland-Altman analysis.

Results and Discussions: 42 data pairs were compared. Bland-Altman analysis gave a bias of -1.54%, and a precision of $\pm 4.21\%$ (see Figure). Linear regression was $y(x) = 0.5x + 4$ with $r^2 = 0.32$.



Conclusion(s): Obtaining online dPP-values by our monitor device shows similar results compared with the traditional manual approach. The automatic assessment of dPP is useful to guide fluid management intraoperatively.

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A-85

Evaluation of the effect of esmolol on P wave dispersion

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Introduction: P wave dispersion (PWD), new ECG parameter, was reported as useful for presumption of atrial arythmias. Our aim was to evaluate the effect of esmolol on PWD and hemodynamic response.

Materials and Methods: 40 patients (ASA I–II) with acceptance of faculty ethic committee were divided into two random groups as group E (n: 30) esmolol and group P (n: 10) plasebo.100 mg/10cc/2 min esmolol for group E and 10 cc 0.9% NaCl/2 min for group P were applied. Anesthesia induction was achieved for both groups with 5–7 mg tiopental Na, 0.1 mg/kg vecuronyum bromür. ECG 50/s speed with 12 derivations was performed for all patients before drug application, 30th minute of induction and 5th minute of intubation. Heart rate, systolic-diastolic and mean blood pressure values were recorded in 1st, 3rd minutes of induction, 1st, 3rd, 5th minutes of intubation. P wave period was measured for all derivations of ECG. The difference between maximum and minimum P wave period was defined as PWD. Measurements were evaluated by a cardiologist and statistical analysis was made with t-test.

Result: There was not istatistical meaningful difference between the groups according to demographic and hemodynamic data. PWD period for group E before induction 35 $\pm$ 13 msn, 3rd min of induction 33 $\pm$ 11 msn; 5th min of intubation 29 $\pm$ 10 msn; for group P 31 $\pm$ 11 msn 3rd min of induction 36 $\pm$ 11 msn; 5th min of intubation 40 $\pm$ 6 msn. PWD values for group E in 5th min of intubation was statistically shorter compared with group P ($p < 0.03$).

Discussion: Compared with the control group, hemodynamic response was not different in the esmolol group. Although more evaluations are necessary for a definite decision, we believed thet esmolol can be used to prevent atrial arythmias.

A-86

Use of a transesophageal device during orthotopic liver transplantation

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Background and Goal of Study: Optimal monitoring providing on-line information is often required in anaesthesia for orthotopic liver transplantation (OLTx). The goal of this study was to compare cardiac output (CO) values obtained using pulmonary artery catheter (PAC) and a new transesophageal Doppler device (TED).

Materials and Methods: 30 patients undergoing OLTx were enrolled after an informed consent was obtained. Anaesthesia and monitoring were performed according to institutional standard, including monitoring of invasive arterial pressure and PAC. The Doppler probe (Hemosonic-Arrow) (TED) was inserted after tracheal intubation. Every time a thermodilution CO was performed, the most recent TED measurements were also recorded. After the first determination, an infusion of dopamine (3–5 mcg/Kg/min) was started. Veno-venous bypass was always used. Statical analyses were executed using Bland-Altman analysis, correlation and two-ways analysis of variance for repeated measurements.

Results and Discussions: In our patients 420 paired measurements of CO were carried out. The absolute values of CO were underestimated by Doppler technique (7.9 $\pm$ 2.46 vs 7.3 $\pm$ 2.37; $p = 0.2$). The systematic underestimation of CO TED with respect to CO PAC was moderate (0.63 L/min) and the limit of agreement ($\pm$2SD) were -1.56 L/min and 2.76 L/min. Percentage error ($\pm$2SD/mean) was $\pm$28% (1). Aortic blood flow acceleration (Acc) and peak velocity (PV), obtained by TED, showed a significant increase after start of dopamine infusion (from 19.4 $\pm$ 7 to 30 $\pm$ 6.5, and from 73 $\pm$ 17 to 105 $\pm$ 28, respectively), and remained elevated throughout the surgical procedure.

Conclusion: TED can provide a clinically useful estimate of CO. What is important, variations of CO were comparable in time using both techniques. In addition TED may provide valuable information regarding myocardial function, such as Acc and PV which with more comprehensive hemodynamic profile would provide for better management of patients.

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A-87

Erroneous measurement of haemodynamic parameters by PiCCO monitor in a critically ill patient with renal replacement therapy

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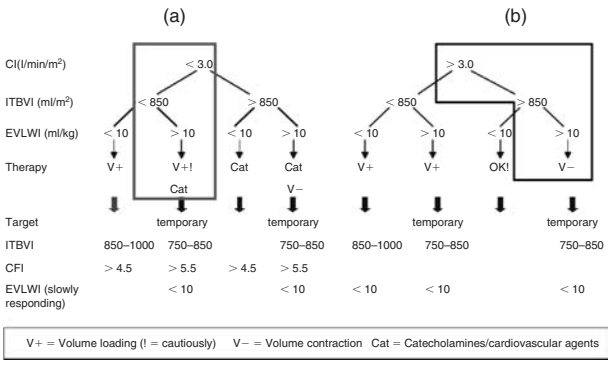
Background and Goal of Study: The determination of the continuous cardiac output by PiCCO™ monitor requires periodic calibrations through a central line catheter.
Materials and Methods: A 54-year-old woman was admitted to the ICU with multiorgan system failure due to nosocomial pneumonia. Calibrations of the PiCCO™ monitor were performed through the accessory lumen of a Certofix™ Trio HF catheter (Braun) placed at the right internal jugular vein to carry out continuous venous–venous haemodialysis (CVVH-D). We followed the management algorithm depicted in the Figure 1A. The patient's clinical worsening made us to perform an echocardiography that showed us a completely different clinical picture than the obtained with the PiCCO™. The CVVH-D technique was stopped, and the new obtained PiCCO™ measurements showed a different physiology, similar to that obtained by the echo (Figure 1b).



Results and Discussions: Due to the high flow of the haemodialysis catheter, there was an alteration of the area under the curve produced by the injection of cold saline. Therefore, PiCCO™ calibration during haemodialysis through a central vein catheter may produce erroneous measurements.
Conclusion(s): We should consider stopping the CVVH-D during the calibration of the PiCCO™ monitor.

A-88

The use of entropy in the monitoring of CNS reaction during general anesthesia

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Background and Goal of Study: It is well known that fentanyl (F) prevents haemodynamic reaction to the tracheal intubation. Less is known about the role of F on diminishing the risk of awareness. The **goal** of this study was to evaluate the effect of F on CNS responses during the early stage of anesthesia and tracheal intubation and to assess the informative role of EEG entropy.
Materials and Methods: 50 patients for elective gynaecological surgery, ageing 33–59 (ASA I–II) were randomised in two groups. Anesthesia was induced with midazolam 2.5 mg, propofol 2 mg/kg, atracurium 0.6 mg/kg, F 0.0025 mg/kg (group A, n = 25). Control group B (n = 25) instead of F received normal saline. Immediately after tracheal intubation sevoflurane inhalation 2 MAC was started. To measure CNS responses during induction of anaesthesia and tracheal intubation the Datex-Ohmeda entropy module was used, which measured two entropy indications: the state entropy (SE) and response entropy (RE). As it is known RE indicates the patient response to external stimulus. CNS reactions and standard monitoring were performed before and after anesthesia induction, during tracheal intubation, 3 and 6 min after intubation (1–3). The data were analysed with unpaired t-test and confidence interval analysis.
Results and Discussions: In A group SE (34 ± 3) and especially RE (36 ± 2) were significantly lower than in the B group at the tracheal intubation procedure, by 11% and 22% lower correspondingly ($p < 0.05$). After beginning of sevoflurane inhalation the entropy value and haemodynamic parameters decreased gradually in both groups and became similar during 6 min.
Conclusion: The response entropy value during intubation of trachea confirmed, that injection of fentanyl in dose 0.0025 mg/kg was effective to suppress the CNS responses to the noxious stimulation, induced by intubation of trachea.
References:
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A-89

Effect of lidocaine on hemodynamic and bispectral index responses to induction of general anesthesia and intubation

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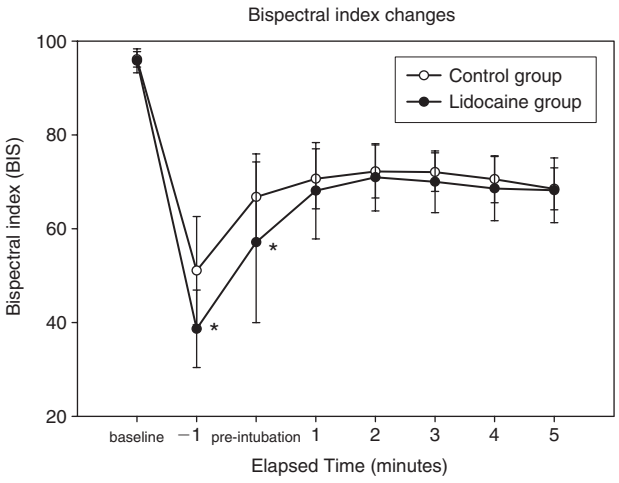
Background and Goal of Study: Bispectral index (BIS) has been utilized to monitor hypnotic response to intubation (1), and lidocaine is used to attenuate response to intubation (2). We investigated the effect of lidocaine on the hemodynamic and BIS responses to induction of general anesthesia and tracheal intubation.
Materials and Methods: Forty patients (ASA I) were randomly allocated into two groups of twenty to receive normal saline or lidocaine 1.5 mg/kg intravenously 30 sec after induction. 90 sec later, tracheal intubation was performed. Systolic blood pressure (SBP), heart rate (HR), and BIS were measured at baseline, 1 min after induction, immediately before (pre-intubation), and every minute until 5 min after tracheal intubation.
Results: Data (Mean ± SD) are shown in the figure:



*P < 0.05 between groups

Conclusion: Lidocaine decreased BIS after induction, but did not prevent BIS increases in response to laryngoscopy and tracheal intubation.
References:
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A-90

Effect of intravenous lidocaine on EEG spectral entropy and haemodynamic responses to laryngoscopy and tracheal intubation: preliminary results

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Background and Goal of Study: EEG spectral entropy can be used to monitor depth of anaesthesia. We investigated the effect of IV lidocaine on entropy and haemodynamic responses to laryngoscopy (L).
Materials and Methods: After IEC approval, 20 ASA I or II consenting patients undergoing routine surgery were studied. They were randomly allocated to receive either 1 mg kg^{-1} lidocaine (n = 10) or the same volume of saline (n = 10) before L. The event sequence was the following, each event occurring at the beginning of the 1 min non-invasive blood pressure (NIBP) measurement cycle: 0.15 μg kg^{-1} sufentanil (L − 5 min), 2 mg kg^{-1} propofol

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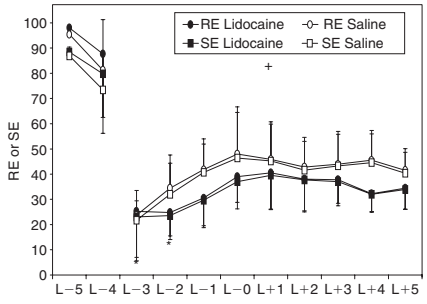
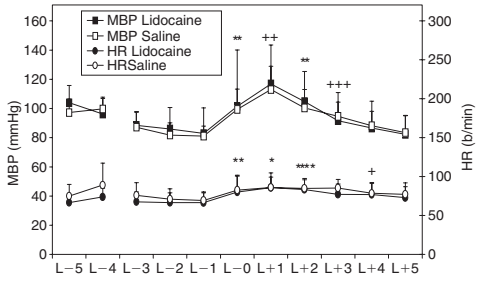
(L − 4), 0.15 mg kg^{-1} cisatracurium (L − 3), lidocaine or saline (L − 2), 1 min before L (L − 1), 20 sec duration L (L − 0) and every min for 5 min after L (L + 1 to L + 5). Mean blood pressure (MBP), heart rate (HR), response (RE) and state (SE) entropy (Datex-Ohmeda™ M-Entropy™) were recorded. Data were analyzed using twoway mixed-design ANOVA's for "Group" and "Time" (from L − 3 to L + 5), and Tukey's HSD tests. $P < 0.05$ was considered significant.
Results: MBP, HR, RE and SE were comparable in both groups before induction. We observed a significant main effect of "Group" and "Time" for RE and SE without interaction between the two, and a significant main effect of 'Time' for haemodynamics. Hence, from L − 3 to L + 5, RE and SE were significantly lower in patients who received lidocaine. L was associated to an increase in MBP and HR, but not in RE and SE. There was no difference between groups. The study power for detecting an interaction between "Group" and "Time" was poor.
Conclusion: After induction of anaesthesia, IV lidocaine maintains entropy lower during the period surrounding laryngoscopy. Additional patients must be recruited to evidence or reject a lidocaine-related differential haemodynamic or entropy response to laryngoscopy.



* = significantly lower at L−3 and L−2 than at all other time points of recording
\+ = RE and SE significantly lower in the lidocaine group than in the saline group for the whole period of recording



* = significantly higher than L−3, L−2, L−1
** = significantly higher than L−3, L−2, L−1, L+4, L+5
*** = significantly higher than L−3, L−2, L−1, L+5
\+ = significantly higher than L−2, L−1
++ = significantly higher than L−3, L−2, L−1, L−0, L+3, L+4, L+5
+++ = significantly higher than L−1

A-91

Is entropy a monitor for the guidance of intraoperative analgesia?

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Background and Goal of Study: Entropy is a new method for analyzing depth of anaesthesia which describes two parameters: SE (State Entropy) calculated from EEG, and RE (Response Entropy) calculated from EEG and frontal EMG. Since patients with inflammatory bowel disease (IBD) suffer from hyperalgesia in the perioperative period [1], entropy could be a good monitoring in these patients, RE being an indicator of analgesia defect. The aim of the study was to compare BIS (Bispectral Index) with entropy during laparotomy for IBD and to evaluate variations of RE and SE during nociceptive stimulation.
Materials and Methods: 14 IBD patients undergoing laparotomy were included prospectively. Anaesthesia was performed with propofol, sufentanil and atracurium. Depth of anaesthesia was adjusted to maintain BIS between 40 and 60 while sufentanil bolus was administered according to systolic blood pressure and heart rate variations larger than 20%. BIS, RE and SE were registered at each nociceptive stimulation. ANOVA was used to assess BIS, RE and SE variations throughout surgery. $P < 0.05$ was considered as significant. Pearson correlation was used between BIS, RE and SE. $P < 0.01$ was significant. The performance of SE and RE for monitoring depth of anaesthesia and for guidance intraoperative analgesia was evaluated by constructing ROC curves.
Results and Discussions: BIS and entropy behaved similarly during anaesthesia. A significant correlation between BIS, RE and SE was observed ($P < 0.01$). For the performance to monitor depth of anaesthesia, area under the ROC curves (AUC) were 0.932 ± 0.26 for RE and 0.926 ± 0.27 for SE while AUC for guidance intraoperative analgesia were 0.709 ± 0.46 and 0.688 ± 0.47. Overall, the AUC were not different between RE and SE.
Conclusion(s): Both RE and SE seem to be as good as BIS for anaesthesia depth monitoring. On the other hand, additional EMG analysis with RE does not seem to bring information regarding defect of analgesia in surgery requiring neuromuscular blockers.
Reference:
1 Guidat et al. *Eur J Anaesthesiol* 2003; 20: 957–62.

A-92

Association between subjective assessment of anaesthetic depth and BIS or spectral entropy by inexperienced and experienced anaesthesiologists

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Background and Goal of Study: Many anaesthesiologists deny the need for a monitor of anaesthetic depth in clinical practice. Subjective assessment of anaesthetic depth is deemed sufficient. To test this notion, we compared subjective assessment of anaesthetic depth by experienced (>4 years of experience in anaesthesia) and inexperienced (<2 years) anaesthesiologists with EEG-based indices as surrogate parameters of anaesthetic depth.
Materials and Methods: Following IRB approval and written informed consent, 100 ASA I–II patients were assigned to either the inexperienced group (I, n = 11) or the experienced group (E, n = 14) of anaesthesiologists prospectively in order to obtain comparable values for patient age and duration of anaesthesia. Anaesthesiologists were blinded towards the EEG parameters and assessed anaesthetic depth subjectively on an 11-point numeric scale and a verbal scale (very deep – deep – light – almost awake – awake). Assessment was recorded at defined time points, starting from 2 minutes after induction until the end of surgery. Simultaneously, bispectral Index (BIS, Aspect Medical Systems) and spectral entropy of the EEG (SE, "state entropy", M entropy module, Datex-Ohmeda) were recorded. The association between the subjective assessment and the EEG parameters was calculated using the prediction probability P_k as suggested by Smith (1).
Results and Discussions: The association (P_k) of subjective assessment and BIS was significantly better in the group of experienced ($P_k = 0.76$) than in the group of inexperienced anaesthesiologists ($P_k = 0.71$). High BIS values correlated well with high SE values. Episodes of intraoperative BIS levels >60 at a verbal assessment "very deep" or "deep" were observed in 13.2% of anaesthetic cases in the experienced group and in 34.3% in the inexperienced group.
Conclusion(s): Although the association between subjective assessment of anaesthetic depth and EEG-based indices improved with experience, in both groups a high incidence of inadequately light anesthetic states (indicated by BIS or SE values >60) was found. Subtle memory formation may be possible during such episodes (2), even though no explicit memory was recorded in our study.
References:
1 Anesthesiology 1996; 84: 38–51.
2 Acta Anaesthesiol Scand 2004; 48: 20–26.

A-93

Sevoflurane titration by using spectral entropy or bispectral index: effects on recovery time

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Background and Goal of Study: Spectral Entropy (Response Entropy: RE, State Entropy: SE) is a new EEG based monitor of anaesthetic depth designed to assess the hypnotic effect of anaesthetic drugs[1]. This preliminary study aimed to investigate the effect of sevoflurane titration by using Spectral Entropy or Bispectral Index (BIS) monitor on recovery time during gynecological surgery.
Materials and Methods: After approval of the Ethics Committee and written informed consent, 24 female patients ASA I–II, aged 40–60, undergoing elective gynecological surgery were randomized into two groups: BIS group (n = 12) and Entropy group (n = 12). Induction technique was standardized with propofol 2 mg kg^{-1}, fentanyl 2 μg kg^{-1}, and tracheal intubation was performed using rocuronium 0.6 mg kg^{-1}. Anaesthesia was maintained with sevoflurane and a mixture of 60% N_2O in O_2. The concentration of sevoflurane

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was titrated to maintain both BIS and Entropy (RE, SE) "target values" between 40–60 during maintenance of anaesthesia and 10 min before the end of the surgery, in the range of 60–70. The end-tidal sevoflurane concentration (ETsevo, vol%), blood pressure, heart rate, the time required to "eye opening", "extubation", "response to verbal command" were recorded. Statistical comparisons were performed by unpaired T-test (statistical significance when $P < 0.05$).

Results: The groups were similar according to age, body mass index, duration of surgery, haemodynamic stability and mean fentanyl dosages. No clinical signs of awareness were noted and no patients had any postoperative recall. Mean (SD±) values are summarized in the table below.

	ETsevo (vol%)	Open eyes (min)	Extubation (min)	Response (min)
Entropy	0.65 ± 0.17	3.96 ± 2.19	4.97 ± 2.48	7.30 ± 3.43
BIS	0.79 ± 0.12	4.54 ± 3,47	5.10 ± 3.56	7.55 ± 3.53
P	0.029	NSS*	NSS*	NSS*

(NSS*: Non-Statistical Significance).

Conclusion: Titration of sevoflurane using Spectral Entropy decreases the end-tidal concentration of sevoflurane, when compared to BIS, but does not improve patient's recovery time probably due to the favorable pharmacokinetic profile of sevoflurane.

Reference:

1 Bruhn J. Anaesthesiology 2000; 92(3): 715–26.

A-94

Effects of the electric drill in accuracy of spectral entropy in tympanoplasty

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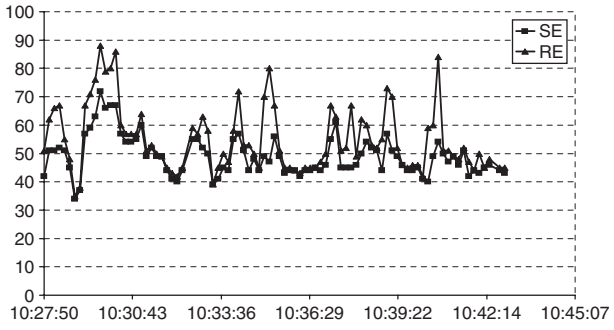
Background and Goals: The concept of spectral entropy has been recently introduced for assessing awareness. Although the algorithm has been designed to detect and remove artifacts such as electrocautery, electrocardiogram, pacers, and movement (1), some situations have not been described before, like the use of the drill in ear surgery.

Materials and Methods: We present two cases undergoing scheduled tympanoplasty under general anaesthesia with propofol and remifentanil. Non invasive arterial pressure and heart rate were recorded, and state entropy (SE) and response entropy (RE) was assessed with the Datex-Ohmeda Entropy™ module.

Results and Discussions: Peaks on the SE and RE lines were coincident with the temporal bone dissection using electric drill. In those events electroencephalographic records were very similar to the signal registered in the awake phase. In a first moment these changes were considered a nociceptive stimulus, so that the dose of propofol and remifentanil was increased.



Conclusion: In ear surgery, bone dissection using electric drill could affect accuracy of spectral entropy, with similar parameters to a decreasing depth of anaesthesia.

Reference:

1 Viertiö-Oja H, Maja V, Särkelä M. Acta Anesthesiol Scand 2004; 48: 154–161.

A-95

Comparison of spectral entropy and BIS during sevoflurane or isoflurane anesthesia

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Background and Goal of Study: It is believed that inhalational anesthetics produce dose-dependent decrease in BIS values. However, some reports showed that the BIS values reach a plateau or show only minimal changes at a range of 1.2–1.8MAC sevoflurane/isoflurane anesthesia (1). The Datex-Ohmeda Entropy module has been developed to measure the irregularity of the EEG signal under general anesthesia. Spectral entropy provides two separate entropy indicators, namely state entropy (SE) and response entropy (RE). Here we studied the dose response relationship of SE, RE and BIS during either sevoflurane or isoflurane anesthesia.

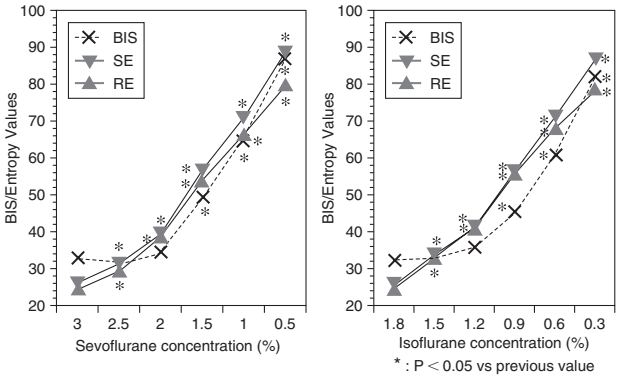
Materials and Methods: After institutional approval and obtained informed consent, 20 patients (ASA I or II, aged 35–45 yrs) scheduled for lower abdominal surgery were included. Patients were not premedicated. After applied both the Entropy and BIS electrode probes, anesthesia was induced with 5% sevoflurane ($N = 10$) or 3% isoflurane ($N = 10$) followed by 3 μg/kg of fentanyl and 0.15 mg/kg of vecuronium. After tracheal intubation, anesthesia was maintained with 3% sevoflurane or 1.8% of isoflurane, respectively. Fentanyl and vecuronium were added in requirement. The comparative RE, SE and BIS values were measured at least 20 mins interval at the following end-tidal anesthetic concentrations.

Sevoflurane Group: 3.0, 2.5, 2.0, 1.5, 1.0, 0.5%

Isoflurane Group: 1.8, 1.5, 1.2, 0.9, 0.6, 0.3%

BIS, SE and RE were compared using one-way ANOVA followed by paired-t-test.

Results: Data are shown in the following figures.



Conclusions: In contrast to BIS, SE and RE changed in dose-dependent manner in all investigated anesthetic concentrations. Spectral Entropy would be more suitable to measure the depth of anesthesia in clinical settings.

Reference:

1 Olofsen E, Anesthesiology 1999; 90: 1345–53.

A-96

Response entropy changes after nociceptive stimulus during general anaesthesia

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Background and Goal of Study: Entropy is a new hypnosis monitor used during general anaesthesia. It analyzes the electromiogram and it could give information about the arousal during the anaesthesia. The main goals of the study were to establish the standard entropy values in different sevoflurane and propofol target concentrations and the entropy response observed to painful stimulus.

Materials and Methods: Prospective, randomized study that included 10 patients ASA I scheduled for ENT surgery. The study was achieved before surgery, we divided in 2 groups: sevoflurane y propofol. Group sevoflurane, anaesthesia induction with fresh gas flow 7 l/min, and FiO_2 100%, sevoflurane end-tidal was kept at 2%, 3% and 4%, during 15 min. each concentration. In Propofol group, we set the plasmatic concentrations calculated, with a TCI device, at 3 mcg/ml, 4 mcg/ml, and 5 mcg/ml, during 15 min each concentration.

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At each target concentration fixed we applied a nociceptive stimulus: tetanus 100 Hz, during 5 sec.

In the operating room we set the standard monitorization, BIS, response entropy (ER), and state entropy (ES).

Results: ER/ES at target concentrations (m ± sd):

	ER	ES
Sevoflurane		
2%	68,75 ± 21	66 ± 22
3%	47,5 ± 12,4	43,75 ± 12,3
4%	37 ± 9,9	37,5 ± 7
Propofol		
3 mcg/ml	63 ± 10,4	58,75 ± 7,5
4 mcg/ml	42,25 ± 17,2	45,75 ± 18,7
5 mcg/ml	30,5 ± 11	32 ± 6,9

At target concentration, RE pre and post-tetanus stimulus, that represents ED95 we found significative differences (*p < 0,05) in both groups.

ER Sevoflurane pre /post-tetanus 37 ± 9,9/45,5 ± 12*

ER Propofol pre /post-tetanus 30,5 ± 11/38,7 ± 8*

Conclusions: On one hand we have set the entropy values at which patients are anesthetized and on the other hand the study shows significative changes in the ER values when a nociceptive stimulus is applied. Nevertheless we should increase our sample size to evaluate the liability of our results.

References:

1 Bruhn J et al. Anesthesiology 2003; 99:621–7.

2 Vanluchene et al Anesthesiology. 2004 Jul; 101:34–42.

A-97

Influence of combined drug effect with sevoflurane/remifentanil and propofol/remifentanil on prediction probability of entropy and auditory evoked response

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Background and Goal of Study: Validity of depth of anaesthesia parameters are less good described with drug interaction. Thus, we investigated the predictive performance of state entropy (SE), response entropy (RE) and the A-Line autoregressive index (AAI) to distinguish between different levels of consciousness during induction and recovery of anaesthesia with sevoflurane or propofol combined with low or high dose remifentanil.

Materials and Methods: With IRB approval and informed consent, forty unpremedicated patients undergoing minor orthopedic surgery were randomly allocated to one of the following groups: (1) sevoflurane/remifentanil (c_e = 2 ng/ml), (2) sevoflurane/remifentanil (c_e = 8 ng/ml), (3) propofol/remifentanil (c_e = 2 ng/ml), (4) propofol/remifentanil (c_e = 8 ng/ml). During induction (loss of consciousness, LOC) and recovery of consciousness (ROC), SE, RE, AAI and the Observer's Assesment of Alertness/Sedation Scale (OAA/S) were continously assessed. Prediction probability (P_K) [1] was calculated to measure the performance of indices to predict patient state.

Results: The table shows calculated P_K values ± SEM (Jackknife standard)

		AAI	SE	RE
Propofol + Remi 2 ng/ml	LOC	1.00 ± 0.00	1.00 ± 0.01	0.90 ± 0.09
	ROC	0.87 ± 0.09	0.79 ± 0.10	0.89 ± 0.07
	OAAS	0.83 ± 0.02	0.90 ± 0.02	0.91 ± 0.02
Propofol + Remi 8 ng/ml	LOC	0.90 ± 0.07	0.70 ± 0.12	0.67 ± 0.14
	ROC	0.93 ± 0.06	0.82 ± 0.10	0.82 ± 0.12
	OAAS	0.87 ± 0.02	0.90 ± 0.02	0.86 ± 0.03
Sevo + Remi 2 ng/ml	LOC	0.64 ± 0.12	0.67 ± 0.12	0.75 ± 0.11
	ROC	0.94 ± 0.05	0.90 ± 0.09	0.80 ± 0.13
	OAAS	0.80 ± 0.03	0.87 ± 0.02	0.84 ± 0.03
Sevo + Remi 8 ng/ml	LOC	0.68 ± 0.12	0.54 ± 0.13	0.66 ± 0.12
	ROC	0.91 ± 0.07	0.60 ± 0.13	0.80 ± 0.10
	OAAS	0.82 ± 0.03	0.82 ± 0.03	0.82 ± 0.02

Conclusion: The predictive performance of SE, RE and AAI to correctly differentiate between different states of consciousness depends on the hypnotic agent used and is negatively influenced by increasing remifentanil effect site concentrations. SE and RE better described LOC and ROC as a graded change, whereas AAI better discriminated patient state.

Reference:

1 Smith WD. Anesthesiology 1996; 84: 38–51.

A-98

Bispectral Index System (BIS): is it related to the MAC value of inhalational anesthetics?

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Background and Goal of study: Bispectral Index (BIS) has been used to measure depth of sedation and anesthesia after different protocols of anesthesia. A range of BIS scores (40–60) has been seen to be an indicator for an acceptable level of hypnosis and anesthesia, independent of the drug used. Davidson and Czarnecki have recently reported that at 1 MAC the BIS for halothane was significantly greater than isoflurane 56.5 ± 8.1 vs. 35.9 ± 8.5[1]. One of the explanations they gave for their finding is that the volume concentration of the MAC value is inversely related to the BIS value. Accordingly, it is expected that the BIS value at 1 MAC of desflurane must be less than halothane and isoflurane.

Materials and Methods: This is a clinical cross-over, prospective, randomized and double blinded study. 80 pediatric patients who were assigned for below umbilical surgery under general and caudal analgesia were allocated into 4 study groups. HI group had halothane then isoflurane, IH group had isoflurane then halothane, HD group had halothane then desflurane and the DH group had desflurane then halothane. The BIS values at 1 MAC of the previously mentioned agents were compared with each other in the same group and between other groups.

Results and Discussion: At 1 MAC, the mean BIS value for halothane 60.4 ± 5.6 was significantly higher than isoflurane 45.5 ± 9.2 and desflurane 38.5 ± 9.2 ($P < 0.001$). Our findings are comparable with that of Davidson and Czarncki as regard the BIS difference between halothane and isoflurane, but in addition, the difference is much more significant between halothane and desflurane. So equivalent MAC doses of different inhalational anesthetics which are expected to prevent movement to equal noxious stimuli are not necessarily having the same effects on cortical and sub-cortical functions and consequently on EEG.

Conclusion: The use of MAC value for titration of inhalational agents may result in less or higher than the required BIS value.

Reference:

1 Davidson A, Czarnecki C. The Bispectral index in children: comparing isoflurane and halothane. Br. J. Anaesth. 2004; 92: 14–19.

A-99

Bispectral index during propofol TCI is influenced by patients' demographics

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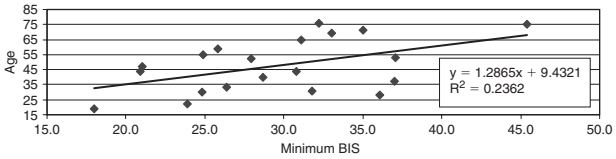
Background and Goal of Study: To our knowledge there is no published study correlating BIS with patient demography. We investigate whether BIS is influenced by age or body mass index (BMI).

Materials and Methods: Neurosurgical patients with a Glasgow 15, ASA 1/2, received TIVA with TCI propofol (Prop) and remifentanil (Remi). Data was collected using RugLoop II® software every 5 seconds from Aspect A2000XP (BIS). Effect site TCI was used with Schnider[1] for Prop (initial target 5 μg/ml) and Minto[2] for Remi (initial plasma target 2.5 ng/ml). Only patients who lost consciousness with the initial target and had a maximum of 5 μg/ml effect Prop concentration, were included. Data were collected between the beginning of infusions until change in target concentrations or stimuli (induction), and maintenance of anaesthesia. Statistics used linear regression (data: mean ± SD).

Results and Discussions: Twenty patients, age 47.5 ± 18, BMI 24.3 ± 6, 13 female. Duration was 262 ± 128 min. Remi and Prop predicted effect concentrations during maintenance were 3.14 ± 0.93 ng/ml and 3.52 ± 0.74 μg/ml, respectively. A positive correlation was observed between age and BIS minimum value at induction ($p < 0.05$). During the maintenance phase a positive correlation was also observed between BMI and median BIS ($p < 0.05$).



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Conclusion(s): For the same effect predicted propofol concentration older patients had a higher BIS at induction. The higher the BMI the higher the median BIS during maintenance. These findings were unexpected. It is possible that the pharmacokinetic[1] model is not adequately adjusted to age, or age interferes with the Prop pharmacodynamics.

References:

1 Anesthesiology, 1998, 88:1170–82.
2 Anesthesiology, 1997, 86:24–33.

Acknowledgements: Portuguese Foundation for Science and Technology

A-100

Comparison of 2 pharmacodynamic EEG models with and without a pharmacodynamic plateau

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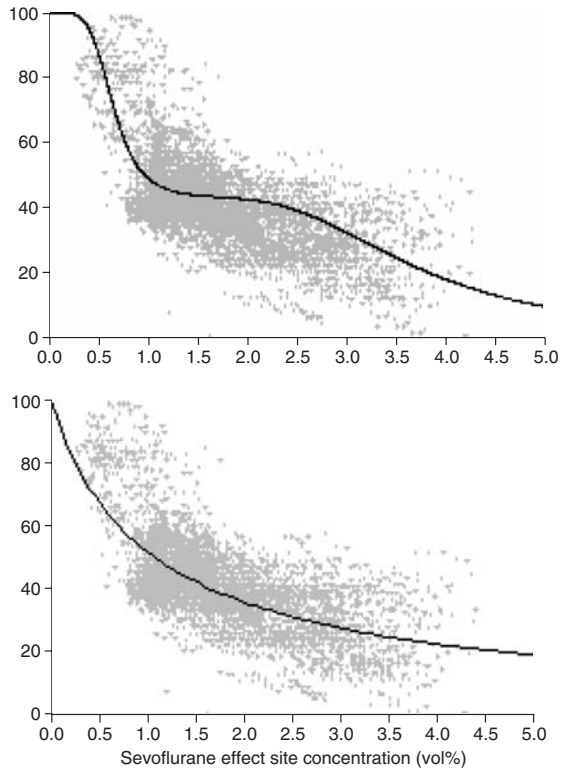
Background: The Bispectral index (BIS XP, Aspect, USA) can be used as an electroencephalographic measure of drug effect. We compared 2 different techniques of modeling the sevoflurane drug effect.

Methods: We investigated 26 adult patients scheduled for radical prostatectomy. After lumbar epidural catheterisation, patients received remifentanil and propofol solely for induction of anaesthesia. Thereafter, epidural analgesia was initiated, and sevoflurane was added to maintain unconsciousness. At least 45 min later, end-tidal sevoflurane concentrations were varied between 1 and 4 vol% and BIS values were recorded. To evaluate the sevoflurane-BIS relationship two different pharmacodynamic models were applied: A conventional model #1 with a single sigmoidal curve, and the novel model #2 with two sigmoidal curves for BIS values with and without burst suppression. Both models were calculated by NONMEM V (GloboMax, Hanover, USA) in one step by minimizing log likelihood. Statistical significance between the two models was calculated by the likelihood ratio test.



Results: The k_{e0} value of the population fit including the plateau effect derived from the BIS was 0.24 min^{-1} versus 0.27 min^{-1} for the single curve model. The difference between the log likelihood values was 396 ($P < 0.001$).

Conclusion: A two sigmoidal curves PK/PD model including a plateau describes the pharmaco-dynamic effects of sevoflurane on BIS better than a single sigmoidal curve model.

A-101

Impact of patient temperature on BIS values during cardiac surgery

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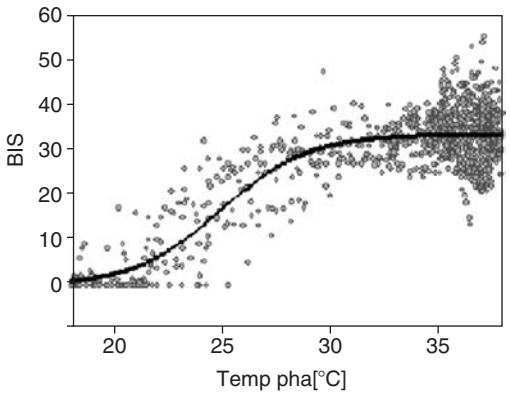
Background: Hypothermia influences the level of consciousness, and this may have impact on depth of anaesthesia monitoring. We investigated the influence of hypothermia on BIS (BIS XP, Aspect, USA) when deep hypothermic cardiac arrest (DHCA) was applied during cardiac surgery with extracorporal circulation (ECC).

Methods: With IRB approval 11 adult patients undergoing DHCA were studied. After induction of anaesthesia with etomidate, propofol 4 mg/kg/h and sufentanil 1.5 μg/kg/h were given for maintenance. BIS values, pharyngeal (pha) and rectal (rec) temperatures were recorded. During DHCA propofol and sufentanil infusion were stopped. Data are mean ± SD; SigmaStat and SigmaPlot (SPSS, Germany) were used for non-linear regression analysis.

Results: BIS and corresponding temperature values were:

	BIS Index	pha Temp°C	rec Temp°C
Start ECC	36.3 ± 5.7	35.7 ± 0.6	35.5 ± 0.5
End ECC	36.0 ± 6.1	36.3 ± 0.7	35.2 ± 1.3
Start DHCA	12.6 ± 7.5	20.8 ± 1.7	24.2 ± 2.6
End DHCA	4.7 ± 9.8	21.1 ± 2.2	24.4 ± 2.3



The regression analysis for all patients is shown in the figure ($R = 0.88$).

Conclusion: Temperature has an influence on the BIS: During propofol-sufentanil-anaesthesia, the relationship may be described as a mean BIS reduction of 2 points per 1°C drop, especially for the range of 22–30°C pharyngeal temperature.

A-102

Subanaesthetic dose of ketamine during propofol anaesthesia increases BIS in a dose depended manner

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Background and Goal of study: Ketamine an old anaesthetic agent, the sole with analgesic properties, induces analgesia even in subanaesthetic dose with negligible side effects.[1] The aim of this study was to evaluate the impact of such low doses of ketamine on the bispectral index (BIS), when it is administered during general anaesthesia with propofol.

Materials and Methods: We studied 40 ASA I and II patients undergoing abdominal procedures. Anaesthesia was maintained in all patients with 60% N_2O in O_2 and continuous infusion of remifentanil and propofol in order to keep the BIS value stable in the range of 40 ± 5. Rocuronium was administered as relaxant according to patient's needs. The patients were randomly assigned to receive IV either ketamine 0.15 $mg*kg^{-1}$ (Group K0.15) or ketamine 0.30 $mg*kg^{-1}$ (Group K0.30) after a period of stable BIS for 5 minutes. BIS values were recorded before (control) and after 1, 5, 10, 15 minutes of ketamine administration. The value BISmax-BISc (Δmax) was also calculated. Statistical analysis was performed with 2-way ANOVA and t-test with $p < 0.05$ as level of significance.

Results: Demographic data were similar in both groups. There was an increase of the BIS values in both groups, which seems to be significantly

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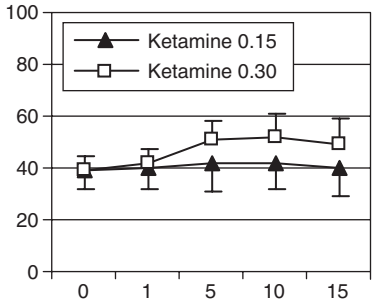
higher in Group K0.30 at 5 ($p < 0.01$), 10 ($p < 0.01$) and 15 ($p < 0.05$) minutes. Furthermore, the Δmax value in Group K0.30 (15.5 ± 7.1) was higher ($p < 0.001$) than the one in Group K0.15 (5.4 ± 4.7).



Conclusions: Administration of ketamine in subanaesthetic dose during general anaesthesia with propofol increases the bispectral index values in a dose-dependend manner.

Reference:

1 Kohrs R, Durieux ME. *Anesth Analg* 1998; 87: 1186–93.

A-103

Remifentanil decreases BIS, an effect independent of intubation and surgical stimuli

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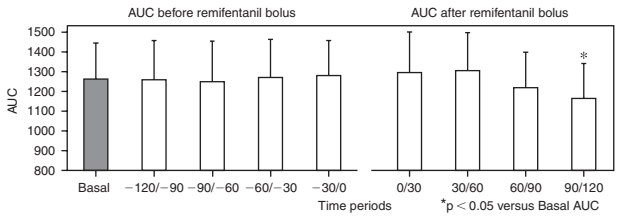
Background and Goal of Study: Remifentanil (Remi) boluses are used in various clinical situations. Several studies addressed the effect of Remi on BIS at different Remi concentrations.[1,2] However, the effect of a Remi bolus on BIS under a propofol (Prop)-Remi anaesthesia without surgical stimuli has not been studied.

Materials and Methods: Neurosurgical patients received a 2 μg/kg Remi bolus under TIVA in a period free from stimuli. TCI was used with Schnider[3] for Prop and Minto[4] for Remi. BIS and haemodynamic data were collected from A-2000XP BIS monitor (every 1 s) and AS/3 Datex monitor (every 5 s) using RugLoopII®. Data was analyzed at the time of Remi bolus (T0), 30, 60, 90 (T90) and 120 s after (T120). The area under the curve (AUC) for each 30 s period was analyzed for BIS data. Basal AUC (average from all AUC before Remi bolus) was considered as the baseline. Student *t*-test was used to compare each AUC after the bolus and basal AUC. Haemodynamic data was analyzed with ANOVA. Data are reported as mean ± sd.

Results and Discussions: 24 patients, ASA I/III, age 50 ± 13, BMI 25.6 ± 3.7, 15 female. During the study period, the average Prop effect site predicted concentration was 2.9 ± 0.7 μg/ml. Remi boluses were delivered over 24 ± 4.2 s. The Remi effect site predicted concentrations were 9.3 ± 1.3 ng/ml at T120 (a 6.6 fold average increase from T0). The AUC for BIS decreased significantly at T90/120 ($p < 0.05$). Mean arterial pressure decreased significantly ($p < 0.01$) from T0 (94.2 ± 24 mmHg) to T120 (72.8 ± 20 mmHg). Heart rate also decreased significantly ($p < 0.01$) from T0 (68.2 ± 19 bpm) to T120 (59.8 ± 16 bpm).



Conclusion(s): Remi, a 2 μg/kg bolus given under Prop/Remi anaesthesia in a period free from surgical stimuli, decreased BIS, heart rate and blood pressure. This effect on BIS has not been previously shown.

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A-104

The influence of muscle-relaxants on BIS values in the patients during laparoscopic cholecystectomy

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Background and Goal of Study: The electromyographic activity can elevate the bispectral index (BIS) values (1). Remifentanyl and N_2O were showed to not affect the BIS (2,3).

The aims of this study were to evaluate the accuracy of BIS readings in remifentanyl, N_2O anesthesia and the influence of muscle-relaxant administration on BIS values in patients during laparoscopic cholecystectomy.

Materials and Methods: After written informed consent, thirty volunteers ASA I or II were anesthetized with remifentanyl continuous infusion 0.3 μg/kg/min throughout the whole procedure. Propofol was used for induction. Simultaneously patients received 60% N_2O in oxygen via a mask to the end of anesthesia. After the loss of consciousness and before the administration of atracurium 0.5 mg/kg, a tourniquet was inflated on the right arm 150 mmHg above the systolic blood pressure to detect any gross movements during abdominal laparoscopic surgery to exclude insufficient hypnosis and/or insufficient analgesia. Every time when BIS was above 65, patients were asked to squeeze the investigator's hand every 30 s. The train-of-four sequence was monitored continuously throughout the hole procedure. Bolus of atracurium 0.15 mg/kg was repeated every time when TOF > 40%. The BIS values were measured during the whole study.

Results: While twitch recovered to 40%, BIS elevated to 83 ± 8. The pure administration of atracurium 0.15 mg/kg significantly decreased BIS values to 69±7. None movement of the isolated arm was seen in the study patients.

	TOF 40%	TOF 0/4
BIS values	83 ± 8*	69 ± 7 *

*$p < 0.05$.

Conclusions: We conclude that BIS level is altered by atracurium administration and correlate well with neuro-muscular blockade in patients anesthetized with N_2O and remifentanyl during laparoscopic abdominal surgery. The study shows that an increase of the BIS values is not caused by sedation level but indicates an insufficient muscle relaxation.

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A-105

Effects of anesthetics on BIS and heart rate variability

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Background and Goal of Study: Anesthetics are known to alter both sympathetic and parasympathetic tone, however, it is not clear whether the changes in heart rate variability (HRV) is associated with the depth of anesthesia. The purposes of the present study were 1) to evaluate the changes in HRV at the different depth of hypnosis, and 2) to compare the effects of anesthetics on HRV.

Materials and Methods: Patients (n = 45) were randomly allocated into the thiopental, propofol or sevoflurane for induction of anesthesia. The depth of hypnosis was monitored by the Bispectral index (BIS). Spectral analysis of HRV resulted in two main regions, a high frequency (HF) and a low frequency (LF). Hemodynamics, entropy, LF, HF, and LF/HF were monitored at awake and after the induction of anesthesia.

Results and Discussions: Thiopental increased HR in a BIS-dependent manner, whereas blood pressure (BP) showed no significant changes. Both propofol and sevoflurane decreased BP in a BIS-dependent manner, whereas HR showed no significant changes. Thiopental decreased HF, entropy and LF with a reduction in the BIS value. LF/HF showed no significant change during the study period. Propofol decreased entropy and HF with a reduction in the BIS value. Although LF decreased after the induction of anesthesia, propofol caused no further decrease in LF. Sevoflurane decreased LF with a reduction in the BIS value. Entropy and HF decreased after the induction of anesthesia, however, no further decreases were observed in spite of a reduction in the BIS value.

Conclusion: In conclusion, anesthetics have differential effects on HRV depending on the depth of hypnosis.

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A-106

Effects of 0.2% and 1% epidural ropivacaine on bispectral index during propofol anaesthesia

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Background: Patients receiving combined epidural-general anaesthesia may be at risk of insufficient depth of anaesthesia. Although it has been shown that the bispectral index (BIS) can predict depth of anaesthesia in patients receiving inhalation and intravenous anaesthetics, the correlation between BIS score and depth of anaesthesia in patients receiving combined epidural-general anaesthesia has not been examined. In this study, we compared the effects of 0.2% and 1% epidural ropivacaine on BIS during propofol anaesthesia at three clinical end-points: loss of consciousness and no response to noxious stimulation within and beyond the level of sensory block.

Materials and Methods: With IRB approval and informed consent, 35 ASA I patients undergoing lower abdominal surgery were randomly divided into two groups to receive epidural 0.2% (group 1) or 1% ropivacaine (group 2). After the upper dermatomal level of loss of cold sensation was determined, a target-controlled infusion of propofol was started to provide a blood concentration of 3 μg/ml, and increased by 0.5 μg/ml every 60 s until all three clinical end-points were reached as follows: 1) when patients lost consciousness; 2) when patients failed to show papillary dilation (PD) to tetanic electrical stimulation (TES) that was applied to the upper sensory level; 3) when they failed to show PD to TES that was applied to C5. BIS were recorded at each end-point and compared between the two groups. $P < 0.05$ was considered significant.

Results: BIS value at every end-point was significantly smaller in group 1 than in group 2.

Table. Bispecral Index Values at Three End-points.

	Group 1	Group 2
Loss of consciousness*	61.5 ± 18.7	73.8 ± 15.1
No response at upper level*	32.7 ± 10.8	40.7 ± 12.0
No response at C5*	19.6 ± 9.6	29.4 ± 8.4

Mean ± SD. *$P < 0.05$ between groups.

Conclusion: During combined epidural-propofol anaesthesia, unconsciousness and lack of response to painful stimulation occur with different BIS values depending on the concentration of ropivacaine. BIS may not be a good indicator when propofol and epidural anaesthesia is combined.

A-107

BIS monitoring compared to mental status evaluation (MSE) during carotid endarterectomy

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Background and Goal of Study: Controversy has remained concerning methods of intraoperative monitoring during carotid endarterectomy (CEA) to identify strokes (1). It has been suggested that unexpected decrease of BIS values may reflect cerebral ischemia (2). The objective is directly to compare the accuracy of BIS monitoring to mental status changes in the awake patients.

Materials and Methods: 30 consecutive CEAs were entered into a prospective study. Regional anesthesia consisted of deep and superficial cervical block. BIS monitoring was compared with neurologic changes under regional anesthesia. Changes in mental status evaluation (MSE) were defined as any speech changes, any focal neurological deficits, any significant increases in agitation or confusion, seizure, restlessness or unresponsiveness. Significant changes in BIS values were defined as more than 20% reduction of previous values. BIS values and other standard monitoritation were recorded basal, before clamping and each 5 minutes after clamping of carotid artery and then after declamping until the end of surgery. Sensibility and specificity were analysed.

Results and Discussion: Neurological changes were noted in 6 cases (20%). In 5 of these cases BIS values decreased. In 3 of them the decreased was simultaneous and in the other 2 cases there was a delay of 1–2 minutes with the neurological changes (loss of conciousness). In these cases no immediately BIS decreased could be the result of the inherent delay of the BIS method. There was only one false negative (3.84%) and no false positive. BIS monitoring is correlated with MES in 88,4% of the cases. Sensitive of the method was 83% and specificity 100%.

Conclusion: Our results suggets that BIS can be useful to detect cerebral ischemia. Nevertheless, These are the preliminary results, because more patients are needed to obtain sufficient statistic power for evaluation of sensitivity and specificity of BIS for this indication.

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A-108

Number of skin conductance fluctuations correlate better with signs of clinical stress during tracheal intubation than response entropy

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Background and Goal of Study: Number of skin conductance fluctuations (NFSC) in the palmar surface correlates well with sympathetic nerve activity. State Entropy (SE) measures the EEG signal, while Response Entropy (RE) measures both EMG and EEG in the forehead. In deep anesthesia both NFSC and a sudden change in RE-SE have been proposed to measure pain responses. The purpose of the study was to examine if NFSC and RE-SE correlate with signs of clinical stress during endotracheal intubation.

Materials and Methods: 20 patients were studied during tracheal intubation. Remifentanil, propofol and cisatracur were given. If the patient had systolic arterial pressure of more than 130 mmHg, movement of large muscles, tears, cough, opening of eyes, sweating in forehead or face muscle reaction, 1 point of stress was assigned for each of these reactions, adding all together to a total stress score. The stress was monitored during tracheal intubation and 60 sec afterwards. Simultaneously the maximum NFSC response and RE-SE was registered blindly. A linear regression analysis was performed between the NFSC, RE-SE and the total stress score. In awaken patients RE is usually significantly higher than SE. We therefore performed the linear regression analysis in the patients separately for all SE levels and those with $SE < 70$.

Results and Discussion: Clinical stress was observed in 9 of the 20 patients. The NFSC increased during intubation in all these patients and in two others, and the magnitude of increase correlated well with the stress score, $r^2 = 0.73$, $P = 0.000$. The RE-SE value increased >10 in 5 of the 9 patients that showed stress and in two others. The RE-SE correlated with the stress score in all the patients $r^2 = 0.33$, $P = 0.007$. Interestingly, when studying the 15 patients with $SE < 70$, 4 of these showed clinical stress. The increase in NFSC correlated well with the stress score, $r^2 = 0.72$, $P = 0.000$ different from the RE-SE $r^2 = 0.14$, $P = 0.15$ in these 15 patients.

Conclusion: These results show that NFSC is a better measure of discomfort during tracheal intubation than the RE-SE value. If the RE–SE value increase when SE is higher than 70, this response may indicate a wake up situation.

A-109

Increase in skin conductance variables versus increase in State entropy and Response entropy during emergence after surgery in general anaesthesia

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Background and Goal of Study: Skin conductance level (SC) and number of fluctuations in skin conductance (NFSC) in the palmary surface is well correlated with sympathetic nerve activity. During emergence after surgery in general anaesthesia both SC and NFSC increase. Response entropy (RE) measures the combined EEG and EMG signal in the forehead, whereas State entropy (SE) measures the EEG signal only. The purpose of the study was to compare the changes in SC, NFSC, SE and RE during emergence after surgery.

Materials and Methods: 20 patients were studied during emergence after laparotomi. Remifentanil and propofol were given for general anaesthesia during surgery and fentanyl was given before emergence. SC, NFSC, the SE index and the RE index were measured continuously during emergence. The time of extubation was chosen from clinical criteria at the discretion of the anaesthesiologist and designated as the time of emergence, time = 0 (T0). A positive value was given for first signs of emergence before T0, a negative value for first signs after T0. The emergence for SE and RE were tested for two time points, when the indexes were 70 or 80. For skin conduction the emergence was defined: 2 or more fluctuations per 15 sec together with an increase in the SC of at least 0.1 microsiemens within 15 sec. The registration

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lasted for 1 min after extubation. The time intervals for the skin conductance variables and SE and RE were compared using Wilcoxon non-parametric test.
Results and Discussion: Signs of emergence were not different (median, range) for skin conductance variables (14, ÷ 27–63) when compared with SE 70 (24, ÷ 2–278) or SE 80 (median 8, ÷ 16–252), respectively P = 0.10 and P = 0.96, different from when compared with RE 70 (median 45, ÷ 58–288) or RE 80 (median 33, ÷ 1–270), respectively P = 0,005 and P = 0,028. In 1 case the skin conductance variables did not increase within 1 min after extubation and in 1 another case the SE 70, SE 80 and RE 80 was not reached. The emergence % before T0 for the skin conductance variables, SE 70, SE80, RE 70, RE 80 were respectively 80%, 85%, 80%, 95%, 90%.
Conclusion: RE 70 and RE 80 react significantly before the skin conductance variables, SE 70 and SE 80 during emergence after surgery.

A-110

Number of skin conductance fluctuations increase in a quantitative manner during tetanic pain stimuli whereas response entropy is non-reactive

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Background and Goal of Study: Number of skin conductance fluctuations per sec (NFSC) in the palmar surface correlates well with sympathetic nerve activity. State Entropy (SE) measures disorders in the EEG signal, while Response Entropy (RE) measures both EMG and EEG activity in the forehead. Both NFSC and RE-SE have been proposed to measure pain response. The purpose of the study was to examine if NFSC and RE-SE could detect pain response from tetanic stimuli, and to further examine if the tetanic stimuli response was stronger in a situation without analgesia infusion compared to a situation with ongoing analgesic infusion.
Materials and Methods: 20 patients in ASA group 1 or 2 were studied after induction of general anaesthesia with propofol, remifentanil and cisatracur, but before start of laparotomi. The patients were given 2 series of tetanic stimuli of 50 mA: Tetanic 1 (T1) with ongoing remifentanil analgesic infusion and Tetanic 2 (T2) after 4 min without analgesic infusion. The RE-SE and NFSC responses were registered continuously, starting 30 sec before stimuli and ending 30 sec after the stimuli started. The maximum values for NFSC and RE-SE during the tetanic pre stimuli periods were compared with the maximum values of the tetanic post stimuli periods. Moreover, NFSC and RE–SE responses during T1 were compared with the responses during T2. The Wilcoxon non-parametric test was used.
Results and Discussion: The NFSC pre stimuli level with median = 0 (range 0–0.02) was lower than the post stimuli level in 16 out of 20 patients with median = 0.02 (range 0–0.7) ($P < 0.001$). NFSC T1 response was significantly lower than the NFSC T2 response (P = 0.002). The RE–SE pre stimuli level with median = 2.0 (range 0.5–11.0) was not different from the post stimuli level with median = 1.5 (range −0.5–4.5) (P = 0.442), neither was the T1 response different from the T2 response (P = 0.20).
Conclusion: In contrast to the RE-SE, the study showed that NFSC is sensitive to tetanic pain stimuli, and the measured response is attenuated when an ongoing analgesic infusion is given.

A-111

State index of nociception correlates both with remifentanil concentration and level of painful stimulation during surgery

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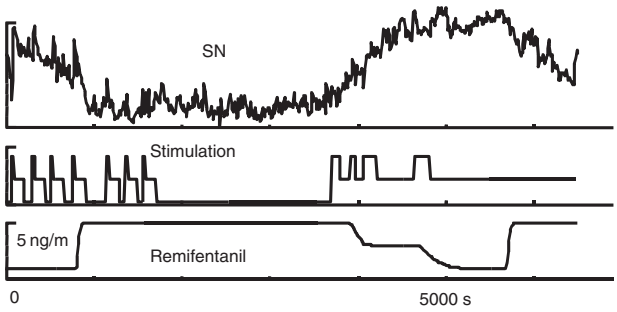
Background and Goal of Study: Today, no numeric measures of nociception during general anaesthesia are available. In search of such readily useable measure both predictive characteristics of the drug effect and responses to surgical stimulation are needed. We analysed the alterations of photoplethysmographic waveform amplitude (PPGA) and heart rate (HR) during changing surgical stimuli and different target site levels of remifentanil. Our purpose was to develop a State Index of Nociception (SN) based on PPGA and HR derived information, which could measure the adequacy of analgesia during general anaesthesia and surgery.
Materials and Methods: Physiological parameters were measured from 53 female patients anaesthetised with propofol and remifentanil, and paralysed with rocuronium. Remifentanil target site concentration was adjusted to 1, 3, or 5 ng/ml during surgery. SN was developed to explain the combination of stimulation and remifentanil effect site concentration. SN was correlated with assessed stimulation severity and remifentanil level and the median of correlation coefficients over the patients was calculated. The significance of the median, compared to zero, was evaluated using Wilcoxon sign rank test.
Results and Discussion: SN correlated positively with stimulation (median r = 0.42, $P < 0.0001$) and negatively with remifentanil level (median r = −0.33, $P < 0.0001$). Median correlation with their difference was 0.50 ($P < 0.0001$). High SN values indicated presence of noxious stimuli and low remifentanil levels (figure).



Conclusion: SN appears to be sensitive to insufficient remifentanil levels during noxious stimulation, and provides information of the adequacy of propofol-remifentanil anaesthesia.

A-113

Mid-latency auditory evoked potentials monitor (AEP) and brain death

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Background and Goal of Study: Brain death (BD) is a catastrophic physiologic event associated with significant disturbances in the function of other organs . Even with maximun support, deterioration in cardiorespiratory function leading to asystole usually occurs. We have evaluated mid-latency auditory evoked potentials (A-AEP; Alaris Medical Systems, Hampshire, UK) values (A-AEP INDEX or AAI) in a brain death diagnosticated patients.
Materials and Methods: This is a prospective, nonramdomized, observational study in a surgical and trauma tertiary intensive care of a universitary hospital. After approval of the hospital's research committee, six consecutive patients (age range 17–75 yrs, mean age 47 yrs) diagnosticated of brain death during 2004, but without brain death at the time of admission were studied. AAI was recordered continuosly during the hospitalization in the ICU. This study was observational and in no way interfered with our routine management of brain dead patients. The A-AEP uses headphones and 3 electrodes, 2 on the forehead and one at the mastoid.
Results and Discussion: In each of six patients when were diagnosticated of brain death (clinically and confirmed by EEG or evoked potencials, according to the Spanish legislation guidelines for assesing brain death) their individual AAI values were 0 (Tase supression of 100).
Conclusions: Because brain death causes severe cardiovascular, hormonal, and metabolic changes, its early diagnosis is crucial in terms of maintaining organ function. Thus, the early diagnosis of brain death is the first step in successful donor management. Prompt treatment to preserve organ function increases the chances of successful organ transplantation. To improve the identification of brain death patients in the ICU we can use the AAI. We think is a noninvasive determination, easy to interpretate and rapid. Anyway, the diagnosis of brain death is based on clinical examination, but we hypothesize that this could be a very useful method for early detection of neurological worsening even brain death.

A-114

Response index of nociception correlates both with remifentanil concentration and level of painful stimulation during surgery

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Background and Goal of Study: No numeric measures of nociception during general anaesthesia exist. For monitoring of nociception a multi-parameter approach may be needed (1). We studied the relation between physiological responses and concentration of remifentanil (Rem) at nociceptive stimuli in anaesthetised and paralysed patients.

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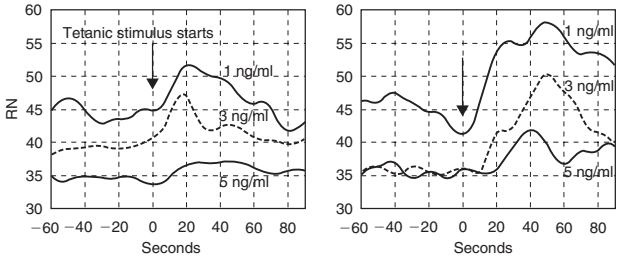
Materials and Methods: 55 females were anaesthetised with propofol (Pr)–Rem target controlled infusions (TCI). Pr was given to maintain EEG State Entropy (SE) at 35–60. Rem TCI was randomised to 1, 3, or 5 ng/ml. Responses to tetanic stimulation of the ulnar nerve (30 s) were studied before surgery in a subgroup of 23 patients. Responses to skin incision were analysed in all patients. Comparison of responses in photoplethysmographic wave amplitude (PPGA), ECG beat-to-beat interval (RRI), and Response Entropy (RE) at different Rem levels was done using the Kruskal-Wallis H test.
Results and Discussion: RRI ($p = 0.00001$) and PPGA ($p = 0.009$) responses to tetanic stimulus differed significantly between Rem levels, while for the incision RRI ($p = 0.019$), RRI SD1 ($p = 0.019$) and RE-SE ($p = 0.018$) responses were different. A Response Index of Nociception (RN), developed by combining RE, RRI and PPGA variability, was significantly higher in the low doses of Rem as compared with the higher doses for both tetanic stimulus ($p = 0.00005$) and skin incision ($p = 0.00003$) (figure).



Conclusions: In paralysed patients anaesthetised with propofol-remifentanil infusions: 1) Combination of information from RE, PPG, and RRI provides promising quantification of responses to abrupt noxious stimuli; 2) Long-lasting 30 sec tetanic stimulus induces qualitatively similar physiological responses as skin incision.

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A-115

Continuous BIS-EEG monitoring to assess evolution in depth of sedation in critically ill patients

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Introduction: The Bispectral Index (BIS) is a processed EEG parameter that has been validated as a measure of sedative-hypnotic effects of anesthetic drugs. Besides, BIS was also reported to correlate quite well with the level of pharmacological sedation in ICU patients. The aim of the present study was to evaluate the evolution over time of BIS in sedated ICU pts.
Materials and Methods: 14 ventilated surgical ICU pts, without any central neurologic disease were monitored. Pts were sedated for at least 5 consecutive days with propofol (1–3 mg/kg/hr) and piritramide (0.05–0.15 mg/kg/hr). Administration of sedatives was titrated to clinical reaction of pts and was aimed at maintaining a maximal Ramsay Sedation Score. In all pts, BIS, using BIS-XP 4.0 algorithm, was continuously monitored and was blinded to ICU nurses and physicians.
Results: Already after start of sedation, we observed a wide range of BIS between 20 and 88 between these 14 pts. In 4 pts, statistical analysis (Spearman analysis) revealed no correlation between dosages of both sedatives and BIS. In 10 of 14 pts, we observed a significant decrease in BIS over time, correlated to increased dosages of both sedatives. In these 10 pts, mean BIS after start of sedation was 68 (± 7), while at day 3 and at day 5 we found significantly lower BIS values (45; ± 7 and 31; ± 9).
Conclusion: In some pts, daily BIS monitoring might become very useful to titrate sedation of ICU patients and to prevent oversedation with possible implications as to quality of ICU management. However, as was already reported (1), BIS monitoring is not suitable for monitoring the sedation in all ICU patients.

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A-116

Bispectral index variations during tracheal suction in mechanically ventilated critically ill patients

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Introduction: The Bispectral Index (BIS), a processed EEG derived parameter, was reported as a useful indicator of depth of sedation. In ICU pts, noxious stimuli, such as tracheal suction, often result in abrupt rises in arterial pressure and/or tachycardia. The aim of this observational study was to evaluate whether BIS monitoring revealed any arousal of consciousness during these periods of noxious stimulation, in adequately sedated pts, as referring to clinical scoring systems.
Materials and Methods: We randomly monitored 30 periods of noxious stimulation (ET aspiration) in 8 ventilated surgical ICU patients who were sedated for more than 48 hr with propofol (1.5–3 mg/kg/hr) and piritramide (0.07–0.17 mg/kg/hr). In all patients, sedatives were titrated to a maximal Ramsay Sedation Score (RSS of 6) before stimulation. All pts were monitored for a standardized 60 min period (with stimulation at 30 min). Correlation between BIS (BIS-XP 4.0), RSS and hemodynamic parameters (arterial blood pressure, heart rate) before and after stimulation was analysed with Anova test.
Results: BIS values (before stimulation) varied between 20 and 74, while all pts revealed a RSS of 6. For all 30 periods, we found no significant difference in BIS and in RSS, before, during and after tracheal suction, while we found a significant increase in systolic blood pressure (and a nonsignificant increase in heart rate). In 3 of the 30 periods, we noticed a significant increase in BIS (towards values above 90). In these 3 periods, BIS before stimulation was significantly higher (64 ± 7) than BIS observed in the other 27 periods (48 ± 9).
Conclusions: Hemodynamic reactions to tracheal suction in ICU pts are not solely explained by arousal. However, in some pts BIS monitoring might be valuable in determining the level of consciousness prior to noxious stimuli, thereby avoiding arousal.

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Can BIS provide any information in sedated ICU patients suffering from acute neurological injury?

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Introduction: Referring to its role in monitoring the hypnotic part of anesthesia, BIS has been introduced as an objective assessment of sedation in critically ill patients without any neurological insult. Indeed, as BIS represents a processed variable derived from the raw EEG, any underlying neurological deficit might influence its value. Therefore, we evaluated whether BIS monitoring, applied during the first 24 hrs after admission, could have any prognostic (as to neurological outcome) value in comatose sedated patients arriving to the ICU department.
Materials and Methods: Over a 12 months period, 26 adult patients with a GCS lower than 8 admitted to our hospital were included. Of these 26 pts, 14 pts suffered from a severe head injury, 7 from intracerebral bleeding and 5 from severe stroke. All pts were ventilated and were sedated with propofol (1.5–2 mg/kg/hr). In all pts, BIS monitoring was applied for a 2 hrs period during the first 24hrs of admission. Afterwards, BIS data were correlated to Glasgow Outcome Scores.
Results: Overall, a wide range of BIS values was observed (7 to 81). In 3 of 26 pts extreme low BIS values (<15) were observed, in 6 pts BIS was between 20 and 40, in 10 pts BIS was between 40 and 60, whereas in 7 pts BIS was higher than 60. Immediate neurological outcome in the 3 pts with BIS below 15 was clearly different from the other pts, as these 3 pts were declared brain dead within 24 hrs of admission. In 2 of these pts, BIS values decreased to 0 during the monitoring period, which confirmed brain death. We found no correlation between BIS values and outcome in the other pts. In the 6 pts with BIS between 20 and 40 no correlation could be found with neurological outcome, as these pts did not reveal a worsened outcome compared with pts that revealed BIS values higher than 40. And we could not observe a better outcome in those 7 pts with BIS values higher than 60.
Conclusion: The finding of extreme low BIS values in sedated pts early after a neurological insult may reveal an extreme bad prognosis. In these conditions, BIS could also be used as an assessment of brain death onset.

A-118

Fractal dimension – a new EEG-based method of assessing depth of anaesthesia in comparison with BIS during induction and recovery from anaesthesia

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Background and Goal of Study: Due to the nonlinear, non-stationary and fractal nature of brain activity, we have employed fractal dimension method,

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adapted from Nonlinear Dynamics, to analyse EEG signals. Fractal dimension (FD) is a fast, simple and efficient technique of analysing complex signals which has already been tested in EEG analyses [1] but which has not previously been applied to anaesthetised patients. The aim of the study was to determine the accuracy of FD in comparison with BIS during induction and recovery from anaesthesia.

Materials and Methods: After ethics committee approval, 30 patients were studied, under general anaesthesia. Anaesthesia was induced with fentanyl, midazolam and propofol, titrated according to the BIS value. The raw, unfiltered EEG signal sampled at 128 Hz and the processed EEG derivatives: Bispectral Index (BIS), Burst Suppression Ratio (BSR) sampled every 10 s were recorded with an A-2000 XP BIS Monitor using BSA for BIS software (version 3.22B2 for A-2000). The study was performed during induction and reversal of anaesthesia. FD was calculated off-line and the results were averaged every 10 s from epochs 30 s long. The correlation method (Pearson or Spearman) was used for statistical analysis. The results are presented as a correlation coefficient (r).

Results and Discussions: Changes in FD are well correlated with BIS behaviour during induction ($r = 0.81$; $p < 0.001$) and recovery from anaesthesia ($r = 0.76$; $p < 0.001$). The table presents the percentage of: almost perfect (1), very high (2), high (3) and poor (4) positive correlation between FD and BIS during both induction and recovery from anaesthesia.

	r value	Induction – n (%)	Recovery – n (%)
1	$0.9 \leqslant r < 1$	13 (43.3%)	9 (30%)
2	$0.7 \leqslant r < 0.9$	12 (40%)	12 (40%)
3	$0.5 \leqslant r < 0.7$	2 (6.7%)	5 (16.7%)
4	$r < 0.5$	3 (10%)	4 (13.3%)

Conclusion: These preliminary results show a very high correlation of FD with BIS, an already accepted measure of hypnosis during anaesthesia. Therefore we conclude that our new, relatively simple method seems to be very promising in monitoring the depth of anaesthesia.

Reference:

1 Olejarczyk E, PhD Thesis, IBBE PAS, Warsaw, 2003.

A-119

Dose–response relationship between sevoflurane concentrations and Narcotrend or bispectral index

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Background: The Narcotrend monitor (MonitorTechnik, Germany) is designed to measure the depth of anaesthesia.We compared the PK/PD parameters of sevoflurane based on Narcotrend or bispectral index (BIS XP, Aspect, USA) during combined epidural/general anaesthesia.

Methods: We investigated 26 adult patients scheduled for radical prostatectomy. After lumbar epidural catheterisation, patients received remifentanil and propofol solely for induction of anaesthesia. Thereafter, epidural analgesia was initiated, and sevoflurane was added to maintain unconsciousness. At least 45 min later end-tidal sevoflurane concentrations were varied between 1 and 4 vol% and BIS and Narcotrend indices were recorded. We developed a novel population pharmacodynamic model obtained by two sigmoidal curves with and without the onset of burst suppression using NONMEM V (GloboMax, Hanover, USA).

Results: End-tidal sevoflurane concentrations ranged from 1.04 ± 0.17 to 4.43 ± 0.43 vol%. Using the respective EEG indices as a measure of drug effect the k_{e0} values were calculated as $0.29\,min^{-1}$ for Narcotrend and $0.24\,min^{-1}$ for BIS. The change between the first and the second sigmoidal curve was positioned at a BIS value of 42.8 and a Narcotrend index of 44.1. The respective sevoflurane effect site concentrations were 1.67 vol% for the BIS and 2.02 vol% for the Narcotrend monitor. The C_{50} values (C_{50} = concentration that causes 50% of the maximum effect) for the response prior to the onset of burst suppression were 0.65 vol% for BIS and 0.62 vol% for Narcotrend. The C_{50} values with burst suppression were higher than those without burst suppression, i.e. for BIS 3.72 vol% and for Narcotrend 2.74 vol%. The λ values (λ = steepness of the concentration–response relationship) for the response prior to the onset of burst suppression were 4.94 for BIS, and 5.52 for Narcotrend. The λ values with burst suppression were lower than those without burst suppression, i.e. for BIS 2.61 and for Narcotrend 4.62 vol%. The accuracy of the Narcotrend scale was $\sigma = 11.8$ and for BIS $\sigma = 8.7$ indicating intraindividual variability.

Conclusion: Sevoflurane pharmacodynamic models as derived by BIS and Narcotrend monitoring yielded nearly identical results.

A-120

Narcotrend or BIS monitoring during sevoflurane-remifentanil anaesthesia – a comparison with a standard practice group

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Background: The BIS monitor (BIS XP, Aspect, USA) is currently the standard device used to assess the depth of anaesthesia. The dimensionless Narcotrend index (MonitorTechnik, Germany, version 4.0) from 100 (awake) to 0 is based on EEG pattern recognition. This study was designed to investigate the impact of Narcotrend or BIS monitoring on recovery times and sevoflurane consumption when compared to standard anaesthetic practice.

Methods: With IRB approval and written informed consent 120 adult patients scheduled for minor orthopaedic surgery were randomised to receive a sevoflurane-remifentanil anaesthetic controlled either by Narcotrend or by BIS or solely by clinical parameters. Anaesthesia was induced with 0.4 μg/kg/min remifentanil and 2 mg/kg propofol. After intubation remifentanil was infused at a constant rate of 0.2 μg/kg/min whereas sevoflurane in 1.5 l/min O_2/air was adjusted according to EEG target values or clinical parameters: during maintenance of anaesthesia to a value of "60" (Narcotrend) or "50" (BIS), 15 min before the end of surgery to "70" (Narcotrend) or "60" (BIS), whereas in the standard protocol group sevoflurane was controlled according to clinical parameters, e.g. heart rate, blood pressure, movements. Recovery times and sevoflurane consumption were recorded by a blinded investigator. The sevoflurane vaporiser was weighed before and after anaesthesia and consumption per min was calculated.

Results: The groups were comparable for demographic data, duration of anaesthesia and mean remifentanil dosages.

	Standard practice	BIS	Narcotrend
Open eyes (min)	6.1 ± 2.7	5.5 ± 2.3	4.2 ± 2.2#
Extubation (min)	7.0 ± 3.7	5.8 ± 2.7	4.3 ± 2.2#
Sevoflurane (mg/min)	236 ± 60	334 ± 82	227 ± 60

Statistics: ANOVA with #$P < 0.05$, data are mean ± SD.

Conclusion: Compared to standard anaesthetic practice Narcotrend and BIS monitoring allow no reduction of sevoflurane consumption whereas recovery time were significantly reduced in the Narcotrend group.

A-121

Changes of EEG in pediatric patients with cerebral palsy during sevoflurane-fentanyl anesthesia

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Background and Goal of Study: We previously investigated the changes of EEG in pediatric patients who had no neurological disorder during sevoflurane-fentanyl anesthesia. Here we investigated the changes of EEG in pediatric patients who had cerebral palsy.

Materials and Methods: After institutional approval and obtained informed consent, we enrolled 22 patients with cerebral palsy (7.1 ± 3.3 years, M/F = 17/5) who received tendon elongation or transfer of lower limbs. Patients who had epilepsy or medicated psycho-motor drugs were excluded from this study. 1 mg/kg of diazepam was premedicated orally 30 minutes before admission to the operating room. Anesthesia was induced with inhalation of sevoflurane 5%. After confirmed of venous line, 3 μg/kg of fentanyl and 0.1 mg of vecuronuim were administered. Then the trachea was intubated. Using the software we developed, we continuously recorded FP_1-A_1 lead of the EEG signal and expired sevoflurane concentration to an IBM-PC compatible computer. After confirming the steady state of each sevoflurane (end-tidal concentration at 0.5%, 1.0%, 1.5% and 2.0%), SEF90 and mean amplitude of EEG were calculated. During surgery 2 μg/kg of fentanyl was added in requirement. We gathered EEG data at sevoflurane 2.0% and 1.5% during surgery, and at sevoflurane 1.0% and 0.5% after finished the operation.

Results and Discussions:

Sevo	0.5%	1.0%	1.5%	2.0%
Amp (μV)	9.1 ± 1.6	22.6 ± 5.4*	38.0 ± 8.6*	43.0 ± 9.0*
SEF90	17.4 ± 3.6	19.7 ± 1.8	14.3 ± 1.8*	12.1 ± 1.0*

(*$p < 0.05$ vs. prev. value)

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Both EEG amplitude and SEF90 showed similar changing pattern which we observed in pediatric patients without neurological disorder.
Conclusion(s): EEG monitoring would be valuable in pediatric patients with cerebral palsy.
Reference:
1 Hagihira et al. Anesth Analg 2001; 93:966–70.

A-122

Attitudes of anaesthetists to awareness and depth of anaesthesia monitoring

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Background and Goal of Study: Depth of anaesthesia monitoring has been the subject of persistent study and scepticism, often polarising the views of the profession. A Swedish study showed an incidence of awareness under anaesthesia of 0.18 to 0.1%.[1] We performed a survey of consultant anaesthetists in the U.K. to ascertain their attitudes to awareness and depth of anaesthesia monitoring.
Materials and Methods: Following Research Ethics Committee approval, questionnaires, based on an Australian survey,[2] were sent to anaesthetic consultants in the U.K. The responses were anonymised.
Results and Discussions: Of the 4927 questionnaires sent out, there was an overall response rate of 44%. Fifty-nine percent of respondents perceived awareness to be a minor problem. Seventy percent thought the national incidence was 0.02% or more. One third have had patients with awareness. Only 4% routinely warn their patients of the risk of awareness during preoperative visits. Although 20% believe that anaesthetists should routinely ask about recall during a post-operative visit, only 7% actually do so. In 91% of the responses, end tidal anaesthetic gas concentration was thought to reduce the likelihood of awareness. Clinical signs were considered unreliable indicators of awareness by 80% of respondents. Only 41% would "always" or "usually" use depth of anaesthesia monitoring if it was available.
Conclusion(s): The perception of the national incidence of awareness is in keeping with other literature. Awareness is perceived as a 'minor' problem and the reasons need to be investigated. Many still believe end tidal volatile agent monitoring is useful in reducing the risk of awareness. Respondents remain unconvinced about the efficacy of currently available depth of anaesthesia monitors in preventing awareness.
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1 Sandin RH et al. *Lancet* 2000; **355**: 707–711.
2 Myles PS et al. *Anaesthesia* 2003; **58**: 11–16.
Acknowledgements: All expenses were met by the Cambridge University Department of Anaesthesia.

A-123

Cerebral state index (CSI): time delay of index calculation

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Background and Goal of Study: The cerebral state index (CSI) has recently been introduced as a measure of the hypnotic component of anaesthesia. Based on spontaneous EEG processing, it is calculated by the cerebral state monitor (CSM). The CSI is displayed as a dimensionless number between 0 and 100 and inversely correlates with depth of hypnosis. All currently available monitors require some unknown time to calculate an index value. The aim of this study was to determine the duration of this time delay for the CSI.
Materials and Methods: Artificially generated EEG signals were used to produce three different CSI values: "awake" (CSI 89), "general anesthesia" (CSI 42) and "deep anesthesia" (CSI 0). All signals produced constant CSI values. We simulated loss of and return to consciousness by changing simulated EEG signals from CSI 0 to CSI 42, then from 42 to 89 and back. We analysed the time necessary for CSM to adapt CSI to the particular input signal.
Results and Discussions: For increasing values, time delays were between 15 and 155 sec, for decreasing values from 53 to 55 sec. We revealed two details: First, at the signal change from CSI 0 to CSI 42 the CSI value reaches and maintains a plateau at CSI 33, then rises again until a constant CSI of 42 is reached. Second, we revealed the novelty of an overshot reaction at the transition from "general anesthesia" to "awake": the CSI initially increases from 42 to 95, then subsequently decreases to 89, the appropriate index value for the underlying signal. This overshot additionally exists at the transition from CSI 89 to 42 and from CSI 89 to 0.
Conclusion(s): The time interval before a new index value was obtained was not constant. Calculation times were different for decreasing and increasing CSI values. The time interval also depended on the baseline index value. This is important if the CSI is used as a tool for pharmacodynamic studies. The overshot reaction at the transition from "general anesthesia" to "awake" can be seen as an additional warning of patient's awareness. The fastest response was calculated at transition from CSI 42 to 89, indicating good results for detection of awakeness.
Reference:
1 Rodriguez BE et al. Abstracts 7th EuroSIVA Meeting, Lisboa 2004.

A-124

Detection of different levels of anaesthesia by auditory evoked potentials: from loss of consciousness to burst suppression

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Background and Goal of Study: Auditory evoked potentials (AEP) have been suggested as a measure of the hypnotic component of anaesthesia (1). The present study was designed to compare parameters obtained by automated AEP analysis with results of visual analysis (2) in respect to their ability to characterise different levels of anaesthesia.
Materials and Methods: 15 unpremedicated consenting volunteers were enrolled into HIC-approved study. On two different days, they received propofol via target controlled infusion or sevoflurane mono-anaesthesia. Standard monitoring parameters, EEG and AEP were continuously recorded (electrode positions: AT1, M2, Fpz (reference) and F7 (ground), binaural rarefaction clicks, 70 dB, 8.3291 Hz, 10% variability of the interstimulus interval). Time of measurements: Volunteers were instructed to relax and close eyes; Anaesthesia was slowly induced until loss of consciousness (LOC). The drug concentration was increased until Burst Suppression (BS) was seen in the EEG. The difference of drug concentrations at LOC and BS was divided into three equal intervals, leading to two intermediate levels (Inter2 and 1). At each level (LOC, BS, Inter2, Inter1), the drug concentration was maintained for 15 min. From the last 3 min of each level, an AEP was analysed (20 volunteers: 10 propofol, 10 sevoflurane). AEP parameters were calculated and ranked by their ability to separate the different levels using Pk analysis.
Results and Discussions: Automated analysis revealed Pk values $\geqslant 0.85$ for: (1) root mean square of the 1st signal derivative (0.86), (2) variance of 1st signal derivative (0.86), (3) mean absolute amplitude of 1st signal derivative (0.85). In the visual analysis Pk values of amplitudes (Na: 0.73, Pa: 0.74, Nb: 0.78, Pb: 0.70, N1: 0.70) and latency (Na: 0.62, Pa: 0.60, Nb: 0.55, Pb: 0.53, N1: 0.53) were found.
Conclusion: LOC and BS are defined endpoints of the full range of anaesthesia. The different levels of anaesthesia were defined by individual effects of the given drug. Three parameters of the automated analysis were identified that can be used to distinguish between different levels of this range. Visual analysis was less useful to distinguish between the different levels.
References:
1 Thornton et al. Br J Anaesth 1984; 56:315–23.
2 Schneider et al. Br J Anaesth 2003; 91:905–8.

A-125

Time delay of EEG index calculation: analysis of Narcotrend and bispectral index

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Background and Goal of Study: Monitoring of anesthetic depth with EEG derived parameters during surgery may detect awareness reactions and thereby may help to decrease the incidence of intraoperative awareness. All currently available indices need some time to react to a change in the state of consciousness. The exact amount of time is unknown. The aim of this study was to determine the latency of two frequently used indices – the bispectral index (BIS) and the Narcotrend® index.
Materials and Methods: Artificial EEG signals were used to generate constant BIS and Narcotrend® index values. These values indicated "awake", "general anesthesia" and "deep anesthesia" (total suppression of cortical activity). After a switch from one simulated state of consciousness to another, the time necessary for both indices to adjust the displayed index was recorded.

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Results and Discussions: We found that both indices showed latencies between 14 and 145 s before the new state was indicated. In general, BIS adapted faster (14–66 s) than Narcotrend® (45–145 s).

Change in input signal		Time to new index (s)	
From	To	BIS	NCT
Deep anes	General anes	60	145
General anes	Awake	30	65
Awake	General anes	14	70
General anes	Deep anes	66	55
Deep anes	Awake	60	n.a.
Awake	Deep anes	66	45

n.a.: not applicable

Latencies of the tested indices limit their value in prevention of recall of intraoperative events. Interestingly, latencies for display of new index values were different between ascending and descending values.
Conclusion(s): This indicates a limitation for the use of both monitors for pharmacokinetic and -dynamic studies.

A-126

High frequency components of auditory evoked potentials are detected in responsive, but not in unconscious patients

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Background and Goal of Study: The dose dependent suppression of mid-latency auditory evoked potentials by general anesthetics has been proposed to measure depth of anesthesia.[1] In this study, perioperatively recorded mid-latency auditory evoked potentials were analysed in a time-frequency space to identify significant changes induced by general anesthesia.
Materials and Methods: Perioperatively recorded AEPs (binaural stimuli, 1000 sweeps) of 19 patients were submitted to a multi scale wavelet analysis. We calculated energy contents of the signal in several frequency bands. Multiple comparison test with Bonferroni correction was performed on the data. We plotted the energy density of signal fragments on a 10 ms grid for the frequency bands (0–57.1 Hz, 57.1–114.3 Hz, 114.3–228.6 Hz and 228.6–457.1 Hz).
Results and Discussions: Statistical evaluation showed a highly significant decrease of the wavelet energies for the frequency bands 57.1–114.3 Hz ($p = 1.49 \times 10^{-8}$) and 114.3–228.6 Hz ($p = 1.35 \times 10^{-8}$) for the measuring points representing deep general anesthesia, accompanied by a significant decrease of the wavelet energy of the frequency band 228.6–457.1 Hz ($p = 0.0006$) and a decrease in the wavelet energy of the frequency band 0–57.1 Hz of no statistical significance ($p = 0.03$), most prominent in the post stimulus interval between 10 ms and 30 ms.
Conclusion(s): These high frequency components may therefore not only reflect the response of the target organ of anesthesia, but a surrogate parameter, i.e. muscle activity.
References:

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2 O'Beirne GA, Patuzzi RB: Basic properties of the sound-evoked post-auricular muscle response (PAMR). Hear Res 1999; 138:115–132.

A-127

Clinical tests are worthless in predicting objective neuromuscular recovery

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Background and goal: To assess if clinical tests are good predictors of objective neuromuscular recovery as registered by the train-of-four (TOF) ratio.
Materials and methods: In 630 patients, the TOF ratio was measured and 8 clinical tests were performed at arrival in the recovery room. The patients had all received a single bolus of neuromuscular blocking drug (NMBD) at induction. The choice and dosage of NMBD had been at the anaesthetist's discretion. The clinical tests were: ability to smile (A), ability to swallow (B), ability to speak (C), appearance of general weakness (D), sustained head lift for 5 s (E), leg lift (F), hand grip (G) and sustained tongue depressor test (H).
Results: Table 1 shows the relation between the TOF and the number of positively scored clinical tests. Table 2 shows the *best* combination of tests for each positive score between 1 and 8 (Pearson and Spearman correlations).

Table 1. Sum of tests vs. TOF category.

Sum of +ve tests	TOF < 70% (% patients)	70% < TOF < 90% (% patients)	TOF > 90% (% patients)
8	12	21	67
0	27	15	58

Table 2. Correlation between sum of tests and TOF%.

Combination of tests	Pearson correlation	Spearman correlation
D E F G B A C H	0.18	0.16
D E F G B A C	0.19	0.17
D E F G B A	0.21	0.18
D E F G B	0.21	0.19
D E F G	0.21	0.20
D E G	0.22	0.19
D E	0.21	0.19
D	0.19	0.18

Of the patients with a good score in all the clinical tests, 12% still belonged to the category of 'clinically dangerous', while among those with a bad score, 58% had an 'ideal' TOF ratio (Table 1). The correlations were low (Table 2), so none of the combinations of clinical tests were good predictors.
Conclusion: The clinical tests considered here are not good predictors of objective neuromuscular recovery as measured by the TOF ratio.

A-128

Clinical evaluation of the TOF-tube

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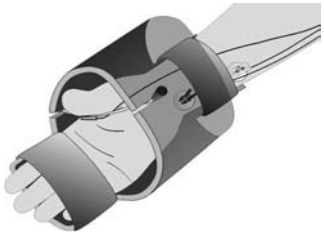
Background and Goal of Study: The risk of postoperative residual curarisation can be eliminated by the correct use of acceleromyography (AMG) (1). Furthermore, its peroperative use insures adequate surgical relaxation. The only requirement is that the thumb must be allowed free movement. This is frequently impossible during surgical procedures.

We investigated the clinical feasibility of AMG protected inside a new device: the TOF-tube (2).
Materials and Methods: The rigid and tubular TOF-tube allows safe positioning of the hand while ensuring thumb mobility under the surgical sheets (Fig. 1).



We asked 8 TOF-tube-unexperienced anaesthetists to answer 4 questions concerning their first few clinical uses of the device.
Results and Discussions: The patients (n = 64) underwent various types of surgery (including gynaecological, abdominal, cardiac, ENT, orthopaedic) in supine position (95%) with the arm alongside the body (76%) or on an armboard.

TOF-tube is easy to set up: yes (93.75%)
Stability during operation: yes (92.19%)
You believed in the measurements: yes (93.75%)
You used them to adapt the depth of blockade or to ensure full recovery: yes (92.19%)

The patients never complained. Few surgeons did (n = 2).

The most frequent comment concerned the bulkiness in gynaecological position with the arm alongside the body, and the lost of measurement when the piezzoelectric crystal fell from the thumb during operation.

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Conclusions: In daily practice, TOF-tube improves the functioning of AMG in various types of surgery and installations. Further improvements of the device will occur taking comments into account.

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A-129

Acceleromyography reproducibility using the TOF-tube: a comparison with mechanomyography and electromyography

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Background and Goal of Study: Acceleromyography (AMG) is used in clinical practice to monitor neuromuscular blockade. However, problems remain in obtaining stable values, making the interpretation of results difficult (1). Furthermore, the thumb must move freely which is frequently impossible under the sheets during the surgical procedure.

This study compares train-of-four ratios (TOFr) recorded at the end of surgery with mechanomyography (MMG), electromyography (EMG) and AMG protected inside the TOF-tube, a rigid tubular device allowing safe positioning of the hand while ensuring thumb mobility under the surgical sheets (2).

Materials and Methods: After Ethical Committee approval, neuromuscular blockade was investigated in 20 informed patients under general anaesthesia. Two consecutive TOFr (15 s interval) were obtained on both hands simultaneously using on one side MMG and EMG, and on the other AMG installed inside the TOF-tube. The evaluation of repeatability between each paired TOFr was performed by assessing the bias, the precision, and the limits of agreement using the Bland and Altman method.

Results: Expressed in % as mean ± SD

Mean TOFr was 75 ± 15 at the end of surgery.

	MMG	EMG	AMG
Bias	−0.30 ± 1.80	−0.04 ± 2.94	−0.75 ± 2.65
Precision	1.10 ± 1.45	1.76 ± 2.35	1.85 ± 2.01
Limits of agreement	−3.82/3.22	−5.80/5.73	−5.95/4.45

Conclusion: Inside the TOF-tube, its protective device, AMG shows an inter-measurement variability of the same magnitude as EMG. This allows a better interpretation of AMG results during the surgical procedure.

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A-130

Transcutaneous electrical stimulation of the P-6 acupuncture point with a nerve stimulator that monitors neuromuscular function, reduces PONV

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Background and Goals: Acupuncture at P6-point (volar anterior ante-brachial region) during gynecologic surgery reduces the incidence of postoperative nausea and vomiting (PONV) (1). Transcutaneous electrical stimulation of P6-point reduced nausea, but not vomiting after cholecystectomy (2). In this RCT we used a conventional neuromuscular stimulator to measure neuromuscular blockade for the stimulation of the ulnar nerve or the median nerve at the P6- point to determine the incidence of PONV.

Materials and Methods: We planned to evaluate 220 ASA I–III women undergoing elective laparoscopic surgery under standardized anesthesia upon the incidence of PONV during the first 24 hours. Besides demographic data and standard anesthesia safety monitoring, severity of nausea and vomiting, pain-score, rescue anti-emetic medication were recorded for the early (first 6-h) and late (6–24-h) postoperative period.

In half of the patients neuromuscular blockade was monitored with a nerve stimulator (TOF-watchS, Organon, NL) above the ulnar nerve at the wrist in single twitch mode (1-Hz). The aim of neuromuscular blockade during surgery was 10% of the twitch height of the baseline reading. The intervention group was stimulated as described above at the P6-point above the median nerve.

Results and Discussions: From 60 patients studied (out of 220 planned). Demographic data, intra- and postoperative hemodynamic measurements and medication, pain score and rescue medication was comparable between the 2 groups and the 2 time periods. The overall PONV incidence was 40% over 24-h and 32% in the first 6-h. Stimulation of the P6 point reduced PONV significantly (15% vs. 54%; $P < 0.05$) and nausea (11% vs. 46%; $P < 0.05$) but not vomiting in the 1st 6-h after surgery. No difference was found for the late postoperative period.

Conclusion(s): Continuous intraoperative transcutaneous stimulation of the P6 acupuncture point at the volar side of the wrist with a conventional nerve stimulator for the monitoring of neuromuscular blockade in the single twitch mode reduces PONV and nausea in the 1st 6-h after surgery.

References:

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A-131

Neuromuscular blockade monitoring in obese patients

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Background and Goal of Study: We have found more differences between the degree of neuromuscular blockade (NMB) measured with peripheral nerve stimulator (PNS) and that evaluated by the surgeons in obese patients (OP) compared with normal weight patients (NWP). This can be secondary to insufficient electrical stimulation. Our goal is to determine the surface supramaximal stimulation (SS) on ulnar nerve in OP and compare it with that of NWP.

Materials and Methods: After Ethical Committee approval and written consent, 10 OP (BMI > 35 kg/m^2) and 10 NWP (BMI 20–25 kg/m^2), ASA I–II, scheduled for elective surgery under general anesthesia, were studied prospectively. Measurements were made after i.v. induction with fentanyl 1–3 μg/kg and thiopental 2–5 mg/kg. A Datex® monitor NMT221 was used to determine automatically SS. The monitor has a maximal intensity output of 70 mA. Patients who did not achieve a maximal response with 70 mA were recorded as SS > 70. Demographic data, wrist circumference (cm) and SS measured (mA) were registered. Statistics were with Student's t-test, Fisher's exact test and lineal correlation. A $p < 0.05$ was considered statistically significant.

Results and Discussions: There were no differences in sex, age and height between groups. Weight was 114 ± 19 vs. 65 ± 11 kg ($p < 0.001$), BMI 40 ± 5 vs. 23 ± 2 kg/m^2 ($p < 0.001$) and wrist circumference 19 ± 3 vs. 16 ± 1 cm ($p < 0.001$) in OP and NWP, respectively. Six out of 10 OP had a non-determinable value >70 mA, while all the NWP had SS ⩽ 70 mA ($p = 0.011$). A mild positive correlation between wrist circumference and SS ($r = 0{,}476$; $p < 0.05$) was found. All patients with a wrist circumference <18 cm ($n = 9$) had SS ⩽ 70 mA.

Conclusion(s): Monitoring of NMB with SS < 70 mA is not reliable in OP. Since most neuromuscular stimulators have a maximum output of 70 mA, this can be the cause of discrepancies between the clinical impression and that measured by PNS. In patients with a wrist circumference <18 cm, the use of a ⩽70 mA stimulation is possibly adequate.

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Complex Myograph: evaluation of a diagnostic device and standard values for force, velocity and working capacity of the muscle in-vivo

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Background and Goal of Study: With the newly developed Complex Myograph it is possible for the first time to determine the individual muscular contraction force, velocity, and work at the point of optimum muscle pre-stretching. This trial investigates the reproducibility and the precision of the measuring method. Physiological standard values for force, velocity and work are presented.

Materials and Methods: The experiments in this study are in-vivo conducted on *musculus adductor pollicis*. A self-developed device brings the physiological rotation axle in a congruent position with the axle of the apparatus, holds it there, and brings the muscle on the optimum of pre-stretching.

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There constant counter-forces can be attached to the muscle and the muscle can be stimulated indirectly. The contraction are measured with three mechanical sensors. For the reproducibility trial we performed a succession of 500 tests with 5 test subjects. The results of amplitude and deviations were analysed with two-way factorial variance analysis by UNIANOVA in SPSS. For collecting the standard values measurements on 700 healthy test subjects were conducted.

Results and Discussions: The precision of the measuring device was 98.6%, which expresses the experimental and measuring fluctuations, cleared from the natural changes of muscular force of an individual test object through time. After single supra-maximal nerve stimulation was the mean for maximal force 9.51 N (±2.42), for maximal velocity 175.23 m/s (±18.92) and for maximal work 43.47 mJ (±15.04).

Conclusion(s): With the Complex Myograph the in-vivo efficiency of the muscular elements can be characterised for the first time, in particular the complex mechanical capacity. A high precision and reproducibility is reached and standard values are established. Important steps in direction of a clinical, pathophysiological diagnostic device for innate or acquired muscular diseases are made.

A-133

Does neuromuscular blockade require for laparoscopic gastroplasty?

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Background and Goal of Study: The aim of the study was to evaluate the depth of neuromuscular blockade requested for laparoscopic gastroplasty.

Materials and Methods: Target-controlled propofol and sufentanil infusions were administered to 12 morbidly obese patients (body mass index: 42.5 [41.8–44.5] kg/m^2). The target plasma propofol concentration was 3 to 4 μg/ml whereas the sufentanil infusion rate was 0.2 to 0.4 μg/kg/h adusted on blood pressure and heart rate. A bolus dose of atracurium (0.5 mg/kg) was given intravenously after onset of unconsciousness to facilitate tracheal intubation. Additional atracurium bolus (0.2 mg/kg) was given when inadequate surgical field was observed by the surgeon (JMC) who was blinded for the depth of neuromuscular blockade. The depth of neuromuscular blockade was monitored by using peripheral nerve stimulator. The evoked response to the train-of-four (TOF) stimulation was measured by acceleromyography at the adductor pollicis (AP) and the corrugator supercilii (CS). A post tetanic count (PTC) was measured at the AP when the recovery of the first response to CS TOF was done. Results were given as median [interquartil 25–75].

Results and Discussions: The characteristics of the patients were age 43 [31–48] yrs; women 75%; ASA 2 [1–2]. The surgical procedure lasted 125 [99–139] min. After 0.5 mg/kg atracurium, time to obtain 0 response to TOF at the CS was 135 [120–135] seconds. Twenty two atracurium bolus were given according to the surgical demands: 0 in two patients, 1 in three patients and ⩾2 in seven patients. Seventeen (77%) demands occurred whereas less than 2 responses to TOF at AP were observed. No demand occurred before the recovery of 2 responses to TOF at the CS. The recovery of the 1 response to TOF at CS corresponded to 2 [1–3] responses to PTC at AP.

Conclusion(s): Based on the surgical demand, the majority of the patients needed atracurium bolus during laparoscopic gastroplasty. The TOF at AP did not allow to anticipate the surgical demand. The TOF at the CS and/or the PTC at the AP were more adapted to the surgical demand.

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A new approach to evaluate colonic motility in vitro

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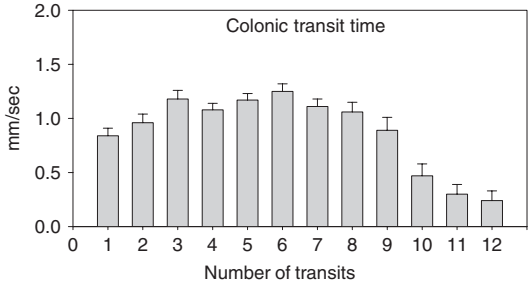
Background and Goal of Study: In patients with postoperative ileus the colon is the last section of the gastrointestinal tract to return to normal function (1). Assessment of small bowel function in vitro and the evaluation of drug effects on small bowel function is golden standard (2). Up to now no reliable setting for the assessment of colonic function was available. Therefore our aim was to develop an experimental setting that allows the evaluation of colonic transit time in vitro, as well as the assessment of drug effects on colonic function.

Materials and Methods: Guinea pigs were sacrificed and their colon excised. Colonic segments (length 8 cm) were fixed on a polyacrylic tray filled with Tyrode's solution. After a resting period of 10 minutes the transit time of a wooden pellet was evaluated. In a first step we used different segments from all parts of the colon in order to evaluate their propulsive function. In a second step we assessed the number of stable transits in the propulsive segments.

Results and Discussions: Propulsive motility was found in the distal part of the colon. The occurrence of propulsive motility was connected with a change of colonic contents – it changed from fluid to compact. The figure below shows the number of possible transits in one segment. In the period between transit 3–8 the segments propulsive motility was relatively stable (transit time 1.14 ± 0.03 mm/sec), after that it decreased rapidly.



Conclusion(s): This new experimental setting is a reliable method to evaluate colonic motility in vitro. The period between transit 3–8 would be the ideal period to assess the effect of drugs on colonic motility.

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A-135

Titration of desflurane using BIS when the anaesthesia is supplemented by intravenous administration of remifentanil or by epidural blockade during urological procedures

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Background and Goal of Study: The purpose of this study was to compare the effect between remifentanil infusion and epidural analgesia on desflurane requirements using bispectral index (BIS) in patients who underwent urological procedures (prostatectomies, cystectomies).

Materials and Methods: Thirty patients ASA I–III, aged 60–85 were randomly assigned to the remifentanil group (group A) which received continuously i.v. remifentanil (0.15–0.25 μg/kg/min) or the epidural group (group B) which received epidurally (O_1–O_3) a local anaesthetic ropivacaine 0.75% followed by boluses if needed throughout the operation. Anaesthesia was maintained with desflurane with fresh gas flow 2 L/min (60% N_2O in O_2). The end tidal concentration of desflurane was titrated so that BIS values to range between 45–60. The median end tidal desflurane was calculated in each patient when BIS was in the desired range every 5 minutes. For statistical analysis was used the paired sampled t-test. A threshold p value of 0.05 was set to determine the statistically significant differences.

The two groups were comparable with respect to demographic characteristics, haemodynamic variables and BIS values throughout the study.

Results and Discussion: The required end tidal concentration of desflurane in the remifentanil group was significantly lower $p < 0.05$ compared with the epidural analgesia group (1.6 (0.5) vs 2.43 (0.82) respectively).

Conclusion: In conclusion the end tidal concentration of desflurane required to maintain BIS values 45–60 is higher when analgesia is maintained with epidural block versus analgesia obtained with i.v. infusion of remifentanil in patients who underwent urological procedures.

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A-136

Mobile phone usage within hospitals – the reality

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Background and Goal of Study: Mobile phones and wireless technology have become a major part of modern life. It is estimated that 85% of UK households own a mobile phone[1]. The Medicines and Healthcare products

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Regulatory Authority (MHRA) produced new recommendations about mobile communication systems in August 2004[2]. Many UK hospitals ban all use of mobile phones within hospital buildings. Despite this, many people in hospitals continue to use mobile phones, yet the authors could find no data supporting this observation. This study assesses the current level of mobile phone usage within two city teaching hospitals.

Materials and Methods: A simple, anonymous, 'yes/no' questionnaire was used. 444 questionnaires were distributed to and completed by staff in two city teaching hospitals over a 48 hour period. Completed forms were divided into three staff categories: group 1 = nursing, group 2 = medical, group 3 = others – cardiology technicians, domestic staff, medical physicists, pharmacists, etc.

Results and Discussions: 60% of questionnaires were completed by nursing staff, 18% by medical staff and 22% by others. 94% (n = 417) owned a mobile phone, of which 90% (n = 376) regularly brought their mobile phone to work. Of those who brought their mobile phone to work, 46% (n = 174) admitted to having their mobile phone switched on in a clinical area. This equates to 39% of all staff having a mobile phone switched on in a clinical area. Whilst there is undoubtedly a degree of bias in this data, there appears to be a significant proportion of staff ignoring hospital policy. The authors suggest that these results represent an under-reporting of mobile phone usage within clinical areas.

Conclusion(s): Despite current hospital policy prohibiting use of mobile phones, this data suggests that more than a third of all hospital staff disregard this policy. These results support the MHRA statement that it is impossible to enforce a mobile phone ban effectively, and endorse the MHRA recommendation that healthcare providers should actively manage wireless technology[2].

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A-137

Implementation of an ICU Data Management System by using the standard Hospital Information System SAP R/3

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Background and Goal of Study: Information technology (IT) may help to support organisational and medical ICU processes. However, available PDMS's are expensive, and there full integration into the standard Hospital Information System may be difficult. Our aim was to create an in-house developed cost-effective IT system based on SAP R/3 (Walldorf, Germany).

Materials and Methods: Programming was focussed on clear and consistent documentation, concentration on critical data sets necessary for medical decisions, support of medical and organisational processes and generation of patients' records and outcome data. Various documents were generated to obtain structured informations from the operating theatre, preoperative clinic, emergency room and concomitant specialities in order to assist risk management and to individualise ICU treatment (Fig 1).

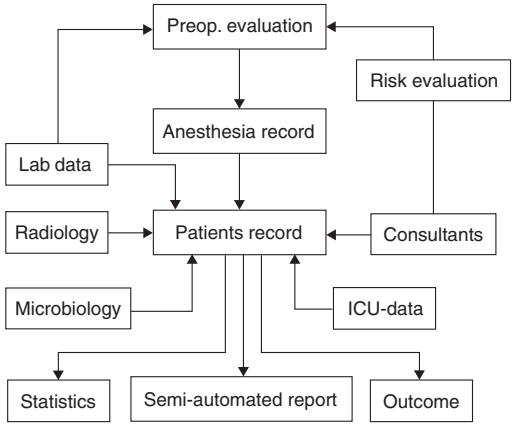

Figure 1. Standardised documents for assessment of patient status, diagnosis management, admission and discharge, planning of tasks, critical incidence reporting and scoring were incorporated. 22 ICU-beds were equipped with the necessary computer hardware.

Results and Discussions: Developement of this system by one computer engineer and two ICU-doctors took one year. After a test period of two weeks its application was fully implemented. In the first four months more than 600 patients were mangaged by using this system. As the same interface as with SAP was used the system was widely accepted by the entire ICU staff.

Conclusion(s): An in-house developed ICU-data-system based on SAP R/3 may be an adequate and cost-effective tool for ICU data management.

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Improving departmental administration using a dynamic database-driven website

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Background: Internet use has grown exponentially in the 12 years since public access became available. In a 2001 survey of Australian Anaesthetists, 97% had internet access at home or work. (1) Many medical practitioners see web sites as simple advertisements for a hospital. By providing a dynamic **user specific "portal"** to an entire department's activities and resources, considerable gains in workplace efficiency, safety and morale may be made.

Materials and Methods: St. George Hospital in Sydney, Australia has developed a departmental website, which has become an essential clinical and administrative tool. Some of its functions include: call rosters with the facility to make immediate changes; lists of departmental meetings; a messaging system; an email system; daily operating room allocations of surgical and anaesthetic teams; staff leave calendar; staff directory of contact numbers, pagers, mobiles and email addresses; publications and resources.

Results: A recent survey (December 2004) of all users (n = 60, 33 respondents) found 91% considered the website had improved the way they worked, 94% believed it saved them time, 76% believed that online patient alerts allowed them to be better prepared for complex patient presentations and 41% believed it reduced the chance of workplace errors. Local users log into the website on average every two days.

Discussion: A successful website requires content that is:

Dynamic: the content of the web site is generated every time it is viewed to reflect the "current" status. e.g. roster changes or meeting cancellations immediately shown.

User specific: what is seen is tailored to the person viewing it. e.g. when logged in the user is told when they are next on call or the subject of the next meeting.

User Editable: content is changed and expanded by users. e.g. users can arrange call exchanges which are immediately updated, and confirmatory emails automatically sent to the staff involved. Users can change their contact details; enter new messages, meetings or publications. Documents can be uploaded and stored using a filing system for easy access.

Reference:

1 Jones C, Lambros M. Use of the internet for patient care: a nationwide survey of Australian anaesthetists. Anaesthesia & Intensive Care. 2003; 31(3): 290–293.

A-139

Auditory signals in operating rooms soundscape

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Background and Goal of Study: Warning signals in operating room are often denounced by anaesthetists as too numerous and then as a nuisance (1). The goal of the study is to observe the part of the auditory signals of anaesthetic equipments in the operating room soundscape.

Materials and Methods: Observations have been realised in three hospitals (A, B, C) during sixteen surgical operations (5 in A, 5 in B and 3 in C). We used a video camera to record occurences and timings of the auditory signals. An observer noted nature of signals distinguishing anaesthetic equipements (An. eq.) from non-anaesthetic equipments (N-an. eq).

Results and Discussion: Mean auditory signal occurences per hour (±SD) are shown as a function of signal category and hospital in the Table:

			Hospital		
			A	B	C
Auditory Signals:	An. eq.	**W**	20.5 ± 10.2	21 ± 8	27.8 ± 11.3
		EK	4.1 ± 5.7	0.4 ± 0.8	0.47 ± 0.8
Warning		**RD**	9.5 ± 2.5	0	0
Equip.		Total	34.2 ± 4.6	21.4 ± 8.3	28.2 ± 11.9
Key	N-an. eq.	**S**	9.4 ± 9.4	4 ± 5.7	8.6 ± 9.7
Recorded		Other	4.6 ± 4.1	4.5 ± 3.7	7.4 ± 2.3
Data		Total	13.9 ± 10.3	8.5 ± 6.5	16 ± 7.4
Surgical					
	Total		48.1 ± 9.2	30 ± 13.7	44.3 ± 19.1

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For the three hospitals, N-an eq signals represented more than the third of all the auditory signals with a large part from surgical signals that cannot be reduced. Concerning the An-eq signals, soundscapes were different among the three hospitals ($p < 0.001$). We observed less warning signals in Hospital A than in the others but the total of An-eq signals was greater than in the other hospitals. This is due to the working of its recent anaesthetic equipment that was designed to decrease warning signals but leads paradoxically to a high increase of the auditory signals in the operating room with recording data signals (EK, RD).

Conclusion: N-an eq signals represent a large part of the soundscape in the operating room. Then, An-eq designers must be careful not to increase the number of auditory signals when trying to decrease warning signals.

Acknowledgement: This work was supported by DCSSA.

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A-140

Introduction of an Operating Room (OR) Scheduling and Management Information System increased overall performance

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Introduction: Operating room information systems should guide the allocation of the optimal amount of block time for every surgeon. This should minimize the sum of costs of unused block time as it should minimize the costs of elective cases being performed outside normal block times. In the present paper, we want to illustrate how the introduction of a visual display of real-time OR activity, as part of an Operating Room Scheduling and Management System, influenced our daily OR activity performance in view of unused or excess OR time.

Materials and Methods: Since January 2001, we introduced an OR status screen, chronologically displaying all scheduled OR activity pro OR suite. This screen is linked in real-time activity with all OR suites, where predefined tracking events (start and ending of procedure) are automatically captured by network technology. For the aim of this paper, we compared all data of OR activity performance for abdominal surgery for the first half of 2000 to the first half of 2001, using the Mann–Whitney U-test.

Results: From January to June 2000, 764 elective cases were performed, whereas 815 cases were performed during the first half of 2001. For both periods, the total OR time allocated to abdominal surgery for this 6 months period was 805 hrs. For 2000, the total duration of OR activity performed for elective abdominal surgery was 1044 h 50 min (resulting in 239 h 50 min total overtime), whereas for 2001 a total of 1127 h 35 min (resulting in 322 h 35 min total over-time) was registered. For 2000, we recorded 147 h 20 min of excess time (exceeding the time limits of normal OR activity and inducing extra costs) and 46 h 45 min of unused OR time (within the total OR time allocated to elective abdominal surgery). For 2001, we recorded 123 h 04 min of excess time and 35 h 21 min of unused time.

Conclusions: In 2001, we recorded an increase in total OR activity for elective abdominal surgery by 7% in number of procedures (815 vs 764) and by 8% in total duration (1127 h 35 min vs 1044 h 50 min). However, this increase did not result in an increase in excess time or in extra costs, mainly by a significant reduction in unused time or by an increased performance.

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Leg bio-impedance measurement is good for foot pumps evaluation

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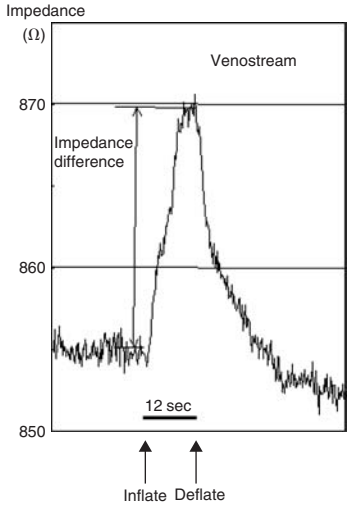
Background and Goal of Study: There was no simple and easy method for comparing anti-DVT (deep vein thrombosis) foot pumps performance. An Ultrasonic Doppler flow meter needs much time and effort for multi time measurements. We made a simple and easy comparing method using bio-impedance measurement.

Materials and Methods: We studied six types foot pumps in each 15 male health volunteers aged 32.1 ± 8.7 (mean ± SD). After electrodes fixation on dorsal foot and frontal thigh, we measured bio-impedance with computer controlled LCR meter under 20 kHz 20 mA transmit current. Compression pressure was monitored with ventilator performance analyzer. Studied foot pumps are A-V Impulse System old/new type (Novamedix), Venostream (Terumo), DVT-2500 (Medomer), Venaflow (Aircast), Wizair DVT (MCS).

Results and Discussions: Control leg impedance was 849.2 ± 94.2. Impedance changes are clear (Figure 1) and parallel with compression pressure waves. Impedance changes in Venostream, A-V Impulse old type, DVT-2500 were significantly higher than Wizair DVT and A-V Impulse new type. Bio-impedance changes response to both intra cellular fluid and extra cellular fluid. But changes in the short period were supposed to show blood volume changes (1,2). Therefore impedance change is a good blood volume shift parameter.



Conclusion(s): Bio-impedance measurement is simple and easy method to compare the foot pump's performance.

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A-142

Implementation of an Anesthesia Information Management System (AIMS)

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Background and Goal of Study: We have recently implemented AIMS in our operating rooms. Although the accuracy of automated charts over hand-written ones is well established, the burden of implementation, other than direct costs, is not clear. We report our experience in the process.

Materials and Methods: The system implemented is an open system requiring customization. A project manager and four super-users from within the anesthesia staff were trained by the vendor. This group provided training for the rest of the department, customization, and maintenance. User satisfaction was evaluated at implementation and after 4 months. Data entry into the chart and the occurrence of artifacts was evaluated after 4 months.

Results and Discussions: The anesthesia department has a staff of 36 physicians (16 residents), with a median age of 41 (35/50) years (1/3 quartiles). Ten have >20 years experience, while 9 have <5. 13 did not previously use computers daily. For the 6-week implementation the project manager worked on the system 100% of the time and the super-users for 50% each. Each user had a training session of 90 min. and 6 required a repeated sessions. Maintenance requires 30% of a full time post. For the first 3207 cases ASA score was entered in 98% of the files, the anesthesiologists name in 92% and the type of surgery in 87%. In 55 (<2%) of the cases (excluding cardiac) there were important artifacts (more than 3 readings of either HR >190 or O_2Sat <80%). The opinion of the staff about the effect of AIMS anesthesia practice (workload and the attention given to the patient) prior to implementation and after 4 months use is presented in the Table.

	Expectation before	Opinion after 4 months use
Workload ↑	13	4
Workload ↓	9	19
Attention ↓	14	1
Attention ↑	7	28

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Conclusion(s): Even in a clinical department with a high rate of computer illiteracy the implementation of AIMS can be successful, although dedication from leaders is required. During implementation there is significant manpower requirement.

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Comparison of two techniques for intraabdominal pressure monitoring

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Background and Goal of Study: Reliable measurements of the intraabdominal pressure are the basis for treatment of intraabdominal hypertension [1]. The intraabdominal pressure (IAP) usually is assessed via the intra-bladder pressure (IBP). The aim of our study was to validate a continuous technique to measure the intraabdominal pressure via a balloon tipped gastric tube (GT, Spiegelberg) connected to an IAP Monitor.

We compared it with the current standard technique of measuring the intrabladder pressure (IBP).

Materials and Methods: We measured the intraabdominal pressure in 14 ICU patients after laparatomy (57.5a ± 19.3; 8m/6f; APACHE II 17.5 ± 6.3; in total 168 paired measurements were performed). All patients were ventilated (BIPAP) and under sedation. We evaluated the correlation of the GT with the intra-bladder pressure at different bladder-volumes (50 ml to 200 ml), the change of the correlation over time (90 minutes) and than we assessed the reaction to external pressure. All values are shown as mean plus/minus standard deviation (MEAN ± SD).

Results and Discussions: We found a good correlation between both methods with an intra-bladder volume of 50 ml ($GT = -1.074 + 1.082 * IBP$; $R^2 = 0.736$; $p < 0.001$). After 60 minutes the correlation was as follows ($GT = 1.929 + 0.908 * IBP$; $R^2 = 0.957$; $p < 0.001$). Bland Altman Analyses showed a good agreement (mean bias was 0.2 ± 4.2)

In each patient we measured the reaction to external pressure with both methods. Both systems reacted immediately to the external pressure. The pressure difference in both systems showed a good correlation ($GT = -0.905 + 1.167 * IBP$; $R^2 = 0.723$; $p < 0.001$).

Conclusion: The balloon tipped gastric tube may be used for assessing reliable the intraabdominal pressure. The validity of the measurement over a longer period as well as the influence of the body position still has to be evaluated.

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A-144

Patients' and healthcare workers' perception on ambient operating theatre temperatures

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Background and Goal of Study: The study aims to determine the correlation between low ambient operating theatre (OT) temperatures and the incidence of perioperative hypothermia and to understand the perceptions of patients and healthcare workers regarding the ambient OT temperature.

Materials and Methods: 46 patients and 53 healthcare workers (17 surgeons, 19 anaesthetists and 17 nurses) were enrolled. The patient's body temperature was taken using a tympanic thermometer at 5 points. The questionnaire was completed postoperatively in the recovery room after the patients had recovered from anaesthesia.

Results and Discussions: The mean ambient OT temperature was 18.4 ± 0.2°C. This could explain the high incidence of hypothermia (54.3%) among patients when they left the OT. 95.7% of patients, 94.7% of anaesthetists and 94.1% of nurses felt that the OT was cold. However, only 58.8% of surgeons found the OT cold. 84.2% of anaesthetist and 64.7% of nurses but only 41.2% of surgeons agreed that a higher OT temperature would improve patient comfort and should be implemented. Surgeons find the ambient OT temperature just nice because they wear OT gowns and work under the OT lights. 42.1% of anaesthetists were unwilling to reduce the patient waiting time in the induction room because they require it to prepare the patient adequately. Point of care temperature control may be useful. The patients can be kept warm and comfortable before and after surgery. The OT temperatures can be reduced during surgery once the patient is adequately draped. This will reduce the heat loss from the patients while keeping the surgeons comfortable. Despite feeling cold, 93.5% patients found the cold tolerable. 80.4% did not experience shivering and 84.8% were not uncomfortable. However, 71.7% would rather have a higher OT temperature if they were given a choice.

Conclusion(s): In conclusion, perioperative hypothermia (body temperature <36.0°C) occurs frequently in a cold ambient OT temperature. Majority of patients feel that the OT is cold and that further measures can be taken to improve their comfort. Point of care temperature control may be able to keep patients and healthcare workers comfortable.

A-145

Efficacy of different methods in maintaining normothermia during OPCAB surgery

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Background and Goal of study: Patients become hypothermic during off pump cardiopulmonary bypass surgery (OPCAB) and are exposed to its deleterious effects (1). We evaluated the efficacy in avoiding intraoperative hypothermia of Allon Thermo Wrap™ system: water at a preset desired temperature (T) to a specially designed garment, vs. sterile forced air warming blankets (2).

Materials and Methods: We randomized 32 patients scheduled for elective OPCAB surgery, 3 were excluded after reconverted to CAB [(Group-A)14 pts warmed by Allon, core T objective 36.5°C; (Group-B)15 pts warmed by sterile Bear Hugger™, this blanket was placed on the lower extremities after the saphenous section had been sutured]. We collected core T by a nasopharyngeal catheter every 30 min from intubation to the end of surgery. All patients received warmed fluids. The operating room T range was 20–22°C. The Brat 2™ autologous blood recovery system was set up in all cases.

Results and Discussion: There were no statistically significant differences between group's variables: Age, body surface, ejection fraction, infusions, Hb, and Brat volume recovery. Core T values (Mean ± SD) are shown in the Table.

	Group-A	Group-B	
First T	36 ± 0.3	35.6 ± 0.3	$p < 0.05$
T End Surgery	36.5 ± 0.2	35.3 ± 0.8	$p < 0.0001$
T 1 hr ICU	36.7 ± 0.3	35.6 ± 0.8	$p < 0.001$

Patients of Group-A maintained normothermia because they could be warmed actively before of anesthesia induction and during all procedure. Most of the pts of Group-B were hypothermic at the moment that air blankets, were started, needing active warming after ICU admission.

Conclusion: Normothermia can be achieved efficiently during OPCAB procedures using the Allon system. It was found to be superior to the air blankets method.

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A-147

Prevention of intraoperative hypothermia during laparoscopic surgery of long duration

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Background and Goal of Study: Laparoscopic surgery (L.S.) as a result of CO_2 pneumoperitoneum induces intraoperative hypothermia. This is a significant source of morbidity (1), with potential sequelae: cardiovascular (vasoconstriction) and higher incidence of postoperative infection (2). Our aim was to examine the degree of hypothermia and the efficacy of air warming blankets in preventing it during L.S. of long duration (>2 hours).

Materials and Methods: We randomized 30 patients scheduled for L.S.: hemicolectomy, anterior rectum resection, splenectomy, and Nissen operation. Four patients were excluded (change to laparotomy). [Control group (G-C) 12 pts protected with the usual surgical drapes. Group Bair–Hugger (G-B) 14 pts covered before anesthesia induction with air warming blanket on thorax and the arm exposed]. Both groups received perfusions warmed by Hotline™. We collected pharyngeal temperature (core T) and operating room T from induction every 30 min until the end of procedure.

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Results and Discussion: There were not statistically differences between variable's groups: Age, body mass index, volume infusions, surgical time. Evolutions of T are shown in the Table (Mean ± SD).

	Group-C	Group-B
T Induction	36.1 ± 0.4°C	36.0 ± 0.4°C
T 60 min*	35.5 ± 0.8°C	36.1 ± 0.4°C
T End surgery**	35.3 ± 0.7°C	36.4 ± 0.3°C
T Induction–T End**	(−) 0.8 ± 0.3°C	(+) 0.4 ± 0.5°C
O.R. final T**	21.1 ± 0.7°C	22.7 ± 1°C

* $p < 0.05$; ** $p < 0.001$.

The use of air warming blankets kept all the pts of group B normothermic (>36°C). It is very important to protect the patient before anesthesia induction in order to prevent the initial loss of core T as a result of redistribution of body T.

Conclusions: Laparoscopic surgery induces intraoperative hypothermia as open surgery does. Normotermia can be maintained efficiently using air warming blankets, a safe and not expensive technique. The use of these devices also increases the operating room T at the end of surgery, as a "collateral" protective action.

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A-148

Handheld Tesla meter confirmation of gum elastic bougie placement

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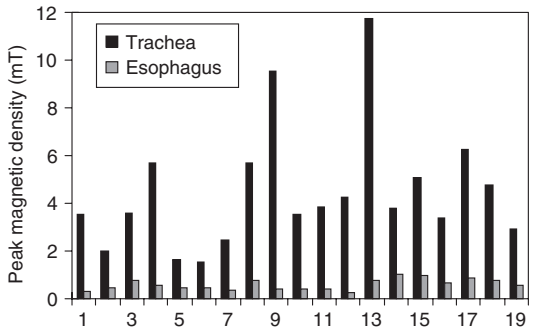
Background and Goal of Study: Gum elastic bougie placement (GEB) into trachea has been confirmed by subjective methods. Tesla meter can measure magnetic flux density of magnets. Magnetic flux density of the magnet depends on the distance from the magnet. This pilot study was undertaken to determine whether the measurement of magnetic flux density of magnet attached to the tip of GEB could be used to distinguish endotracheal from esophageal insertion of the GEB.

Materials and Methods: Nineteen adult patients (56 ± 19 yr) scheduled for an elective surgery under general anesthesia were included in this study. Routine monitoring was performed and a standard anesthesia protocol was followed. Anaesthesia was induced with 1.5–2 mg/kg propofol and 1–2 μg/kg fentanyl, followed paralysis with 1 mg/kg vecronium. A GEB with a small magnet on its tip was inserted first into the esophagus, and next into the trachea before tracheal intubation. During GEB insertion, magnetic flux density on the skin of the cricoid cartilage was measured and continuously recorded with Tesla meter.

Results and Discussions: Peak magnetic flux density during the GEB insertion into the trachea or esophagus ranged between 11.75 and 1.54 mT, or between 0.26 and 1.02 mT, respectively. These ranges did not overlap each other.



Conclusion: Combination of Handheld Tesla meter and GEB with a small magnet was reliable in distinguishing tracheal from esophageal insertion of the GEB.

A-150

A pilot study to detect esophageal intubation using dual channel Visual Stethoscope (VisiStetho)

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Background and Goal of Study: An unobserved esophageal intubation causes significant hypoxemia. To auscultate patient's breathing and gastric sound using stethoscope is the essential method for confirming the endotracheal tube (ETT) position after tracheal intubation, but it can frequently be inaccurate.

We have tried to invent a new technology for changing the breathing sounds signals into a visual form. We could visualize breathing sounds in a three-dimensional (3-D) color visual form, continuously in the previous study. We improved the Visual Stethoscope (VisiStetho) to visualize two sounds simultaneously. We applied this new dual channel VisiStetho to detect esophageal intubation.

Materials and Methods: Fifty patients who were scheduled to undergo general anaesthesia were involved in this study. Routine monitoring and standard anesthesia induction was performed.

One stethoscope sensor of VisiStetho was placed on the right side of the chest, at the lateral axillary line and another sensor placed over the epigastrium. The trachea was intubated by an anesthesia intern attended by a skilled anesthesiologist. During tracheal intubation, an observer monitored both breathing and gastric sound continuously and simultaneously by the dual channel VisiStetho. Esophageal intubation was judged when the large gastric sound synchoronizing with bag compression was visualized, but the representative breathing sound was not visualized. Within 5 breathes after intubation was performed, the observer was requested to judge whether the ETT was inserted into the trachea or esophagus.

Results and Discussions: Four accidental esophageal intubations occurred (4/50), and the observer identified all the tracheal and esophageal intubations using the dual channel VisiSthetho.

Objective evaluation of the breathing and gastric sound using traditional stethoscope is difficult because it is conducted by a single attending doctor and traditional stethoscope can not evaluate both sounds at once. Using dual channels VisiStetho, it solved these problems.

Conclusion: Dual channel VisiStetho may be an effective tool for detection of accidental esophageal intubation under scheduled general anesthesia.

A-151

A new effective warm-air mattress gives access to the patient

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Background and Goal of Study: To maintain a patient's core body temperature (CT) during anaesthesia is important (1,2). We evaluated the intraoperative efficacy of a new warm air mattress. It is placed under the patient, thus giving full access to the upper surface of the patient.

Materials and Methods: After ethical approval and informed consent, 12 patients (ASA I–II), scheduled for major abdominal surgery were included. CT was measured rectally (RT) and in the esophagus (ET). Skin temperature (ST) was measured between the skin and the mattress. The warming mattress was started before the induction of general anaesthesia. The aimed CT was ⩾36.5°C. The air mattress was disconnected after emergence of anaesthesia and extubation. The RT was recorded 2 and 4 hours postop. The skin was inspected for burns or decubital sores 2 hours postop and the next day. Data are presented as median and range.

Results and Discussion: All patients reached the aimed CT. The initial RT awake was 36.9°C (36–37.3). The lowest RT (36.3, 35.5–36.8) and ET (36.0, 35.5–36.4) were found 79 (20–118) and 79 (15–105) min. after the initiation of the warming. The time to achieve the aimed CT was 68 (0–210) min. for RT and 120 (15–165) min. for ET. The highest ST was 39.6 (37.8–40.5)°C. The postop RT were 37.5 (36.0–37.8)°C at 2 hours and 37.9 (35.9–38.6)°C at 4 hours. No signs of burns or decubital sores were found.

Conclusion: Cutaneous warming with this mattress was an effective means of preventing intraoperative hypothermia during prolonged abdominal surgery. No device-related adverse effects were observed. The mattress also gives access to the patient without interrupted warming.

Acknowledgements: This study was supported by KanMed, Bromma, Sweden.

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A-152

A new infrared temporal-artery thermometer: accuracy and precision during perioperative and ICU/PACU-monitoring

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Background and Goal of Study: Thermal changes of a patient's core temperature have significant implications [1,2] and must be monitored closely.

Core temperature can be measured at different sites of the body such as bladder, nasopharnyx or tympanic membrane, however invasive monitoring is not always possible or wanted. A new temporal-artery (TA) thermometer may be a feasible alternative.

Materials and Methods: We studied 50 patients (25 OR patients, 25 ICU patients); for each patient 7 measurements were performed. The value of the TA-thermometer was recorded twice, averaged and compared with a Mallinckrodt Thermistor built-in bladder catheter for core temperature measurement. Ambient temperature and forehead-sweating were recorded.

Results and Discussions: The mean difference between TA-measurements and bladder temperature was **0.58 ± 0.46°C**.

Correlation coefficient for all measurements was **0.721 ($p < 0.01$)**.

326 measurements: Fever: $T_{core} > 37.8°C$;

Hypothermia: $T_{core} < 35.5°C$.

No influence of sweating was detected on the accuracy of the TA-thermometer.

	Fever	Hypothermia
Sensitivity-TA	0.74	0.2
Specifity-TA	0.98	0.94

Conclusion: The TA-thermometer is not yet able to replace invasive core temperature measurement methods due to the low sensitivity for both fever and hypothermia and due to the high mean difference (>0.5°C, above physiological variations [3]) between the TA and the bladder thermometer.

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Clinical and Experimental Circulation

A-153

Effects of pneumoperitoneum on cardiac autonomic nervous activity during laparoscopic surgery

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Background and Goal of Study: The effects of pneumoperitoneum on the activity of the cardiac autonomic nervous system have not been completely understood. Pneumoperitoneum has significant implications for cardiovascular and respiratory status.

Materials and Methods: We studied 16 adult women who underwent laparoscopic cholecistectomy. Patients were anesthetized with 6% deslflurane, 2.5 mg/kg propofol, 1 mg/kg fentanyl. Status of cardiac autonomic nervous system was evaluated by heart rate variability (HRV) three times: once when the patient was awake, once after induction of anesthesia and once after insufflation of pneumoperitoneum. Intrabdominal pressure was maintained automatically at 11 mmHg by a carbon dioxide (CO_2) insufflator. Patients were divided in two groups: hypertrophic (group A) and nonhypertrophic (group B). All patients underwent transthoracic echocardiography, ECG, ECG Holter 12 hours before surgery, during surgery until 3 hours after surgery; and non-invasive monitoring (blood pressure, heart rate, $EtCO_2$, stroke volume).

Results and Discussions: The groups were similar with respect to demographic data including age, gender and body weight. At baseline HRV was lower in group A than in group B. Mean arterial pressure and HRV decreased at the anesthetized stage and at max insufflations stage. A $P < 0.05$ was considered significant. No significative differences among two groups in $EtCO_2$, Blood pressure and Stroke volume.

	GROUP A		GROUP B	
	SDNN	SD	SDNN	SD
Awake	54.63	4.53	114	
11.05				
Pneumoperitoneum	25.00	7.8	41.75	7.6

Conclusion: Our dates confirm the reduction of HRV in hypertrophic group and indicates a dramatic decrease of HRV at max pneumoperitoneum stage in this subset of patients.

References:

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A-154

Hyperoxia during extreme methemoglobinemia

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Background and Goal of Study: Treatment of severe methemoglobinemia (MH) includes the avoidance of methemoglobin-inducing drugs, the application of methylene blue, and the administration of supplementary O_2 (1). However, the efficacy of the latter on O_2 transport, tissue oxygenation and survival in the treatment of methemoglobinemia is ambiguous (2). We therefore investigated whether hyperoxic ventilation as sole therapeutic intervention (i.e. ventilation with pure oxygen, FiO_2 1.0, HV) improves the short-term (6-hrs) survival rate during otherwise lethal methemoglobinemia.

Materials and Methods: In 14 anesthetized pigs mechanically ventilated with room air (FiO_2 0.21), the O_2 transport capacity was reduced by injection of 15 mg/kg 4-dimethylaminophenol (4-DMAP, Köhler Chemie, Germany) inducing the formation of 60 ± 2% methemoglobin. After subsequent randomization ventilation was either continued with room air (G 0.21, n = 7) or with pure O (G 1.0, n = 7). A constant level of MH was maintained by continuous infusion of 4-DMAP throughout a 6-hrs follow-up period.

Results and Discussions: Although all animals died within the 6-hrs follow-up period, the survival-time was found prolonged in G 1.0 (G 0.21: 105 ± 30 min; G 1.0: 210 ± 64 min, $p < 0.05$). No differences were encountered between G 0.21 and G 1.0 regarding the investigated parameters of macrohemodynamics, O_2 transport, and tissue oxygenation.

Conclusion(s): In contrast to acute normovolemic anemia HV has negligible effects on oxygen transport and tissue oxygenation during lethal methemoglobinemia (3); nevertheless survival was increased without severe adverse reactions provoked by HV.

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A-155

Heart rate variability may predict heart rate response to tracheal intubation

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Background and Goal of Study: Spectral analysis of heart rate variability (HRV) may predict hypotensive effects of spinal anaesthesia and of

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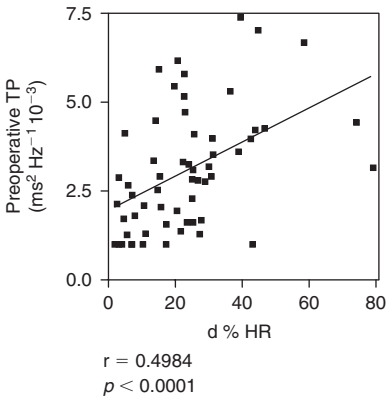
induction to general anaesthesia (1,2). The goal of this study was to investigate the relationship between preoperative values of HRV and hemodynamic responses to tracheal intubation.

Materials and Methods: Spectral analysis of HRV was assessed in 100 patients (TOM Signaltechnik, Hashiba & Niederl OEG, Graz, Austria) before induction of general anaesthesia (preoperative), after induction (pre-intubation) and after tracheal intubation (post-intubation). Fentanyl with propofol (Group I, n = 52) or with thiopental (Group II, n = 48), followed with rocuronium, were given for induction. Absolute values of total power (TP), low and high frequency powers (LF and HF, respectively), and LF/HF ratio were analyzed. The highest percentage changes between pre- and post-intubation heart rates (d% HR) and mean arterial pressures (d% MAP), recorded by pulse oximetry and noninvasive measurements respectively, were correlated with the preoperative HRV (r-Pearson).

Results and Discussions: Demographic, HRV and hemodynamic preoperative data showed no significant differences. The significant positive correlations between d% HR and preoperative TP ($r = 0.4984$; $p < 0.0001$), LF ($r = 0.4946$; $p < 0.0001$) and HF ($r = 0.3473$; $p < 0.001$) but not LF/HF ratio ($r = 0.0250$; $p = 0.851$) were observed in all patients. The similar correlations were observed in Group I and II. We did not observe correlations between preoperative HRV values and d% MAP, probably due to different recording techniques of HR and MAP.



Conclusion: Preoperative HRV may be predictable for the increased heart rate response to tracheal intubation.

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A-156

Central neuraxial blockade increased the severity of hypotension due to mesenteric traction during major abdominal surgery

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Background and Goal of Study: Central neuraxial blockade (CNB) decreases cardiac output and frequently causes hypotension in general surgery. In this randomized study, we investigated that combined spinal and epidural (CSE) technique would increase severity of hypotension, induced by mesenteric traction (MT).

Materials and Methods: Fifty-five patients (n = 28, 27 in each group) undergoing major abdominal surgery, were administered either spinal anesthesia with bupivacaine 15 mg, followed by mepivacaine 100 mg through thoracic epidural anesthesia or intravenous 10 $\mu g \cdot kg^{-1}$ of fentanyl. General anesthesia was maintained with sevoflurane and phenylephrine was continuously infused for maintaining arterial pressure. A baseline measurement of mean arterial pressure (MAP) was conducted before peritoneal incision, followed by measuring MAP at 10 min and 30 min after MT. All data were expressed as mean ± SD and ANOVA with repeated measures and post-hoc test were used to determine the effects of group, time, and group-time interaction. A P-value <0.05 was considered significant.

Results and Discussions: There were no significant differences in MAP between both groups (90 ± 12 mmHg in CSE group vs. 97 ± 15 mmHg in fentanyl group). MAP significantly decreased at 10 min after MT in both groups, especially in CSE group (65 ± 15 mmHg vs. 82 ± 16 mmHg; $P < 0.001$). We considered that lower cardiac contractility due to CNB aggravated post-MT hypotension and prophylaxis for this phenomenon by ibuprofen would be needed when CNB was conducted.

Conclusion(s): CNB increased severity of MT-induced hypotension.

A-157

Decrease of postoperative heart rate variability may be related to the extensiveness of major surgery

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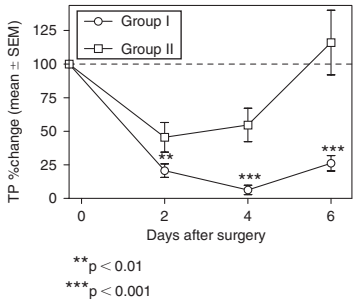
Background and Goal of Study: A persistent decrease of postoperative heart rate variability (HRV) has been reported to be independent of anaesthetic technique and was observed in patients without cardiovascular diseases after noncardiac surgery (1). The goal of this study was to investigate the relationship between postoperative values of HRV and the extensiveness of surgery.

Materials and Methods: Spectral analysis of HRV was assessed in esophagectomized patients undergoing thoracotomy with laparotomy (Group I, n = 14) and in patients undergoing only laparotomy for total ventricle resection (Group II, n = 15). Holter recordings were performed before (1 and 3 days) and after surgery (2, 4, 6 days). Values of total power (TP), very low, low and high frequency powers (VLF, LF and HF, respectively) and LF/HF ratios were analyzed and compared as a percentage change of mean preoperative values (unpaired Student's t-test).

Results and Discussions: Demographic and HRV preoperative data showed no significant differences. Significant differences between both groups in postoperative HRV indices: TP (Figure), VLF, LF and HF, but not LF/HF ratio, were observed. The lowest values of HRV were observed in Group I and remained decreased on 6th postoperative day, while in Group II HRV values returned back to the preoperative level. The significant linear regression between duration of surgery and TP values in all patients on 6th postoperative day ($r = -0.4098$; $p < 0.05$) was observed.



Conclusion: The postoperative decrease in all HRV bands may be related to the extensiveness and duration of surgery.

Reference:

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A-158

The effect of midazolam on erythrocyte deformability and plasma viscosity in rats

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Background and Goal of Study: Besides hemodynamic parameters erythrocyte deformability (ED) and plasma viscosity (PV) are the major determinants of tissue perfusion especially at the microcirculation level. Various anesthetic agents have been shown to alter these two parameters (1). Our aim was to investigate the effects of midazolam, a widely used anesthetic agent, on ED and PV in rats.

Materials and Methods: The study was performed on 20 male Wistar rats. These 20 rats were randomly divided into 3 groups according to study drug:

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(1) Control group (no injection) (2) Vehicle group (the dissolving chemicals of midazolam in its pharmaceutical formula) (3) Midazolam group (midazolam 50 mg/kg). Blood samples were collected 7 minutes after the intraperitoneal administration of these drugs. ED was measured with photoelectrical principle while filtering through the Whatman cyclopore.

PV was measured with a cone plate viscometer. One-way ANOVA was used for statistical analysis. Sample size of 4 per group was needed to obtain 20% difference from the control group with $\alpha = 0.008$ significance and 83% power and 98% power for ED and PV, respectively.

Results and Discussions:

	Control n = 8	Vehicle n = 5	Midazolam n = 7
Weight (Gr)	314 ± 42	273 ± 27	295 ± 21
Hematocrit	40 ± 2.2	40 ± 2.6	41 ± 3
Corpuscular Volume	52 ± 1.4	52 ± 1.6	53 ± 0.9
ED	1.26 ± 0.08	1.26 ± 0.2	1.28 ± 0.09
PV	1.53 ± 0.11	1.78 ± 0.5	1.45 ± 0.2

Data are given as mean ± SD ($P > 0.05$).

Conclusion(s): Midazolam did not effect the erythrocyte deformability and the plasma viscosity in rats. We conclude that midazolam can be used in patients at risk for tissue perfusion defects.

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A-159

Anesthetic management of renal cell carcinoma with supradiaphragmatic tumor thrombus extension, without the use of cardiopulmonary bypass

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Background and Goal of Study: Surgical resection is the only curative treatment for renal cell carcinoma (RCC) with tumor thrombus extending into the supradiaphragmatic inferior vena cava (IVC) and right atrium. These procedures impose a challenge to the anesthesiologist and have required the use of veno-venous or cardio-pulmonary bypass (CPB). Recent reports however show that using techniques from liver transplantation CPB can be avoided. (1) We describe the anesthetic management of this complex surgical procedure that includes the exposing of the intrapericardial IVC and right atrium without the use of CPB.

Materials and Methods: Between 1997 and 2004, 59 patients underwent surgical resection of RCC extending into the IVC by techniques developed in liver transplantation, with intention of avoiding sternotomy and CPB. All patients were managed through a transabdominal approach. Seven patients had tumors extending above the diaphragm while four of these presented intra-atrial extensions. General inhalational anesthesia was employed in all cases. Venous access consisted of 12F multilumen right internal jugular catheter connected to high-flow heated IV lines. Monitoring included standard ASA monitors, radial arterial line and CVP. A transesophageal echocardiogram probe (TEE) was placed and the extent and mobility of the tumor assessed. Continual imaging of the tumor guided surgical approach at all times. CPB was on stand-by for supradiaphragmatic tumors.

Results and Discussions: Surgery was succesfully completed in all patients without CPB. Patient mean age was 71 yrs (51–80), mean operative time was 7 h:47 min and mean blood loss 2.500 cc (500 cc–6000 cc). Two patients required vassopressor intervention during clamping of IVC. Adequate IV access, continuous TEE monitoring and correction of the hemodynamic and acid–base balance are essential.

Conclusions: RCC extending into the IVC to the intrapericardial level can be resected without use of CPB. Support and experience of liver transplant anesthesia team is essential for the succes of these complex surgical procedures. TEE is an irrepleaceble tool for assessing tumor morphology and cardiac function.

Reference:

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A-160

The effects of intrathecal magnesium in rats as an analgesic and the histopathologic changes in medulla spinalis

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Background and Goal of Study: During regional anaesthesia applications to potantialise the effects of anaesthetic drug and to minimize the side effects of local anaesthetic, different adjuvants are added to local anaesthetics. Magnesium (Mg) is a noncompetetive N-Metil-D-Aspartat (NMDA) antagonist and provides analgesia by preventing central sensitization developed by a nosiseptive stimulation (1). In our study we aimed to observe analgesic effect of intrathecal Mg and histopathologic changes in medulla spinalis.

Material and Method: After approval of the animal ethic committee 20 female rat between 240–260 gr weights selected randomly intrathecal catheter applied to the rats with anaesthesia and the day after they are separated into two groups. In the control group (Group K) (n = 10), for 4 days hot plate test performed for 2 hours period with 15 minutes intervals and the response time was recorded. In the magnesium group (Group M) (n = 10), for 4 days basal hot-plate test performed and then 0.02 mL (1.5% concentration) was given and for 2 hours period with 15 minutes intervals, hot plate test applied and response times were recorded. On the 5th day the medulla spinalis of sacrified rats examined pathologically. 2 samples are taken from formalined medulla spinalis of every rat and routine follow up procedures performed then 5 micro mL sections painted by hemotoxilen eosin. "Axonal vacuoler degeneration", "inflammation-necrozis", "red neuron" histopathologic parameters assessed by light microscope. The statistical analysis was made by independent sample t-test, paired sample t-test and chi-square test. $p < 0.05$ accepted as meaningfull.

Results: Times for basal hot-plate test in the first day was not meaningfull between groups ($p < 0.05$). On the other days all the measurement showed that hot-plate test times in Mg group was meaningfully long ($p < 0.05$). According to the histopatological examinations all the pathologic views between groups were not meaningfull ($p > 0.05$).

Conclusion: The use of Mg in rats by intrathecally provided analgesia without increasing histopathological damage.

Reference:

1 Anesth Analg 2002;95:661–666.

A-161

The effects of dexmedetomidine on plasma viscosity and erythrocyte deformability in vivo study in rats

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Background and Goal of Study: Dexmedetomidine is a highly selective alpha2 agonist used for premedication and sedation. Its effect on the different organs' blood flow is intensely studied (1). Besides vascular regulation, the other factors which affect the isolated organ and tissue perfusion are plasma viscosity and erythrocyte deformability. The goal of the study is to detect the effect of dexmedetomidine on the erythrocyte deformability and plasma viscosity.

Materials and Methods: 21 Wistar rats were randomly allocated into three groups. Control group did not receive any injection. Vehicle group received 1 ml distilled water intraperitoneally (i.p.). Dexmedetomidine group (Dex) received 100 μg/kg dexmedetomidine in 1 ml of distilled water i.p. 10 minutes after i.p. injections the intracardiac blood samples were collected. The plasma viscosities were measured with a cone plate viscometer between 11,25 and 450 sec^{-1} with 6 different velocities. The time courses to strain from a specified filter were digitalized with a photoelectrical method for detection of erythrocyte deformabilities. The statistical analysis of the results evaluated with Kruskal–Wallis and Mann Whitney U tests.

Results and Discussions: Data is given as mean ± SD in the Table below.

	Control	Vehicle	Dex	p
Hematocrite	40 ± 0.88	40 ± 0.65	39,5 ± 0.88	0.94
Plasma viscosity (mPasec)	1.55 ± 0.04	1.51 ± 0.07	1.19 ± 0.05	0.002
Erythrocyte deformability index	1.28 ± 0.02	1.28 ± 0.04	1.31 ± 0.02	0.680

Conclusion(s): We have concluded that dexmedetomidine does not affect erythrocyte deformability and its effect on plasma viscosity may be beneficial. These findings might have important clinical implications such as in ischemic heart and brain diseases, sedation of septic shock cases in intensive care unit.

Reference:

1 Lawrence CJ, Prinzen FW, de Lange S. Anesth Analg. Dec;83(6):1160–5, 1996.

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A-162

Are ultra-short-acting beta-blockers useful to prevent hemodynamic changes during endotracheal intubation?

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Background and Goal of Study: Endotracheal intubation often causes undesirable hemodynamic changes. In this study, we examined the usefulness of ultra-short-acting beta-blockers, esmolol and landiolol, in comparison of fentanyl.

Materials and Methods: After institutional approval and written consent, 40 patients classified ASA I–II, 30–70-year-old, were randomly assigned to receive esmolol 1 mg (group E), landiolol 1 mg/kg (group L), fentanyl 3 μg/kg (group F) or none (group C) during repeated vital capacity induction with 7% of sevoflurane in oxygen. Blood pressure (BP), heart rate (HR) were recorded during anesthetic induction. Stroke volume (SV) and cardiac output (CO) were also evaluated using BioZ™ Impedance Cardiography module (GE Healthcare IT Inc, USA). Serum noradrenaline concentration (NAD) was measured 1 min and 7 min after intubation.

Results and Discussions: There were no significant differences in patients' background between groups. Although BP decreased to about 70% of pre-induction value, no significant difference was observed between groups until endotracheal intubation. In all groups, BP was significantly increased after intubation, while BP increase was significantly less in group F ($P < 0.01$); increase of systolic BP to the pre-intubation value: 177 ± 33% in group C, 153 ± 15% in group E, 136 ± 15% in group L and 118 ± 13% in group F. There was no significant difference in CO between groups after intubation. However, increase of NAD after intubation was suppressed to 124% of pre-intubation value in group F, while NAD increased to more than 300% in other groups.

Conclusion(s): Fentanyl significantly suppressed hemodynamic change and noradrenaline secretion during endotracheal intubation, although both esmolol and landiolol showed only tendency to suppress hemodynamic change.

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Pivotal role for nitric oxide in isoflurane preconditioning-induced protection during cardiac ischemia/perfusion injury

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Background and Goal of Study: To establish the significance of isoflurane-induced early and delayed preconditioning (PC) on myocardial protection during ischemia and reperfusion (I/R) injury and to elucidate the role of nitric oxide (NO) signaling pathway in this process.

Materials and Methods: A 30-min left coronary artery occlusion followed by 2-h reperfusion was used to develop I/R injury in the anesthetized Sprague-Dawley rats. All rats undergo a pretreatment period consisting of either no intervention or preconditioning stimulus with two cycles of 3 min-ischemia followed by 10 min-reperfusion, 30 min of 1.4% isoflurane inhalation followed by a 10-min washout period, or received 60 min of 2.0% isoflurane inhalation 24 hours before I/R. A nonselective NOS inhibitor L-NAME or selective iNOS inhibitor SMT was administered before or 24 h after isoflurane, respectively. Myocardial infarct size was determined using triphenyltetrazolium staining.

Results and Discussions: Acute administration of isoflurane, similar to the protection of ischemic PC experiments, significantly decreased infarct size (acute ISO, 40 ± 3%; IPC, 38 ± 3%) as compared with control group (62 ± 4%). The infarct-sparing effect was also apparent in the delayed isoflurane PC (35 ± 3%). L-NAME had no effect on infarct size when administered alone (59 ± 7%) or during acute isoflurane PC (39 ± 5%), but abolished the delayed preconditioning effect of isoflurane (57 ± 4%). The protection afforded by delayed isoflurane PC was also abrogated when SMT was administrated 24 hours after isoflurane (60 ± 2%). During delayed PC, cardiac level of nitite and nitrate was significantly elevation at the end (24.6 ± 0.6 μM) and 24 h (29.1 ± 1.5 μM) after isoflurane administration than control (15.7 ± 0.7 μM).

Conclusion(s): Isoflurane preconditioning confers both acute and delayed cardiac protection during I/R injury that mimics the ischemic preconditioning phenomenon. The beneficial effect of isoflurane-induced delayed but not acute preconditioning depends on the release of NO in the heart. NO acts as a trigger initially and subsequently as a mediator (produced by iNOS) during isoflurane-induced delayed preconditioning.

A-165

Hyperglycaemia blocks anaesthetic-induced preconditioning by desflurane during the mediator phase

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Background and Goal of Study: The preconditioning effect of volatile anaesthetics is blocked by hyperglycaemia [1]. We investigated whether hyperglycaemia blocks anaesthetic preconditioning (APC) by desflurane during trigger (during administration of the anaesthetic) or during mediator phase (immediately before or during ischaemia).

Materials and Methods: Anaesthetised rats underwent 25 min of regional myocardial ischaemia followed by 2 h reperfusion to induce infarction. Control animals were not further treated (CON, n = 10). One group (APC, n = 11) was preconditioned by two 5-min periods of desflurane inhalation (1 MAC of the rat) each followed by 10-min washout. Four groups received an infusion of glucose 50% in order to achieve blood glucose concentrations between 400 and 600 mg dl^{-1}. In two of these groups, glucose infusion started 40 min before ischaemia and stopped with beginning of the ischaemia (trigger phase). However, blood glucose concentration stayed elevated during ischaemia. One of these groups was preconditioned (TPH, n = 12) the other was not (TPH-APC, n = 10). In two groups, glucose was administered during ischaemia starting immediately before coronary occlusion, again with (MPH-APC, n = 9) or without desflurane preconditioning (MPH, n = 8). We measured heart rate (HR), mean aortic pressure (AOP) and infarct size (IS). Statistics: One-Way-ANOVA with Bonferroni correction.

Results and Discussions: HR and AOP was similar in all groups during baseline (HF = 419 ± 89 bpm, mean ± SD, AOP = 131 ± 25 mmHg) ischaemia (HR = 318 ± 106 bpm, AOP = 109 ± 32 mmHg) and after 2 h reperfusion (HR = 309 ± 106 bpm, AOP = 88 ± 32 mmHg). IS in the control group was 51.7 ± 9.0% of the area at risk. APC by desflurane reduced IS to 28.8 ± 11.8% ($P < 0.01$ *vs.* CON). Hyperglycaemia did not affect IS (TPH, 51.5 ± 9.0%, P = ns *vs.* CON; MPH, 44.3 ± 16.9%, P = ns *vs*. CON), but glucose infusion during trigger as well as during mediator phase blocked desflurane induced preconditioning (TPH-APC, 49.1 ± 12.3%, $P < 0.01$ *vs*. APC, P = ns *vs*. CON; MPH-APC, 48.1 ± 17.6%, $P < 0.05$ *vs*. APC, P = ns *vs.* CON).

Conclusion(s): Hyperglycaemia blocks APC by desflurane during mediator phase. Whether trigger phase is also blocked cannot be answered with the present data.

Reference:

1 Anesthesiology 2002;96:183–188.

A-166

Evaluation of NT-proBNP in coronary artery bypass surgery: OFF-pump versus ON-pump

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Background and Goal of Study: The N-terminal pro Brain natriuretic peptide (NT-proBNP) is recently considered as effective marker of severity of acute coronary syndrome and heart failure. The aim of the study was to compare the kinetic and the ability of this marker to predict cardiac event, in patients undergoing coronary bypass graft on or off-pump.

Materials and Methods: Prospectively, during six months, 20 patients were included in each group (OFF/ON). Plasma NT-proBNP levels were measured before and 2, 12, 24 and 48 hours after the end of operation. Complicated postoperative course was defined as myocardial infarction, congestive heart failure, cardiogenic shock, arrhythmias, sudden death. We compared the variations over time of NT-proBNP levels with MANOVA for repeated measures. The maximal level or variation of preoperative level were compared between each group using Mann and Withney test. The link between NT-proBNP level and cardiac events was evaluated by a logistic regression model (with $p < 0.1$ in univariate analysis). The ROC curve were constructed to evaluate the complication risk.

Results and Discussions: Demographic and clinical characteristics of the patients are not different between groups OFF and ON. The NT-proBNP kinetic show an increase of plasma level without statistically difference in each group. 4/20 patients in group OFF and 3/20 in group ON present cardiac events. In univariate analysis, the NT-proBNP level was associated with cardiac events: in OFF before, 12, 24 and 48 hours after surgery; in ON 24 and 48 hours after surgery. The logistic regression showed no association with complications. The area under the ROC curves was always lower than 75%.

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Conclusion(s): According our results, the time course of NT-proBNP during the first 48 hours is not different in OFF or ON-pump coronary bypass. Moreover, NT-proBNP seems not to be predictive of cardiac complication after coronary bypass.

Acknowledgements: We thank Roche Diagnostics for the generously providing NT-proBNP assay.

A-167

Ischemic preconditioning attenuates myocardial stunning during minimally invasive direct coronary artery bypass grafting (MIDCAB)

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Background and Goal of Study: A brief, controlled period of ischemia is able to exert cardioprotective properties due to a phenomenon called preconditioning [1]. During the MIDCAB-procedure the left anterior descendent coronary artery (LAD) is clamped to enable anastomosis with the left internal mammary artery graft. Thus, depending on the degree of preexisting vessel occlusion, the myocardial tissue is rendered ischemic. A prior LAD clamping in terms of a ischemic preconditioning may be advantageous in preserving left ventricular (LV) function. The myocardial performance index (MPI) derived from echocardiography is a sensitive tool for the assessment of LV function [2].

Materials and Methods: After IRB approval and written informed consent, 39 ASA III patients were randomly assigned to a standard (S, n = 20) or a preconditioning (P, n = 19) group. In both groups, anaesthesia was performed as total intravenous anaesthesia with propofol and remifentanil. Patients were anaesthetised and operated on always by the same anaesthesiologist and surgeon. In the preconditioning group, LAD was clamped for 2 minutes followed by a 3-minute period of reperfusion prior to definite clamping. Following induction of anaesthesia (baseline) and after definite LAD clamping, the MPI was analysed off-line by a blinded in-vestigator. Additionally, troponin T and CK-MB values were followed up to 72 hours after end of surgery. MPI data and biochemical values at baseline, during LAD clamping and after reperfusion were compared with ANOVA for repeated measures followed by appropiate post testing.

Results and Discussion: Demographic data and duration of LAD clamping (S = 15.4 min. vs P = 14.2 min.) were comparable in both groups. While there were no differences in biochemical markers of myocardial cell damage, the MPI declined significantly ($p < 0.02$) in the standard group during LAD clamping and reperfusion, whereas there was no change in the preconditioning group.

Conclusion(s): During LAD clamping myocardial function was better preserved after ischemic preconditioning. In contrast to the reported cardioprotective action of volatile anaesthetics, there was no effect with respect to myocardial cell damage.

References:

1 Ann Thorac Surg. 2003; 75(2):709–714.
2 Echocardiography 2002; 19:273–278.

A-169

Prebypass preconditioning with sevoflurane has no effect on postoperative myocardial cell damage

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Background and Goal of Study: Volatile anaesthetics were shown to exert cardioprotective properties depending on a phenomenon termed preconditioning [1]. There is an ongoing debate about timing and dosage of volatile anaesthetics and if continued administration during cardiopulmonary bypass (CPB) is essential for the reported effects on myocardial cell damage [2].

Materials and Methods: After IRB approval and written informed consent, 19 ASA III patients were randomised to standard (S, n = 10) or preconditioning (P, n = 9) group. In both groups, anaesthesia was induced as total intravenous anaesthesia with propofol and remifentanil (TIVA). Subsequently, in the preconditioning group, sevoflurane was administered aiming at a BIS value of 40–60 and for 10 minutes prior to initiation of CPB at at least 1 MAC. Sevoflurane was stopped directly before CPB. In the TIVA group, propofol dosing was guided according to BIS. Pro-BNP, Troponin T and CK-MB values were followed for up to 72 hours after end of surgery. Laboratory values were compared with two way ANOVA for repeated measures followed by appropriate post testing.

Results and Discussions: Time on bypass, duration of aortic cross clamp, total time of surgery and demographic data were not statistically different. In addition there were no differences in laboratory markers of myocardial cell damage.

Conclusion(s): Anaesthetic preconditioning before cardiopulmonary bypass had no impact on postoperative myocardial cell damage. This emphasizes the significant influence of timing on the effect of anaesthesia related myocardial protection.

References:

1 Ann Thorac Surg. 2003; 75(2):S709–14.
2 Anesthesiology 2004; 101(2): 299–310.

A-170

Sevoflurane induced preconditioning in men: 1 MAC for 5 min does not influence the phosphorylation of tyrosine kinase Src at Tyr 416

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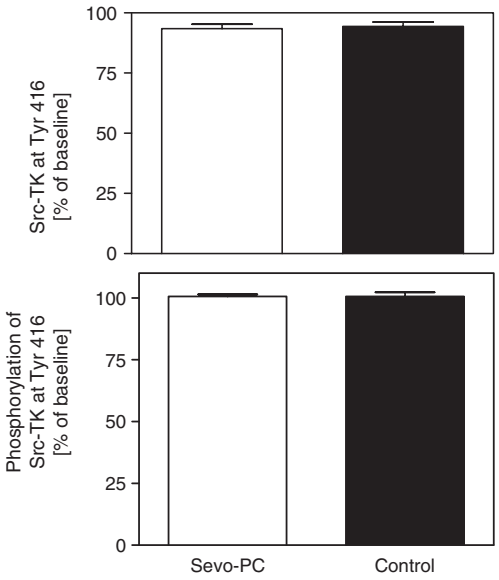
Background and Goal of Study: In ischaemic preconditioning, activation of tyrosine kinases (TK) is an essential step in signal transduction (1). In anaesthetic induced preconditioning, the evidence regarding the role of TK is conflicting (2,3). We therefore investigated if TK are activated in men in right atrial samples after sevoflurane (Sevo-PC: 5 min, 1 MAC) administration before coronary artery bypass grafting (CPBG).

Materials and Methods: After approval by the local ethics committee and written informed consent, 20 Patients undergoing elective CABG were enrolled in this study. Both groups received a total intravenous anesthesia (TCI Propofol/Sufentanil). Ten patients were not further treated and served as control. In 10 patients, Sevo-PC was induced. Before and 10 min after Sevo-PC, or at the corresponding time point in controls, samples of right atrial tissue were taken and processed for Western Blot analysis of phosphorylated Src-TK (Tyrosine 416). After measurement of the mean light intensity for each sample, and normalization to actin the ratio of phosphorylation after Sevo-PC or at the corresponding time point in controls to baseline sample was calculated. Data are mean ± SEM; Statistics: paired t-test for repeated measurements.

Results and Discussions: In both groups phosphorylation of Src-TK at Tyr 416 was not affected (see Figure).



Conclusion(s): Sevo-PC by 1 MAC for 5 min does not increase phosphorylation of Src-TK. This is in accordance with animal studies of desflurane induced PC (3). In patients, Sevo-PC by 10 min Sevoflurane with 2.5 MAC induces TK activity in samples taken after CPB (2). Therefore, the stimulus of 1 MAC for 5 min may be to weak to induce phosphorylation of Src-TK and Sevo-PC.

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3 Ebel D Anesthesiology 2004; 100:555–61.
Acknowledgements: This study was in part supported by Abbott Laboratories, Abbott Park; Illinois, USA.

A-171

Desflurane induces a first and second window of anesthetic preconditioning against myocardial infarction

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Background and Goal of Study: In ischemic preconditioning (IPC) one short ischemic stimulus induces early and late preconditioning[1,2]. These time windows are separated by an intervening time interval without cardioprotection[1]. We tested the hypothesis that a 30-min administration of desflurane induces both early and late preconditioning separated by a time interval of no cardioprotection.
Materials and Methods: All procedures conformed to the APS-guidelines and were approved by the institutional Animal Care & Use Committee. Anesthetized rabbits (n = 47) were instrumented for measurement of systemic hemodynamics and were subjected to 30-min coronary artery occlusion (CAO) followed by 180 min of reperfusion. Infarct size (IS) and area at risk (AAR) was assessed with TTC and patent blue, respectively. Seven randomized groups received 0.0 or 1.0 MAC desflurane (Des) for 30 min either 0.5 h, 12 h, 24 h, 48 h, 72 h or 96 h prior to CAO. Statistics: repeated measures ANOVA, post hoc Duncan test. Data are mean ± SEM.
Results and Discussions: Systemic hemodynamics during baseline and AAR were not significantly different among groups. IS was 63 ± 5% (IS/AAR) in controls (N = 7). Des significantly (*p < 0.05) reduced IS in Des + 0.5 h (35 ± 2*%, N = 7), Des + 24 h (31 ± 3%*, N = 7), Des + 48 h (30 ± 5%*, N = 6) and Des + 72 h (38 ± 2%*, N = 6), but not in Des + 12 h (71 ± 3%, N = 7) and Des + 96 h (66 ± 2%, N = 7). Des administration induces early preconditioning at 30 min that is absent at 12 h. The same short administration of Des induces late preconditioning at 24 h, 48 h and 72 h that disappears after 96 h.
Conclusion: APC follows the same characteristic time pattern as that of IPC. APC mimics IPC with regard to temporal relationships and duration.
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1 Kuzuya et al. Circ Res. 1993; 72(6):1293–9.
2 Baxter et al. BasicResCard. 1997; 92(3):159–67.
3 Kehl et al. Anesth 2002; 96:675–80.
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Acknowledgements: This study was supported in part by funds from the IZKF, Wuerzburg and Baxter, Germany.

A-172

Desflurane-induced postconditioning similarly cardioprotective as desflurane-induced preconditioning and mediated by nitric oxide

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Background and Goal of Study: Desflurane (DES)-induced preconditioning is mediated by NO[1]. DES confers cardioprotection during reperfusion[2] (postconditioning). Systematic studies comparing the effects of volatile anesthetics[3] administered during the three distinct periods within the ischemia/reperfusion paradigm are lacking. We tested the hypothesis that DES-induced cardioprotection depends on the timing of application and is mediated by NO.
Materials and Methods: All procedures conformed to the APS guidelines and the institutional Animal Care & Use Committee. Anesthetized rabbits (N = 54) were subjected to a 30-min coronary artery occlusion (CAO) followed by 180-min of reperfusion. Infarct size (IS) and area at risk (AAR) was assessed with TTC and patent blue, respectively. DES was administered at 1.0 MAC. Groups were: (1) Controls; (2) Pre, DES for 30 min, until CAO; (3) Isch, DES during CAO; (4) Rep, DES for 30 min after CAO; (5) Pre+Rep, DES for 30 min before and after CAO; (6) Pre+Isch+Rep, DES for 90 min; (7) LNA, the NO synthase (NOS) inhibitor N-Omega-nitro-L-arginine (L-NA) was given before Rep; (8) LNA + Rep, Rep in the presence of L-NA. Statistics: repeated measures ANOVA with post hoc Duncan test. Data are mean ± SEM.
Results and Discussions: Systemic hemodynamics during baseline and AAR were not significantly different among groups. IS was 67 ± 5% (IS/AAR) in controls (N = 7). DES significantly (*p < 0.05) reduced IS in Pre (43 ± 4%*, N = 7) and Rep (49 ± 5%*, N = 7), but not in Isch (64 ± 6%, N = 8). Pre+Isch+Rep and Pre+Rep produced similar reduction in IS to 47 ± 5%* (N = 7) and 45 ± 3%* (N = 6), respectively. L-NA had no effect on IS (64 ± 4%, N = 5) but blocked postconditioning (68 ± 4%, N = 7).
Conclusion: The results demonstrate, that DES-induced cardio-protection is phase-specific and suggest, that DES-induced postconditioning is mediated by NO.
References:
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2 Schlack et al. BrJAnaesth 1998;81(6):905–12.
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Acknowledgements: This study was supported in part by funds from the IZKF, Wuerzburg and Baxter, Germany.

A-173

Systolic pressure variation is a sensitive method to detect hemodynamic changes during pneumoperitoneum. An experimental study

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Background and Goal of Study: Systolic pressure variation (SPV) and its components have been shown to be valuable tools for hemodynamic analysis (1). Pneumoperirtoneum (PMOP), through CO_2 insufflation, is widely used for laparoscopic procedures, during hemorrhage or not. Eventually, significant hemodynamic changes could occur (2). The aim of this study was to investigate SPV in rabbits submitted to hemorrhage and PMOP.
Materials and Methods: Eleven female rabbits, weighing 2.5 to 3.0 Kg, under general anesthesia, were studied. SPV and its components, vital signs and ABG were measured at four moments: baseline (T1), after 10 mmHg PMOP (T2), after controlled hemorrhage of 20% of the estimated volemia under 10 mmHg PMOP (T3) and after retransfusion of this volume with no PMOP (T4). SPV was measured as the mean difference between the maximum and the minimum systolic blood pressure (SBP) over 5 consecutive breaths. Its components, Δ up and Δ down, were measured based on an apneic SBP (over 10 s).
Results:

	Baseline	PMOP	PMOP + hemo	Final
HR (bpm)	219 ± 29	236 ± 24	245 ± 30	225 ± 32
MAP (mmHg)	55 ± 15	69 ± 16	62 ± 17	64 ± 16
Lung Compl. (ml/cmH_2O)	2.5 ± 0.7	1.5 ± 0.3	1.5 ± 0.5	3.0 ± 0.8
SPV (mmHg)	***8.5 ± 1.6***	***13.3 ± 2.6***	***19.9 ± 3.7***	***9.0 ± 1.9***
Δ up (mmHg)	***2.0 ± 1.0***	***6.7 ± 2.1***	***5.9 ± 1.6***	***3.0 ± 1.4***
Δ down (mmHg)	***6.4 ± 1.6***	***6.6 ± 3.3***	***14.0 ± 4.9***	***5.9 ± 2.5***
pH (SD: ±0.04)	7.43	7.40	7.37	7.45
$PaCO_2$ (mmHg)	42 ± 2	47 ± 3	48 ± 3	39 ± 3
PaO_2 (mmHg)	401 ± 88	362 ± 97	367 ± 109	426 ± 92
Hematoctit (%)	25.6 ± 2.9	26.7 ± 2.5	23.1 ± 3.0	23.0 ± 3.0

Data (mean ± SD) are shown in the Table **(P < 0.05)**:

Conclusion: SPV and its components were shown to be sensitive tools for hemodynamic changes analysis in rabbits submitted to hemorrhage and pneumoperitoneum.
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1 Perel A. Anesthesiology 1987; 67:498–502.
2 Tournadre JP. Acta Anaesthesiol Scand 2000; 44:231–235.
Acknowledgements: FAPESP 03/12968-8.

A-174

Effects of acute isovolemic hemodilution under inhalation anesthesia on left ventricular function in cardiac surgery patients

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Background: Preservation of tissue oxygenation during acute isovolemic hemodilution (ANH) depends on an increase in cardiac output (CO) and an increase in blood oxygen extraction. However, the precise effects of ANH during inhalation anesthesia on left ventricular function have not yet been determined in cardiac patients.
Materials and Methods: 13 elective coronary surgery patients received a sevoflurane based anesthesia. After aortic cannulation, a pressure micromanometer was inserted in the left ventricle (LV). The measurements

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consisted of recordings of electrocardiographic and LV pressure tracings during an increase in systolic and diastolic pressures, obtained by leg elevation. Measurements were obtained before and after ANH. Arterial and mixed venous blood gases were taken before and after ANH. Data were compared using a paired t-test. All data (mean ± SD) were considered significant if $p < 0.01$.

Results: ANH resulted in a significant decrease in hematocrit (Hct) from 40 ± 4 to 29 ± 2%. After ANH, CO increased significantly from 5.3 ± 1.3 to 6.4 ± 1.2 l/min. This was associated with a significant decrease in systemic vascular resistance from 905 ± 182 to 757 ± 123 dynes/sec/cm^{-5}. With ANH, oxygen delivery significantly decreased from 953 ± 245 to 811 ± 153 ml/dl. Oxygen consumption was similar before and after ANH, hence oxygen extraction ratio increased significantly from 15 ± 2 to 19 ± 2%. Compared to before ANH, the increase in dP/dt_{max} with leg elevation was significantly lower after ANH (48 ± 32 before ANH versus 11 ± 22 mmHg after ANH). The rate of isovolumic relaxation (τ) significantly increased from 60 ± 5 to 64 ± 5 ms with ANH. The change in τ with leg elevation was also significantly different before and after ANH (−2 ± 2 versus 2 ± 3 ms).

Conclusion: Despite an increase in CO after ANH, myocardial function seemed to be depressed as evident from a slower myocardial relaxation and a decreased response in dP/dt_{max} with an increased cardiac load.

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Effects of acute isovolemic hemodilution under total intravenous anesthesia on left ventricular function in cardiac surgery patients

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Background: Preservation of tissue oxygenation during acute isovolemic hemodilution (ANH) depends on an increase in cardiac output (CO) and an increase in blood oxygen extraction. However, the precise effects of ANH during total intravenous anesthesia on left ventricular function have not yet been determined in cardiac patients.

Materials and Methods: 13 elective coronary surgery patients received a midazolam based anesthesia. After aortic cannulation a pressure micromanometer was inserted in the left ventricle (LV). The measurements consisted of recordings of electrocardiographic and LV pressures tracings during an increase in systolic and diastolic pressure, obtained by leg elevation. Measurements were obtained before and after ANH. Arterial and mixed venous blood gases were taken before and after ANH. Data were compared using a paired t-test. All data (mean ± SD) were considered significant if $p < 0.01$.

Results: ANH resulted in a significant decrease in hematocrit (Hct) from 40 ± 4 to 29 ± 4%. After ANH, CO increased significantly from 5.6 ± 1.1 to 6.7 ± 1.3 l/min. This was associated with a significant decrease in systemic vascular resistance from 908 ± 166 to 760 ± 160 dynes/sec/cm^{-5}. With ANH, oxygen delivery significantly decreased from 987 ± 191 to 830 ± 141 ml/dl. Oxygen consumption was similar before and after ANH, hence oxygen extraction ratio increased significantly from 16 ± 1 to 20 ± 1%. Compared to before ANH, the increase in dP/dt_{max} with leg elevation was significantly lower after ANH (60 ± 40 before ANH versus 23 ± 33 mmHg after ANH). The rate of isovolumic relaxation (τ) significantly increased from 60 ± 7 to 64 ± 6 ms with ANH. The change in τ with leg elevation was also significantly different before and after ANH (−1 ± 1 versus 2 ± 1 ms).

Conclusion: Despite an increase in CO after ANH, myocardial function seemed to be depressed as evident from a slower myocardial relaxation and a decreased respons in dP/dt_{max} with an increased cardiac load.

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Anesthesia for left ventricular assist device placement: preoperative risk factors for right ventricular failure after device insertion

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Background and Goal of Study: The major concern on weaning from cardiopulmonary bypass after left ventricular device (LVAD) placement is right ventricular (RV) failure. This complication has a poor prognosis and is generally unpredictable. Prediction of RV failure after LVAD insertion would lead to optimal patient selection and more ready anesthesiologic management.

Materials and Methods: From 1992 to 2003, 51 Novacor™ N100 LVADs were implanted in our Hospital. In order to determine preoperative risk factors for RV failure developing, we compared patient preoperative characteristics and hemodynamics in the group that developed RV failure in the first 24 h after LVAD insertion and in the group that did not develop RV failure. The RV failure group presents low LVAD pump flow index (<2.0 L/min/m^2) with inotropic support and tricuspid regurgitation at transesophageal echocardiography monitoring. These patients required vasopressors, nitric oxide inhalation, and/or right ventricular assist device.

Results and Discussions: There was no significant difference between the groups in demographic and hemodynamic characteristic. Mean and standard deviation (between round brackets) of the variables significantly different are summarized in the Table.

Variable	RV failure 15pts	No RV failure 36pts	p
BSA (m^2)	1.86 (0.14)	1.79 (0.13)	0.07
BUN (mg/dL)	92.2 (3.8)	65.7 (3.4)	0.02
Creatinin (mg/dL)	1.7 (0.5)	1.3 (0.4)	0.01
Bilirubin (mg/dL)	2.8 (0.9)	1.9 (0.7)	0.06
AST (U/L)	635 (13.4)	63 (10.1)	0.026
ALT (U/L)	590 (10.1)	120.6 (3.2)	0.028

BSA = body surface area; BUN = blood urea nitrogen; AST = aspartate aminotrasferase; ALT = alanine aminotrasferase.

Conclusion(s): Preoperative severe impairment of liver and renal functions and low body surface area were significant predictors for RV failure development after LVAD insertion. This information may lead to better patient selection for isolated LVAD implantation.

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A-177

Effect of nitrotyrosine on α-adrenergic receptor mediated vascular reactivity in rats

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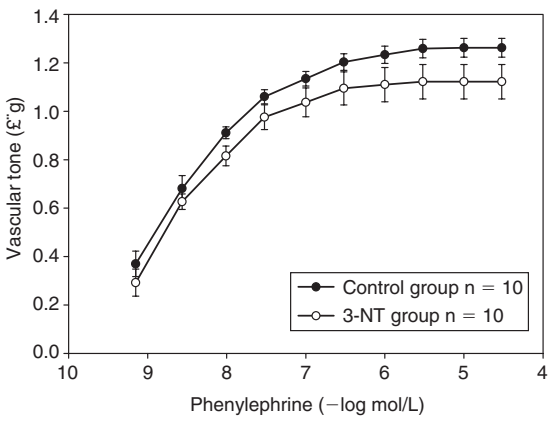
Backgound and Goals: To observe the effects of 3-nitro-L-tyrosine (3-NT) on adrenergic receptor mediated vascular reactivity in rats and investigate its possible mechanism.

Material and Methods: 24 male SD rats were randomly divided into 2 groups: the control group (intravenous administration of saline, n = 12), and the 3-NT group (intravenous administration of 3-NT 2.5 μmol kg^{-1}, n = 12). After 30 minutes and 90 minutes, apply Phenylephrine (0.5 ~ 2.5 μg · kg^{-1}) and vasopressin (1.3 ~ 5.2 μg · kg^{-1}) intravenously to both groups and record the percentage increased in MAP, respectively. The rings of aorta from another 6 male SD rats were incubated for 60 min in Krebs buffer, dose-response curve were obtained by cumulative addition of PE ($1 \times 10^{-9} - 3 \times 10^{-5}$ mol/L). After five washes, again divide the samples into the repeat control group (Krebs Ringer Solution) and the 3-NT group (250 μmol 3-NT). After 60 minutes of incubation, reapply PE to both groups and record the response of tissue. Data represent Mean ± SD. Significance was defined as $p < 0.05$.

Results: Compared with control group, application of 3-NT (2.5 μmol · kg^{-1}) significantly inhibited the MAP increase induced by phenylephrine with time-dependent way, but it did not affect the MAP level induced by vasopressin. In the vascular tension experiment, no significant differences were observed between the control group and 3-NT group in dose-response curve, E_{max} and EC_{50} values to PE.



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Conclusion(s): 3-NT selectively attenuated α-adrenoceptor-mediated the hemodynamic responses, but this property is not related to the competitive antagonise α_1-adrenoceptor.

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Non-invasive assessment of the impact of increasing concentrations of isoflurane on cardiac performance in mice

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Background and Goal of Study: Echocardiography allows for sensitive, non-invasive assessment of cardiac function in mice, but requires sedation and immobility, which influences cardiac performance. We studied the effects of increasing levels of isoflurane on cardiac performance.
Materials and Methods: 18 C57-Bl/6 mice were studied at 3 levels of isoflurane: 0.875%, 1.75% and 3.5%. Cardiac performance was measured at baseline condition (B), after dobutamine, 2 mg/kg ip (D) and after esmolol, 40 mg/kg ip (E) using a high-resolution ultrasound system. Stroke volume (SV, μL) was assessed by Doppler in the aortic outflow tract and fractional shortening (FS) by M-mode in the short axis view. Cardiac output (CO, mL/min) was calculated as SV*HR. Data are presented as mean $\pm$ SD; ANOVA was used for statistic analysis.
Results and Discussions: Isoflurane decreased cardiac function in a concentration-dependent fashion (see Table).

Condition	HR	FS	SV	CO
0.875% B	518 $\pm$ 17	42 $\pm$ 5	45 $\pm$ 8	24 $\pm$ 4
0.875% D	537 $\pm$ 9	58 $\pm$ 3*	46 $\pm$ 7	25 $\pm$ 4
0.875% E	356 $\pm$ 15*^	28 $\pm$ 3*^	41 $\pm$ 6	15 $\pm$ 2*^
1.75% B	427 $\pm$ 29#	30 $\pm$ 4#	55 $\pm$ 18	23 $\pm$ 7
1.75% D	501 $\pm$ 15*	53 $\pm$ 1*	62 $\pm$ 14	31 $\pm$ 7
1.75% E	356 $\pm$ 20*^	28 $\pm$ 3^	46 $\pm$ 10	16 $\pm$ 3^
3.5% B	457 $\pm$ 39	34 $\pm$ 5#	37 $\pm$ 3$	17 $\pm$ 3
3.5% D	439 $\pm$ 33#	45 $\pm$ 5*#$	36 $\pm$ 8$	16 $\pm$ 3#$
3.5% E	275 $\pm$ 67*^#$			

*P $<$ 0.05 vs Baseline; ^P $<$ 0.05 vs Dobutamine;
#P $<$ 0.05 vs Iso 0.875; $P $<$ 0.05 vs Iso 1.75.

Increasing isoflurane depressed cardiac performance at baseline, but responses to D were preserved at 1.75%. At 3.5%, responses to D were decreased, and E caused decompensation, suggesting exhaustion of sympathetic reserve.
Conclusions: Non-invasive ultrasound proved to be a sensitive tool to detect changes in cardiac performance. Isoflurane depresses cardiac function in a dose-related fashion in mice. Sympathetic responses compensate, but reserve is limited.

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Pulsed pressure variation and stroke volume variation: predictive parameters of response to a fluid challenge in coronary-artery surgery

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Background and Goal of Study: The pulsed pressure variation (PPV) and stroke volume variation (SVV) derived from the pulse contour analysis are proposed as predictive parameters of response to fluid challenge in a closed-chest situation (1,2). In this study, we investigated the applicability of these parameters in an open-chest situation in patients undergoing elective coronary-artery bypass grafting surgery (CABG).
Materials and Methods: After informed consent, 24 patients with ejection fraction $>$45%, sinus rhythm and without valvulopathy were monitored using a continuous pulse contour based cardiac output monitor (PiCCO, Pulsion, Germany). Anaesthesia was induced and maintained with propofol, sufentanil and cisatracurium. The patients were ventilated with a FiO_2 of 0.5 in air, a tidal volume of 6 ml/kg and a respiratory rate of 12/min. Two fluid challenges (5 ml/kg of saline) were performed: 10 min. after induction of anaesthesia (closed-chest) and 5 min. after sternotomy prior the opening of the pericardium. The PPV, SVV and cardiac index (CI) were noted at the beginning and 1 min. after the end of the fluid challenge. Correlation between PPV or SVV and ΔCI (CI post test minus CI pre-test) were assessed by Spearman rank correlation coefficient.
Results and Discussions: The mean age, weight and height were respectively 72 $\pm$ 8 years, 77 $\pm$ 12 kg and 175 $\pm$ 15 cm. The correlations between pre-test PPV or SVV and ΔCI were positive after fluid challenges. In an open-chest situation, the pre-test PPV-ΔCI correlation seems to be better than the pre-test SVV-ΔCI correlation.

	Closed-chest		Open-chest	
	$_{pretest}$ SVV	$_{pretest}$ PPV	$_{pretest}$ SVV	$_{pretest}$ PPV
Δ CI	0.365	0.353	0.388	0.502
	(p = 0.079)	(p = 0.090)	(p = 0.061)	(p = 0.012)

Conclusion: PPV and SVV seem useful parameters in predicting a cardiac index's gain following a fluid challenge in a closed-chest as well as in open-chest situations in CABG patients with a good left ventricular function.
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A-180

Relationship between preload dependency and tissue perfusion during aortic surgery

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Intoduction: Aortic surgery leads to volume status variation and hemodynamic impairment. In intubated and ventilated patients, respiratory pulse pressure variation (ΔPP) reflects ventricular preload dependency (1). ΔPP is a good predicting marker of increase in stroke volume index (SVI) after a fluid challenge (FC) (2). The aim of the study was to evaluate whether preload dependency assessed by ΔPP measurement was associated with impaired tissue perfusion.
Methods: After approval from the local Ethics Committee, 15 patients undergoing aortic surgery were prospectively enrolled. Intraoperative hypovolemia was suspected when heart rate increased and/or systolic blood pressure dropped more than 20% from baseline. A 250 mL colloidal FC was performed and repeated until delta PAPO was less than 2 mmHg. Automated gastric tonometry (Tonocap®, Datex-Ohmeda, Finland) was used to assess $PgCO_2$-$PetCO_2$ before and after FC (CO_2gap1, CO_2gap2). An increased CO_2gap larger than 20 mmHg was taken as a threshold value of decreased tissue perfusion. A test of Pearson for correlation analysis, and a test of Wilcoxon for comparison between CO_2gap1 and CO_2gap2 measurements were performed.
Results: 85 FC were studied. There was a significant correlation between ΔPP and SVI variation: 0.748 (p $<$ 0.0001). There was no correlation between ΔPP and CO_2gap1 (rho = $-$0.08; p = 0.643) and no significant difference CO_2gap1 and CO_2gap2: 14 mmHg [9.5–19] vs 13.5 [10–20], (p = 0.624).
Conclusion: In patients undergoing aortic surgery, preload dependency may not be equivalent to decreased tissue perfusion.
References:
1 Lebuffe G *et al.* Intensive Care Med 2003; 29 (Suppl. 1): G681.
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A-181

Nitric oxide but not EDHF is important for hypercapnia induced coronary vasodilation in mice

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Background and Goal of Study: Endothelial mediators have been suggested to contribute to coronary vasodilation. In the present study the potential importance of NO and EDHF during hypercapnic acidosis was addressed.
Materials and Methods: Isolated mouse hearts were perfused (90 mmHg) with modified Krebs–Henseleit buffer. Hypercapnic acidosis was induced by switching from control perfusate (pCO_2 = 37 mmHg, pH = 7.34) to hypercapnic buffer (pCO_2 = 61 mmHg, pH = 7.15).
Results and Discussions: 5 min perfusion with hypercapnic buffer enhanced coronary flow by 42%, reduced left ventricular pressure development (LVD)

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by 13% and reduced myocardial oxygen consumption by 20%. Infusion of L-NMMA (100 μmol/l) to block NO-synthesis reduced coronary flow by 15%. In the presence of L-NMMA hypercapnic perfusion was associated with a reduced flow increase (22%). Additional infusion of TEA (1 mmol/l) to block Ca^{2+}-dependent K^+-channels was associated with a slight increase of coronary flow and LVD. However, the hypercapnia-related flow increase was not further reduced. In contrast, acetylcholine (0.5 μM) induced flow increase was decreased in the presence of L-NMMA and in the additional presence of TEA.

Conclusions: NO is important for the mediation of hypercapnic coronary dilation in mouse heart. While K^+_{Ca}-channels are involved in the mediation of cholinergic coronary dilation, they are unimportant for hypercapnic vasodilation.

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Pulmonary artery perfusion during cardiopulmonary bypass improves postoperative gas exchange in a swine model

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Background and Goal of Study: Respiratory dysfunction occurs in virtually all patients undergoing cardiopulmonary bypass (CPB) (1) and it has been recognized that CPB is cause of pulmonary ischemic-reperfusion injury (2). We hypothesized that hypothermic perfusion of the pulmonary artery by oxygenated blood during CPB would have a protective effect and can attenuate the deterioration of lung function after CPB.

Materials and Methods: After governmental approval 17 pigs underwent CPB for 60 min. The animals were assigned prospectively and randomizedly to the control group (n = 6) or the pulmoperfusion group (PP, n = 11). In the PP the lungs were perfused by hypothermic oxygenated blood during the clamping time of 45 min. Before and 5, 60, 120 and 180 min post CPB the alveoloarterial O_2-gradient ($AaDO_2$), the pulmonary capillary wedge pressure (PCWP) and the content of neutrophiles in the right atrium (PMN) were evaluated and compared to baseline (Wilcoxon-test). Group differences were estimated by Mann-Whitney-U-test, level of significance was $p < 0.05$.

Results and Discussions: Compared to baseline $AaDO_2$ increased in either group after discontinuation of CPB with significantly higher values after 120 and 180 min in control. PMN dropped significantly only in PP immediately after CPB. PCWP remained nearly unchanged after CPB independently of the group.

Conclusion(s): Pulmonary function after CPB can be ameliorated by hypothermic pulmonary artery perfusion with oxygenated blood. The decrease in PMN might indicate an attentuation of the inflammatory response.

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A-183

Effect of nutritional status on oxidative stress in an *ex vivo* perfused rat liver

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Background: Ischaemia-reperfusion (IR) is a determinant in liver injury occurring during surgical procedures, ischaemic state and multiple organ failure. The preexisting nutritional status of the liver might contribute to the extend of tissue alteration and primary non-function.[1,2] The aim of this study was to determine the role of starvation on hepatic IR injury in normal rat livers.

Methods: Rats were divided into two groups (n = 5): one had free access to food, the latter was fasted for 18 hours. The portal vein was cannulated, the liver removed and perfused in a closed *ex vivo* system. The experiment consisted of perfusion for 15 min, warm ischemia for 60 min, and reperfusion during 60 min. Glucose, lactate, free radicals, i.e. dienes and trienes, and cytochrome *c* were analysed in perfusate samples from 0 to 135 min. The proportion of glycogen in hepatocytes was determined in tissue biopsies. GLMM test and Student's *t* with Bonferroni correction.

Results and Discussion:

Table 1. Biological variables at 135 min.

Variable	Fed	Fasting	P-value
AST (IU/l)	120 ± 25	826 ± 479	<0.001
ALT (IU/l)	74 ± 27	787 ± 621	<0.001
LDH (IU/l)	1,153 ± 325	9,745 ± 3,716	<0.001
Glucose (mg/dl)	253 ± 40	84 ± 38	<0.001
Lactate (mg/dl)	60.0 ± 8.5	3.9 ± 3.6	<0.001
Cyt *c* (ng/ml)	7.2 ± 0.7	50.8 ± 32.7	0.030
Dienes (%OI)	0.34 ± 0.05	0.42 ± 0.03	<0.001
Trienes (%OI)	0.16 ± 0.02	0.21 ± 0.02	<0.001
Glycogen (%)	40.5 ± 33.7	6.0 ± 2.6	<0.001

Livers of fasting rats are more sensitive to warm IR injury than livers from fed animals. Reduced glycogen stores in hepatocytes is related to the reduced tolerance.[3] Mitochondrial damage, demonstrated by the release of cytochrome *c*, may contribute to amplify the deleterious effect of glycogen depletion.

Conclusion: In clinical conditions where livers are exposed to a temporary oxidative stress, nutritional support may be part of a treatment strategy.

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A-184

Lipids minimise oxidative stress in an *ex vivo* perfused rat liver

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Background: Alterations in nutritional status are common in clinical setting. Glycogen store in hepatocytes seems to protect against ischaemia-reperfusion (IR) injury.[1] Fat has an energy value twice that of carbohydrates and is an excellent fuels. This study investigated whether Intralipid® (IL) could protect the liver after IR in food deprived rats.

Materials and Methods: Female Wistar rats (150–200 g) fasted for ±18 hours were anaesthetised, the portal vein cannulated, the liver removed and immediately perfused (5 ml/min, 37°C, closed *ex vivo* system with HBSS+ insulin and O_2). The 3 experimental phases: perfusion for 15 min, ischaemia for 60 min, and reperfusion during 60 min. Animals were divided into 3 groups (n = 5): control group, IL 10 μg/ml and IL 100 μg/ml. Lactate, enzymes, K^+, free radicals (dienes and trienes) and cytochrome *c* were analysed in perfusate at different time-points from 0 to 135 min. The proportion of glycogen in hepatocytes was determined in biopsies. Mean ± SD. GLMM statistics and Student *t* with Bonferroni corrections.

Results and Discussion: Results are presented in Table 1. No difference was observed in lactate level. The glycogen content was low in all livers and decreased at 135 min in the control group only (P = 0.05).

Table 1. Biological variables at 135 min in the perfusate.

Variable	Control	IL 10 μg/mL	IL 100 μg/mL
AST (IU/L)	826 ± 479	356 ± 152	172 ± 36[a]
ALT (IU/L)	787 ± 612	312 ± 153	63 ± 18[a]
LDH (U./L)	9,745 ± 3,716	6,103 ± 3,048	1,875 ± 566[a]
K^+ (mEq/L)	9.3 ± 0.8	8.6 ± 0.2	7.7 ± 0.3[b]
Cyt *c* (ng/mL)	50.8 ± 32.7	11.9 ± 4.9[b]	9.2 ± 1.7[b]
Dienes (% OI)	0.40 ± 0.03	0.35 ± 0.04[b]	0.29 ± 0.04[b]
Trienes (% OI)	0.20 ± 0.02	0.19 ± 0.04	0.15 ± 0.01[b]

$P < 0.05$ when compared with [a]control and [b]IL 10 μg/mL.

IL presents a protective effect on IR injury demonstrated by the reduction of enzymes, K^+, free radicals, and cytochrome *c* release in the perfusate.

Conclusion: In a clinical setting, the infusion of IL may be indicated to compensate fasting in surgical patients and thus might improve outcome after liver surgery and transplantation.

Reference:

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A-185

Protective effect of alanine on *ex vivo* perfused rat liver during ischaemia-reperfusion

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Background: Glycogen seems to protect hepatocytes against ischaemia-reperfusion (IR) injury whereas fasting increases lipid peroxidation.[1] Alanine (Ala) has shown to improve survival of liver cells exposed to oxidant stress.[2] This study investigated whether Ala could protect the liver after IR injury in food deprived rats.

Materials and Methods: Wistar rats (150–200 g) fasted for ±18 hours were anaesthetised, the portal vein cannulated, the liver removed and immediately perfused (5 ml/min, 37°C, closed *ex vivo* system with HBSS + insulin and O_2). The 3 experimental phases: perfusion for 15 min, warm ischaemia for 60 min, and reperfusion during 60 min. Animals were divided into 5 subgroups (n = 5): control (glucose 1 g/l), and Ala groups at 1, 5, 10 and 25 g/l, without glucose. Glucose, lactate, enzymes, dienes and trienes and cytochrome *c* were analysed in perfusate from 0 to 135 min. The proportion of glycogen in hepatocytes was determined in biopsies. Mean ± SD. GLMM statistic and Student *t* with Bonferroni corrections.

Results and Discussion:

Table 1. Numbers at final time-point, i.e. 135 min.

Variable	Control	Ala 1 g/l	Ala 5 g/l	Ala 10 g/l	Ala 25 g/l
Gluc(mg/dl)	111 ± 3	19 ± 19[a]	6 ± 2[a]	16 ± 17[a]	8 ± 1[a]
Lact (mg/dl)	3.9 ± 3.6	5.0 ± 7.6	4.2 ± 1.0	8.0 ± 6.0	0.2 ± 0.1[a]
AST (IU/l)	716 ± 104	600 ± 284	53 ± 272	150 ± 28[a,b]	150 ± 80[a,b]
ALT (IU/l)	570 ± 69	302 ± 147[a]	373 ± 178	80 ± 34[a,c]	139 ± 64[a,c]
LDH (IU/l)	12273 ± 1432	11203 ± 9580	6943 ± 3033	1751 ± 56[a]	1659 ± 690[a]
Dienes (% OI)	43 ± 3	33 ± 6[a]	31 ± 4[a]	24 ± 4[a]	20 ± 3[a,b,c]
Trienes (% OI)	0.20 ± 0.02	0.18 ± 0.01	0.16 ± 0.02[a]	0.14 ± 0.02[a,b]	0.11 ± 0.01[a,b,c]
Cyt *c* (ng/ml)	50.8 ± 32.7[a]	9.3 ± 0.7[a]	7.1 ± 0.9[a]	7.8 ± 0.4[a]	5.3 ± 0.5[a]
Glycogene (%)	6.0 ± 2.6	10.9 ± 8.9	14.5 ± 6.4	7.8 ± 4.0	10.4 ± 1.4

$P < 0.05$ [a]control *vs* others; [b]Ala 1 g/l *vs* others; [c]Ala 5 g/l *vs* others.

Ala above 10 g/l might reduce the oxidative injury in hepatocytes by promoting ATP production.[3]

Conclusion: In a clinical setting, the infusion of Ala may be indicated to compensate fasting in patients after liver surgery and transplantation.

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A-186

Effect of general anesthesia on apoptosis, proliferation and responsiveness to angiotensin II of renal mesangial cells from rats with experimental renal failure

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Background and Goal of Study: Transient decline of blood pressure and GFR, following induction of general anesthesia, affects autoregulatory functions of renal glomerular mesangium. Patients with chronic renal failure are predisposed to perioperative renal complications and higher rates of postoperative morbidity and mortality. We studied Angiotensin AII (AII) stimulated proliferation and apoptosis in cultured mesangial cells from kidneys of experimentally uremic rats after induction of anesthesia.

Materials and Methods: Renal failure was induced in 12 Sprague–Dawley rats by administration of 15% LiCl in their drinking water. Anesthesia was induced in 12 uremic vs 12 healthy rats by 2 mg/kg b.w. propofol or 4 mg/kg b.w. thriopental. GFR was assessed by 0.1 μCi/ml technetium DTPA injection. Blood pressure was measured by Gould PE50 transducer. Renal mesangial cells were isolated and cultured in a specific selective medium. Apoptosis was assessed by TUNEL method, and proliferation by ^3H thymidine incorporation. The results were evaluated by Kruskal-Wallis test (ANOVA).

Results: Blood pressure declined 10 min following induction of anesthesia (131 ± 3 mmHg to 83 ± 5 mmHg, p = 0.001, 95% confidence interval). GFR of healthy controls dropped from 5.1 ± 0.5 ml/min to 1.9 ± 0.6 ml/min within 10 min and returned to normal 1 h′ later. The uremic group started with GFR 2.4 ± 0.5 ml/min (50% of normal rate). Within 10 min it dropped to 1.12 ± 0.6 ml/min and remained low (1.5 ± 0.6 ml/min) 1 h later. Proliferative responsiveness to AII declined in both groups, being significantly lower in uremic group ($p < 0.01$ in each comparison). Apoptosis was significantly higher in uremic group (21 ± 5% vs healthy 14.5 ± 3%, $p < 0.001$).

Conclusions: 1. In healthy controls, a transient drop of blood pressure and GFR following anesthesia coincided with a loss of proliferative responsiveness to AII and augmented apoptotic death of cultured renal mesangium. 2. Mesangial cells from experimentally uremic animals demonstrated sustained decline of GFR, and higher apoptotic death, inhibition of proliferation and irresponsiveness to AII stimulation. These observations may be indicative of a cellular mechanism(s) predisposing the diseased kidney to higher rates of renal complications following general anesthesia.

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Ischaemic preconditioning on oxidative stress in an *ex vivo* perfused rat liver

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Background: Ischaemia-reperfusion is a major cause of morbidity and mortality in liver surgery and transplantation. Brief episodes of ischaemia followed by a period of reperfusion called ischaemic preconditioning (IPC) have been shown to protect organs against subsequent sustained ischaemia. (1) The goal of this experiment was to investigate the biological effect of 2 or 10 minutes IPC in an *ex vivo* perfused rat liver after oxidative stress.

Materials and Methods: Female Wistar rats (150–200 g) fasted for ±18 hours were anaesthetised, the portal vein cannulated, the liver removed and immediately perfused (5 ml/min, 37°C, closed *ex vivo* system with HBSS + insulin and O_2). The experiment consisted of different phases: in the group control, perfusion 15 min, warm ischaemia for 60 min, and reperfusion during 60 min; in the IPC groups 2 or 10 min ischaemia during the first 15 min, followed by warm ischaemia and reperfusion as in the control group. Glucose, lactate, enzymes, free radicals (dienes and trienes) and cytochrome *c* were analysed in perfusate at different time-points from 0 to 135 min. The proportion of glycogen in hepatocytes was determined in biopsies. Mean ± SD. GLMM statistics and Student *t* test.

Results and Discussion: 10′ IPC decreases transaminases release (Table 1). Cytochrome *c* was lower in the IPC groups.

Table 1. Biological variables at 135 min in the perfusate.

Variables	Control (n = 5)	IPC 2′ (n = 5)	IPC 10′ (n = 6)
Gluc (mg/dl)	111 ± 3	42 ± 31*	98 ± 29
Lact (mg/dl)	3.9 ± 3.6	3.5 ± 1.8	3 ± 3*
AST (IU/ml)	716 ± 104	760 ± 143	580 ± 356
ALT (IU/ml)	570 ± 69	656 ± 98	377 ± 166*
LDH (IU/ml)	12,273 ± 1,432	12,038 ± 3,352	9,517 ± 7,793
Dienes (% O.I.)	43 ± 3	44 ± 5	39 ± 5
Trienes (% O.I.)	0.20 ± 0.02	0.22 ± 0.03	0.18 ± 0.02
Cyt *c* (ng/ml)	50.78 ± 32.69	6 ± 0.7*	6.8 ± 0.4*
Glycogen (%)	5.9 ± 2.6	8.7 ± 4.8	3.2 ± 1.7

*$P < 0.05$ vs control.

Conclusion: Further studies are required to clarify whether IPC is a promising strategy in assisting preservation of the liver in clinical situations of anticipated hepatic ischaemia such as transplantation and hepatic surgery.

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A-188

Heme oxygenase-1 induction improves pancreatic microcirculation after ischemia/reperfusion in rats

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Background and Goal of Study: Microcirculatory derangements caused by ischemia/reperfusion (IR) play a pivotal role in acute and graft pancreatitis (1,2). The inducible isoform of heme oxygenase (HO-1) has been shown

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to decrease IR injury influencing capillary perfusion in other organs (3). It was the goal of this study to evaluate the effect of HO-1 on the pancreatic microcirculation after IR.

Material and Methods: After institutional approval, rats (200–300 g) were randomly assigned to four groups: (1) sham controls; (2) IR + vehicle; (3) IR + cobalt protoporphyrin IX (CoPP, 5 mg/kg; HO-1 inducer); (4) IR + CoPP + tin protoporphyrine IX (SnPP, 50 μmol/kg; HO-inhibitor). Ischemia was induced by clipping the pancreas supplying arteries for 1 h. Functional capillary density (FCD) was measured by intravital epifluorescence microscopy after 2 hrs of reperfusion. Expression of HO-1 mRNA, HO-1 protein and HO enzymatic activity were assessed by northern blot, western blot and activity assay. Statistical analysis was performed with ANOVA followed by Student–Newman–Keuls tests. Data are expressed as mean ± SD. Differences were considered significant when $p < 0.05$.

Results: CoPP treatment induced pancreatic HO-1 mRNA and protein levels and increased HO enzyme activity, while SnPP decreased HO activity to baseline levels. Comparison of FCD showed a significant decrease in IR treated animals (134 + 25 cm/cm^2) as compared to control (267 + 25 cm/cm^2). Preinduction of HO-1 with CoPP increased FCD after IR to control values (257 ± 25 cm/cm^2). HO activity inhibition of CoPP treated animals decreased FCD significantly (217 ± 26 cm/cm^2) as compared to sham controls and CoPP treated animals.

Conclusion: Preinduction of HO-1 improves pancreatic microcirculation after normothermic IR. Given this improvement, we hypothesize that HO-1 could be of clinical relevance in postischemic pancreatitis by decreasing acute IR during the early onset of reperfusion.

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A-189

Progesterone treated mice show decreased endothelial progenitor cell counts and impaired neovascularization in a model for hind limb ischemia

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Background and Goal of the Study: Progesterone (PG), in combination with Estrogen (E_2), is currently used for hormone replacement therapy (HRT). A recent study in over 16,000 postmenopausal women provides evidence for an increase in cardiovascular events as well as strokes for women on long term HRT (1). Contrary to E_2 little is known about the role of PG in the setting of ischemic diseases. Therefore, we investigated the effect of PG treatment in a mouse model for hind limb ischemia (HLI).

Material and Methods: PG pellets (releasing approx. 1.7 mg PG per day) or placebo pellets were implanted subcutaneously in 8 week old ovariectomized female FVB mice. HLI was induced by ligation of the left femoral artery at day 7 of treatment. A cell culture assay for quantification of endothelial progenitor cells (EPC) in the peripheral blood was carried out 7, 14, and 28 days after the onset of HLI. A double staining, using fluorescent DilAcLDL and BS1-lectin, was used to identify EPCs. Gastrocnemius muscles from both legs were weighed. Muscle weight ratio (ischemic/control leg) was calculated to quantify atrophy. Ischemic muscle was stained for IL-B4 and capillaries were counted in 10 high power fields (200× magnific.). Results are presented as mean ± SEM.

Results and Discussion: EPC counts in PG treated mice are decreased at day 14 ($1.4 \times 10^4 \pm 2.3 \times 10^3$ vs. $2.3 \times 10^4 \pm 1.5 \times 10^3$ EPC/ml blood, $n = 4$, $p < 0.03$) and day 28 ($2.2 \times 10^4 \pm 2.0 \times 10^3$ vs. $6.7 \times 10^4 \pm 1.4 \times 10^4$, $n = 4/5$, $p < 0.03$). Significantly fewer capillaries are found in the treatment group two weeks after HLI (1.0 ± 0.04 vs. 1.2 ± 0.05 capillaries/muscle fiber, $n = 5$, $p < 0.02$). Capillary density increases in both groups within the next two weeks, but the increase is more pronounced in placebo treated mice (1.17 ± 0.07 vs. 1.51 ± 0.07 capillaries/muscle fiber, $n = 5$, $p < 0.02$). Mice in the PG group display more severe muscle atrophy at day 7 when compared to their placebo littermates (0.55 ± 0.05 vs. 0.69 ± 0.06 g, muscle weight ratio: ischemic/control leg, $n = 5$, $p < 0.03$).

Conclusion: PG lowers EPC counts, leads to impaired neovascularization and goes along with more pronounced muscle atrophy. This antiangiogenic effect might account for an unfavorable role of PG in ischemic diseases.

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A-190

Hepatic organ protection by isoflurane is mediated by heme oxygenase-1 induction

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Background and Goal of Study: The heme oxygenase (HO) enzyme is responsible for the maintenance of liver perfusion and hepatocellular integrity especially under pathological conditions (1). We have previously shown that isoflurane (ISO) leads to an expression of the inducible isoform of HO (HO-1) in the liver and thus improves hepatic blood flow (2,3). It was the objective of this study to characterize the influence of ISO induced HO-1 expression on hepatocellular integrity after partial ischemia/reperfusion (IR) in the rat.

Material and Methods: After institutional approval rats were randomised into four groups: (1) pentobarbital (PEN, 40 mg/kg/h i.v.) + vehicle; (2) ISO (2.4 MAC) + vehicle; (3) PEN + SnPP IX (HO-Inhibitor, 50 μmol/kg, i.v.); (4) ISO + SnPP IX. A tracheotomy was performed and animals were mechanically ventilated. After injection of SnPP IX or vehicle, six hours after onset, partial hepatic ischemia was induced for 1 h, followed by 1 h of reperfusion. At the end of each experiment, blood and liver tissue were obtained for molecular biological, histological and immunohistochemical analyses. Statistical analysis was performed with ANOVA and Student–Newman–Keuls tests. Differences xwere considered significant when $p < 0.05$.

Results: Partial hepatic IR increased ALT, AST and α-GST plasma activity compared to sham operated animals ($p < 0.05$). ISO pretreatment increased hepatic HO activity and decreased transaminases and α-GST after IR ($p < 0.05$). Application of SnPP IX inhibited HO activity and increased markers of hepatocellular injury to control levels of PEN anesthetized animals. Histological analysis of livers obtained from ISO pretreated rats showed a reduction of necrotic areas particularly in the perivenular region, the predominant site of ISO induced HO-1 expression. HO-blockade abolished the ISO induced protective effects.

Conclusion: ISO pretreatment reduces hepatic IR injury by increasing HO activity in the rat liver. This may offer a new potential for hepatic organ protection.

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A-191

Selective cerebral low-flow perfusion versus deep hypothermic circulatory arrest: effects on evoked potentials in piglets

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Background and Goal of Study: Cardiac surgery is often done in deep hypothermic circulatory arrest. Selective cerebral low-flow perfusion could help to reduce neurological complications (1). Somatosensory evoked potentials (SEP) can monitor neurologic integrity and give us prognostic insights (2). In this study the effect of low flow perfusion on SEP after reperfusion was examined.

Materials and Methods: On approval of local authorities, general anaesthesia, extracorporeal circulation (ECC) and deep hypothermia were established in piglets. 15 subjects were assigned to either "NoFlo" (60 min circulatory arrest, $n = 8$) or "LoFlo" protocol (60 min perfusion of the tr. brachiocephalicus with 10% of the baseline cardiac output, $n = 7$). After reperfusion and rewarming the ECC was stopped at a core temperature of 36°C.

After induction of general anaesthesia SEP were generated and recorded by stimulation of the N. medianus until 120 minutes after cessation of ECC (Nicolett Viking IV). The recordings were evaluated visually. The frequency of return of cortical SEP was the primary endpoint. For statistical evaluation Fisher's exact test was used.

Results and Discussions: In all animals cortical potentials disappeared during cooling by ECC (a cortical potential could be no longer percepted visually). In all LoFlo subjects there has been no return of cortical SEP activity. In contrast to that, cortical SEP returned in 5 of 7 LoFlo animals. This difference is significant ($p = 0.034$).

Conclusion(s): As far as detectable by SEP, the return of neural functionability already within 120 minutes of reperfusion indicates that using low flow perfusion provides a quicker neurologic recovery in cardiac surgery.

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A-192

Optimizing cardiac output by fluid loading: effects on liver function and splanchnic microcirculation

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Introduction: Hypovolemia may be associated with hepato-splanchnic hypoperfusion which is of major prognostic relevance (1). In general, optimizing cardiac preload to increase cardiac output is a primary clinical goal. We tested whether increasing cardiac output by optimizing intravascular fluid status leads to an improved regional, i.e. hepato-splanchnic, blood flow and function.
Methods: After approval by our Ethics Committee we post-operatively studied 12 patients (mean age 66 ± 13 years) with elective coronary artery bypass grafting who underwent extended hemodynamic monitoring by a pulmonary artery for clinical indication. Microcirculation within the splanchnic area was assessed by gastric tonometry, liver blood flow and function non-invasively by transcutaneous measurement of ICG-PDR. All patients were considered hypovolemic and received hemodynamic optimization by infusion of hydroxyethylstarch (130 kD). Global and regional parameters were measured at baseline and one hour after optimization. All patients were on pressure-controlled mechanical ventilation and respirator settings remained unchanged throughout the study. Data are mean ± SD. A $p < 0.05$ was considered significant.
Results: Overall, 630 ± 130 ml of hydroxyethylstarch were administered. Cardiac index and stroke volume index increased significantly after fluid administration, in average from 2.8 ± 0.7 to 3.6 ± 0.6 l/min/m^2 and from 30 ± 7 to 38 ± 8 ml/m^2, respectively. Central venous and left atrial pressure significantly increased from 6 ± 2 to 12 ± 2 and from 5 ± 3 to 11 ± 3 mmHg, respectively. However, ICG-PDR and PCO_2-gap (difference between gastric mucosal and end-tidal CO_2-tension) did not change significantly, i.e. from 21.2 ± 6.5 to 21.6 ± 6.5%/min and from 0.9 ± 0.5 to 1.0 ± 0.7 kPa.
Conclusion: Optimizing cardiac output by fluid loading per se is not associated with a significant change in ICG-PDR or gastric mucosal PCO_2. However, since ICG-PDR increased in all patients with a value <18%min, particularly patients with a low ICG-PDR may benefit. Further studies are required to test this hypothesis.
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A-193

Effect of a intravenous infusion of lidocaine on the stress and metabolic responses after laparoscopic colectomy

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Background and Goals: Intravenous (iv) lidocaine (LIDO) is analgesic and anti-inflammatory.[1] When used in an acute rehabilitation protocol for laparoscopic colectomy (LAPCOL), iv LIDO reduces postop pain, speeds the return of bowel function and allows for a reduction in hospital stay.[2] We investigated the effects of iv LIDO on the stress and metabolic responses after LAPCOL.
Materials and Methods: After approval of our institution Ethics Committee, 30 patients scheduled for LAPCOL gave their consent to be included in this randomised double-blind placebo-controlled study. Patients were allocated in two groups: iv LIDO (bolus = 1.5 mg/kg, intraop infusion 2 mg/kg/h, then postop infusion of 1.33 mg/kg/h for 24 h) or saline. Anaesthesia (sevoflurane in O_2/air 80%) and postop analgesia (propacetamol, ketorolac, and PCA opioid) were standardised. All patients were included in the same acute postop rehabilitation protocol.[2,3] Postop iv infusion (Glucose 10% 80 ml/h) was stopped 24 h after surgery if oral intake was tolerated. Cortisoluria and catecholaminuria were measured intraoperatively, during the first and second postop days. Plasma concentrations of glucose, cortisol, catecholamines, C-reactive protein, and leukocytes counts were also measured 2 h, 6 h, 24 h and 48 h postoperatively. Data were analysed using ANOVA or Students' *t* test; $P < 0.05$ = statistical significance.
Results: Patient data were similar in the two groups. No significant differences between the two groups were observed with regard to intra and postop release of stress hormones. Concentrations of glucose, C-reactive protein, and leukocytes counts were also similar in both groups.
Conclusions: The beneficial effects of iv LIDO after LAPCOL[2] is not mediated by, or not associated with a reduction of the stress and metabolic responses.
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A-194

Effects of i.v. mannitol and hemofiltration on CD 14 expression density after cardiopulmonary-bypass

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Background and Goal of Study: Ischemic insults during surgery, such as cardiopulmonary-bypass (CPB), can cause a systemic inflammatory response syndrome. Changes in the expression density of the LPS-receptor CD 14 on peripheral blood mononuclear cells (PBMC) result in a modulation of the cytokine release pattern of these cells. PBMCs with a high expression density (CD 14^{++}) produce the antiinflammatory Il-10, primarily, PBMCs with a low expression density mainly proinflammatory cytokines. Suppression of the LPS-stimulated TNF-α reponse after a surgical stimulus[1] correlates with an unfavorable postoperative course.[2] Therefore, goal of this study was to assess the ability of hemofiltration during CPB (filtration of immune-suppressing substances) and mannitol (antioxidant) to blunt this suppression of the innate immune system.
Materials and Methods: After approval by the regional Ethics Committee, 51 patients undergoing elective coronary aortic bypass graft surgery with CPB were randomized into a control group, a mannitol group (50 g iv), or a hemofiltration group (15 ml/kg). CD 14 expression on PBMCs was assessed by FACS-analysis. Whole blood assays were used to measure the LPS-stimulated cytokine response.
Results and Discussions: Immediately after CPB, there was a significant shift towards the antiinflammatory CD 14^{++} PBMCs in the control group, which was not observed in either treatment group. Along with these results, we found a trend towards a higher TNF-α release in the mannitol and hemofiltration groups after CPB.
Conclusion(s): Our results suggest a proinflammatory modulation of the CD 14 expression density on PBMCs after CPB by mannitol and hemofiltration. Together with an increased TNF-α production the immune response might thereby be affected favorably by both therapeutic interventions.
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A-195

Platelet-derived microparticles induce angiogenesis and stimulate post-ischemic myocardial revascularization

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Background and Goal of Study: Platelet activation is accompanied by release of microparticles. Recently, it has been observed that platelet-derived microparticles (PMP) affect endothelial cells protecting them from apoptosis and inducing their proliferation. The study was aimed to evaluating the effect of PMP on angiogenesis using *in vitro* and *in vivo* approaches.
Materials and Methods: PMP were isolated from platelets of healthy volunteers who had not taken any medication for at least 2 weeks. Platelets were activated by thrombin, and PMP were sedimented from the supernatant at 100 000 × g. Angiogenesis was assessed using rat aortic ring model (1) and rat chronic myocardial ischemia with further evaluation of the number of functioning capillaries using intracardiac injection of BSA-FITC.
Results and Discussions: PMP induced angiogenesis in the aortic ring model. The area of sprouting (AS) in the control was 0.24 ± 0.2 mm^2. PMP in concentrations of 50 μg/ml protein and higher strongly increased vessel sprouting (AS of 4.2 ± 2.4 mm^2, $p < 0.001$). Intensity of PMP-induced vessel growth was comparable with angiogenesis induced by VEGF and bFGF (AS of 5.24 ± 1.4 mm^2, $p > 0.2$ vs. PMP). The pro-angiogenic effect of 100 μg/ml

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PMP (AS of 5.3 ± 2.1 mm^2) was eliminated by inhibition of VEGF, bFGF, and PDGF (AS of 0.7 ± 0.5 mm^2, 1.7 ± 1.5 mm^2, and 2.4 ± 1.2 mm^2, respectively, $p < 0.02$). In the *in vivo* model of chronic myocardial ischemia used, ligation of the left coronary artery induced a decrease in the number of functioning capillaries in ischemic myocardium from 157 ± 42 to 34 ± 21.5 (mean ± SD) capillaries per view field ($p < 0.001$). However, the amount of functional capillaries increased significantly after injection of PMP into the myocardium (to 97 ± 27.3; $p < 0.001$ vs. ischemia without PMP).

Conclusion(s): PMP possess a strong pro-angiogenic potential and may promote re-vascularization of the ischemic myocardium.

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A-196

Isocapnic hyperoxia impairs endogenous fibrinolysis in healthy men

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Background and Goal of Study: Fibrinolysis is impaired in acute atherothrombotic disease[1]. Because oxygen tension affects fibrinolysis in animals[2], we studied the effects of hypoxia and hyperoxia on fibrinolysis in humans.

Materials and Methods: We carried out a 3 way, randomised, cross-over study. On separate visits, healthy volunteers breathed hyperoxic (F_EO_2 target 0.85), hypoxic (S_pO_2 target 80%), and normoxic (air) gas mixtures from a tight-fitting face mask. End-tidal CO_2 was held constant throughout the study. Substance P (SP) (2, 4, and 8 pmol/min) was infused into the non-dominant brachial artery for 10 minutes at each dose to cause endothelium-dependent vasodilatation and release of tissue plasminogen activator (tPA). Forearm blood flow (FBF) was measured by venous occlusion plethysmography at 10 min intervals, and the data analysed using Chart™ software. Venous blood was sampled from both arms at the end of each infusion and analysed for tPA and plasminogen activator inhibitor 1 (PAI-1) antigen using ELISA. Net tPA release was calculated from the product of infused arm plasma flow and the difference in tPA between arms. Data were examined by single factor ANOVA and two factor ANOVA with repeated measures.

Results and Discussion: We studied 8 men (aged 38 (13), 19–53 (mean, (SD), range). SP caused dose-dependent release of tPA that was not affected by inspired O_2 tension. PAI-1 levels were significantly greater during hyperoxia than hypoxia ($P < 0.05$) and were not affected by SP.

Substance P (pmol/min)	0	2	4	8
	Net release tPA antigen (ng/100 ml/min)			
Normoxia	−0.2 (1.0)	1.4 (2.3)	3.6 (2.7)	6.7 (3.6)*
Hypoxia	−0.3 (0.6)	0.8 (1.1)	1.8 (2.3)	5.9 (2.4)*
Hyperoxia	−0.6 (0.8)	2.1 (1.9)	2.8 (3.3)	6.0 (4.0)*
	PAI-1 antigen (ng/ml)			
Normoxia	4.2 (2.8)	4.1 (2.9)	4.1 (3.2)	3.8 (1.4)
Hypoxia	4.6 (2.1)	4.5 (2.2)	4.3 (2.2)	4.4 (1.8)
Hyperoxia	6.3 (4.4)	5.9 (4.6)	5.8 (4.3)	5.8 (3.6)†

Values are mean (SD), *$P < 0.001$, †$P < 0.05$ hyperoxia vs. hypoxia.

Conclusion: Hyperoxia impairs endogenous fibrinolysis in healthy humans by increasing PAI-1. This could affect the value of oxygen therapy in acute atherothrombotic diseases such as myocardial infarction.

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A-197

Alpha-2B adrenoceptor polymorphism: effects on peripheral vasoconstriction in healthy volunteers

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Background and Goals of the Study: The alpha-2B adrenoceptor (AR) is the vasoconstrictive AR subtype in mice[1]. Human alpha-2B AR deletion (D) allele has been associated with loss of short term agonist-promoted receptor desensitization, which may lead to increased vasoconstriction upon alpha-2 AR activation[2]. The goal of this study was to test the hypothesis that alpha-2B AR activation will induce enhanced vasoconstriction in carriers of the DD genotype, compared to carriers of the II genotype.

Material and Methods: We administered increasing doses of the alpha-2 agonist dexmedetomidine (targeting plasma concentrations of 0.15, 0.3, 0.6, and 1.2 ng/ml) to 16 healthy young volunteers (alpha-2B DD genotype: n = 8, II genotype: n = 8). In all subjects, sympatholytic effects of the drug were attenuated by general anaesthesia. Measurements included finger blood volume (an indicator of vasoconstriction) detected by photoplethysmographic determination of light transmitted through a fingertip, finger blood flow detected by venous occlusion plethysmography and hemodynamic variables.

Results and Discussion: All concentrations of dexmedetomidine increased light transmitted through a fingertip (vasoconstriction) as well as systolic blood pressure and decreased heart rate in both groups ($p < 0.001$ for all). Dexmedetomidine reduced finger arterial inflow only in the DD group ($p < 0.001$). Dexmedetomidine had no effect on finger venous outflow or venous capacitance. There were no significant differences between the II and DD groups in any of the variables.

Conclusions: The results of this study confirm the alpha-2 agonist induced vasomotor and hemodynamic effects in peripheral vasculature. However, the results do not support our hypothesis that this alpha-2B AR polymorphism has an effect on peripheral vasoconstriction in humans.

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A-198

Effects of nitroprusside and esmolol-induced controlled hypotension on hepatic perfusion and oxygenation in healthy pigs

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Background and Goal of study: The aim of this animal study was to compare the influence of controlled hypotension (CH) induced by sodium nitroprusside (SNP) or esmolol (ES) on hepatic perfusion and oxygenation.

Materials and Methods (1): After ethical approval 17 anaesthetized and ventilated pigs were investigated. Blood flow (BF) was measured in the hepatic artery and portal vein. Arterial and venous blood-gases (femoral- and pulmonary artery; portal and hepatic vein) were analysed. CH was maintained at a level of 40 mmHg (MAP) via a closed-loop system. By means of randomisation animals were divided into two groups (ES; SNP). Baseline values (t_0) before and 15 (t_1) and 30 (t_2) min after starting CH were analysed.

Results:

	ES (n = 8)			SNP (n = 9)		
	t_0	t_1	t_2	t_0	t_1	t_2
Cardiac Index ($mL \cdot min^{-1} \cdot kg^{-1}$)	139 (118–150)	51#§ (38–55)	50#§ (44–53)	119 (105–133)	111 (101–135)	114 (95–166)
BF A. hepat. ($mL \cdot min^{-1} \cdot kg^{-1}$)	5.4 (4.0–7.0)	1.22#§ (0.5–2.4)	1.16#§ (0.4–1.5)	5.9 (4.0–6.1)	5.2 (4.3–6.2)	5.8 (4.0–7.3)
BF V. portae ($mL \cdot min^{-1} \cdot kg^{-1}$)	27.0 (21–30)	15.0#§ (12–18)	13.0#§ (11–20)	23.4 (21–33)	28.0 (24–34)	31.7 (26–36)
Hepatic DO_2 ($mL \cdot min^{-1}$)	93 (68–122)	28#§ (21–36)	27#§ (20.5–40)	104 (91–121)	101 (84–116)	116 (89–127)
Hepatic VO_2 ($mL \cdot min^{-1}$)	29 (23–38)	21# (15–25)	21.5# (15–26)	26 (18–35)	25 (21–46)	25 (21–41)

Results are expressed as median and 25%–75% interquartile range. Statistics: Wilcoxon's signed rank test ($p < 0.05$: §versus SNP, #versus t_0).

Conclusions: With regard to splanchnic oxygenation, SNP is superior to ES in inducing CH since hepatic arterial and portal venous blood flow as well as DO_2 are well maintained. Furthermore, ES may cause a delivery-dependency of oxygen-uptake in the liver.

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A-199

Activated C protein and endotoxinic shock: endothelial effects

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Background: Activated protein C (aPC) reduces mortality from severe sepsis. Its mechanism of action remains however unprecised. We studied the effects of human recombinant activated CP (aCP) in an *E.coli* lipopolysaccharide (LPS)-induced shock model characterized by delayed endothelial dysfunction and monocyte tissue factor (mTF) expression.
Materials and Methods: 4 groups of rabbits were studied. In 2 groups, endototoxic shock was induced by an intravenous (IV) bolus of LPS ($0.5\,mg \cdot kg^{-1}$): one group received an IV aCP injection 1 hour after LPS, the other received saline. The last 2 groups, received only saline IV injection, with or without injection of aCP in the same conditions. We assessed *in vitro* vascular reactivity on abdominal aortic rings, in particular phenylephrine (PE) sensitivity, and mTF expression five days (D5) after LPS injection. Immunohistochemistry (CD31) was performed at D5 to assess damaged endothelial cell surface of aortic segments (% of endothelial cell surface).
Results and Discussion: LPS was responsible for endothelial injury (40.4 ± 2.4% surface) associated with decreased PE sensitivity (2.2 ± 0.2 μM). Treatment with aCP decreased LPS-induced endothelial injury to 28.5 ± 2.3% ($p < 0.05$), restored PE sensitivity (1 ± 0.2 μM, $p < 0.05$) without any effect on mTF expression ($1710 \pm 433\,mU/1.5 \cdot 10^5$ cell in LPS + aPC group vs. LPS group, not significant). aPC did not decrease the mortality rate of endotoxinic rabbits (1 death/6 animals in LPS group and LPS + aCP group).
Conclusion: In LPS-induced rabbits, aPC was not able to decrease monocyte tissue factor activation, whereas it restored both contractile sensitivity and endothelial structure.

A-200

In-vivo videomicroscopy of mesenteric postcapillary venules after cardiac arrest in rats

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Background and Goal of Study: Recent data demonstrate, that the ischemia reperfusion syndrome after whole body ischemia following cardiac arrest (CA) shows similar pathological findings like septic patients (1). As the microcirculation plays a central role in the pathogenesis in sepsis, we therefore evaluated the combination of two established models of (a) experimental CA (2) and (b) in-vivo microscopy of postcapillary mesenteric venules (3) in rats to investigate the leukocyte endothelial interaction (LE), plasma extravasation (PE), and wall shear rate (WSR) in postcapillary mesenteric venules.
Materials and Methods: After approval of the animal care committee, male wistar rats were subjected to 6 min CA (2). At 30 min after successful cardiopulmonary resuscitation, the rats were reanaesthetized and a laparotomy for in-vivo microscopy was performed as described earlier (3). LE was characterized by the incidence of rollers and stickers. PE was measured using fluorescein isothiocyanate labeled albumin. WSR was determined with fluorescent-labeled erythrocytes. Data were acquired at baseline, 60 and 120 min. A sham group served as control.
Results and Discussions: Compared to controls, (CO) the WSR was strongly reduced at baseline and recovered at 120 min to normal values. The rollers and stickers were increased at baseline and decreased to normal values at 120 min. At baseline the PE was 4 fold stronger and continued to be 3–4 fold stronger at 120 min as compared the CO. These data indicate that animals surviving CA show signs of microcirculatory impairment such as LE and PE. The increase of PE is a typical sign of endotoxaemia, whereas the early normalization of the WSR and LE might indicate active repair mechanisms of the animals.
Conclusions: To our knowledge this is the first study showing a link between ischemia reperfusion injury after CA and the pathogenesis of sepsis in such a model. If these results can be validated in further studies, this might open new therapeutic strategies in the treatment of patients surviving CA.
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A-201

Myofilament calcium resensitization accounts for the protective effect of fenofibrate on septic heart in rats

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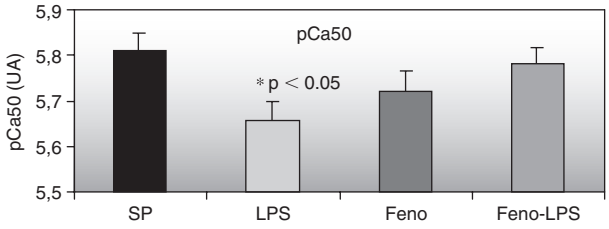
Background and Goal of Study: The nuclear factor PPARα regulates genes involved in metabolic, inflammatory, and oxidative responses to stress. We recently showed that a pretreatment with fenofibrate (Feno, a PPARα activator) prevented the septic myocardial dysfunction in rats. Our aim was to identify the cellular mechanisms involved in this protective effect.
Materials and Methods: adult male rats received standard chow diet or food containing Feno for 14 days Myofilament Ca^{2+} sensitivity (skinned fibres method), the inflammatory response (NOx) and the oxidative stress (TBARS) were measured in myocardium 12 hours after LPS (5 mg/kg) or saline (SP) i.v. injection. 4 groups were thus studied: SP, Feno + SP, LPS and Feno + LPS. 4 groups were thus studied: SP, Feno + SP, LPS and Feno + LPS. The results (mean ± SEM) were compared by ANOVA.
Results and Discussions: A decreased myofilament Ca^{2+} sensitivity, as attested by a reduction in pCa50 (the Ca^{2+} concentration corresponding to half-maximal force, with $pCa = -\log_{10}[Ca^{2+}]$) was found in the LPS skinned fibres group. This effect was prevented by Feno (figure).



The NOx and TBARS measurements were similar in LPS and Feno-LPS groups.
Conclusion(s): Fenofibrate pretreatment appears to prevent the septic myocardial dysfunction by preventing Ca^{2+} desensitization of myofilaments. This effect was not associated with a reduction of the tissular inflammatory response or oxidative stress. Our results are consistent with recent findings (1,2) suggesting that this protective effect may be due to an increase in fatty acid metabolism and oxidation in heart.
References:

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A-202

When do we start Glucose-Insulin-Potassium – Comparison of two regimens in patients with severe left ventricular dysfunction undergoing coronary artery bypass grafting

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Background and Goal of Study: Glucose is a preferential fuel in first hour of coronary artery bypass grafting (CABG) for functional recovery of heart with reduced cardiac function preoperatively. Glucose Insulin Potassium (GIK) reduces ischaemic myocardial damage after coronary revascularisation. The goal of the study is to evaluate the efficacy of two perioperative GIK infusion regimens in patients with severe Left ventricular dysfunction undergoing CABG.
Materials and Methods: A prospective, randomized study on 30 patients undergoing on-pump CABG with left ventricle (LV) ejection fraction less than 35% was conducted. Glucose (95 ml of 25% dextrose) and potassium (5 ml i.e. 10 meq) at rate of 0.5 ml/kg with separate insulin infusion (0.05 U/kg/hr) was started 12 hrs preoperatively, stopped at induction, restarted depending on groups assigned and continued 48 hrs postoperatively. In Group 1 ($n = 15$), GIK was restarted on aortic cross clamp (ACC) release and in Group 2 ($n = 15$) after shifting to ICU. Patients undergoing combined procedures and those with documented renal failure, hepatic insufficiency, hyperkalemia were excluded from the study.
Results: Group 1 showed higher postoperative cardiac indices at 12 and 48 hours compared to Group 2 (3.14 and 3.57 l/min/m^2 vs 2.6 and 3.01 l/min/m^2, $P = 0.05$). Left ventricular work index (37.3 vs 31.5 g-m/m^2,

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$P = 0.04$) improved in Group 1. Group 1 showed lower inotrope scores (12.3 ± 2.2 vs 28.2 ± 3.6, $P = 0.04$), decreased incidence of arrhythmias (6.6% vs 56.6%, $P = 0.01$), and decreased IABP usage (14.3% vs 33.3%, $P = 0.03$). Duration of ventilation (mean 38.8 vs 42.8 hrs, $P = 0.9$) and length of ICU stay (mean 3.4 vs 5.02 days, $P = 0.08$) were statistically not significant but clinically significant. Serum Troponin-I (0.57 ± .37 vs 0.82 ± 7.5, $P = 0.39$) and CPK-MB (5.5 ± 1.82 vs 7.1 ± 7.18, $P = 0.54$) levels were statistically not significant in both groups. There was no mortality in either group.
Conclusion: Substrate enhancement with GIK at an appropriate time i.e., after ACC release, improved myocardial performance and resulted in faster recovery after CABG in patients with severe LV dysfunction.

A-203

Beta-endorphin plasma levels during regional myocardial ischaemia and myocardial stunning in chronically instrumented conscious dogs

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Background and Goal of Study: In a previous study we have shown that the opioid receptor antagonist naloxone improves recovery from myocardial stunning in chronically instrumented conscious dogs (1). Beta-endorphin (β-end) release is a component of the neuroendocrine activation associated with myocardial ischaemia (2). The aims of the present study were (a) to determine whether myocardial stunning induces β-end release and (b) to characterize the profile of β-end plasma levels during the time course of myocardial stunning.
Materials and Methods: This study was approved by the local Animal Care Committee. Ten dogs were chronically instrumented for measurement of heart rate, left atrial, aortic and left ventricular pressure, coronary blood-flow velocity and myocardial wall-thickening fraction (WTF). Occluder around the left anterior descending artery (LAD) allowed the induction of a reversible 10 min LAD-ischaemia. Experiments were performed after a postoperative recovery period of 12 days. Peripheral β-end levels were measured in duplicate by radioimmunoassay under baseline conditions (BL), during ischaemia and 1, 5, 15 and 30 min and 1, 3, 6, 12 and 24 h after the beginning of reperfusion. The haemodynamic parameters were recorded at the same points of time. Data were analysed using Wilcoxon matched pair rank test. Statistical differences were considered significant at $P < 0.05$. Data are presented as mean ± SD.
Results: β-end [pmol·l^{-1}] BL plasma concentrations were 5.95 ± 0.63. β-end levels increased significantly after induction of ischaemia with a peak value of 13.11 ± 1.64. They remained elevated after the first minute of reperfusion (9.34 ± 1.21) and returned to BL levels after 5 min. Regional ischaemia led to a reduction of WTF to negative values (−39 ± 14% of BL). Pre-ischemic WTF values were reached after 24 h of reperfusion.
Conclusions: Peripheral β-end plasma levels are increased during regional myocardial ischaemia and early reperfusion in chronically instrumented conscious dogs. With regard to the findings of our previous study (1) these results indicate that the endogenous opioid system has an important pathophysiological role in myocardial stunning.
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A-204

Mu opioid receptor antagonism reduces splanchnic perfusion in chronically instrumented conscious dogs

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Background and Goal of Study: In a previous study we demonstrated that the non-selective opioid receptor antagonist naloxone improves splanchnic perfusion in chronically instrumented conscious dogs (1). The present study investigates the effects of a selective μ-opioid receptor antagonism with naloxonazine (NLX) on the regional blood flow distribution of intraabdominal organs.
Materials and Methods: The study was approved by the local Animal Care Committee. Ten healthy dogs were chronically instrumented for measurement of heart rate (HR), left atrial and aortic pressure (MAP). Cardiac output (CO) was assessed non-invasively by transthoracic Doppler echocardiography. The regional blood flow (RBF) was determined with fluorescent microspheres. Experiments were performed after a postoperative recovery period of 12 days. In all animals, RBF and CO were assessed (a) before application of the selective μ-opioid receptor antagonist (Baseline) and (b) 24 hours after pretreatment with NLX (10 mg/kg i.v. over 30 min). Tissue samples were taken in triplicate in a systematic way. Data were analysed using Wilcoxon matched pair rank test. Statistical differences were considered significant at $p < 0.05$. Data are presented as mean ± SD.
Results and Discussions: In comparison to baseline, NLX resulted in a significant reduction in arterial RBF [ml/min/g] of distal jejunum (0.37 ± 0.04 vs. 0.24 ± 0.03), proximal ileum (0.73 ± 0.03 vs. 0.37 ± 0.05), proximal colon (0.75 ± 0.06 vs. 0.4 ± 0.04), distal colon (0.83 ± 0.08 vs. 0.48 ± 0.06), liver (0.16 ± 0.02 vs. 0.22 ± 0.03), renal cortex (5.33 ± 0.48 vs. 3.29 ± 0.29), renal medulla (0.38 ± 0.05 vs. 0.22 ± 0.03) and skeletal muscles (0.38 ± 0.04 vs. 0.14 ± 0.02). The RBF of gastric corpus (1.29 ± 0.08 vs. 1.42 ± 0.06), gastric antrum (0.87 ± 0.08 vs. 0.73 ± 0.09), duodenum (0.63 ± 0.05 vs. 0.69 ± 0.03), proximal jejunum (0.28 ± 0.04 vs. 0.36 ± 0.05), distal ileum (0.52 ± 0.04 vs. 0.42 ± 0.06), spleen (2.44 ± 0.27 vs. 2.46 ± 0.23) and pancreas (2.86 ± 0.15 vs. 2.79 ± 0.23) was not significantly changed. CO (3.24 ± 0.35 vs. 2.63 ± 0.27 l/min), HR (90 ± 8 vs. 92 ± 11 bpm) and MAP (98 ± 8 vs. 92 ± 6 mmHg) remained unchanged.
Conclusion: The selective μ-opioid receptor antagonist NLX deteriorates splanchnic perfusion in chronically instrumented conscious and normovolemic dogs. This effect is independent of the CO.
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A-205

Influence of a TNF-beta gene polymorphism on perioperative renal dysfunction in cardiac surgery with cardiopulmonary bypass

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Background and Goal of Study: Cardiac surgery with cardiopulmonary bypass (CPB) can cause acute renal dysfunction perioperatively, which is associated with an increased mortality. (1) It is also known, that genetic polymorphisms influence perioperative outcome. (2) Therefore, the aim of our study was to investigate a possible association between a polymorphism in the TNF-β gene and perioperative renal dysfunction after CPB.
Materials and Methods: After approval of the regional ethics committee, 62 patients undergoing elective coronary aortic bypass graft surgery were enrolled consecutively. DNA was isolated from peripheral blood, amplified with PCR and digested with a restriction enzyme. The genotypes were assessed with gel electrophoresis. N-acetyl-glucosaminidase (NAG), fractional sodium excretion (FSE), creatinine clearance (CC) and α1-microglobuline (AMG) were measured as markers of tubular and glomerular renal dysfunction at four time points perioperatively.
Results and Discussions: TNF-B1/B1 homozygotes had a higher increase of FSE after CPB compared to the other genotypes, returning to their level 24 h postoperatively. Regarding NAG, TNF-B1/B2 heterozygote patients showed a significant rise immediately post-CPB that declined to baseline about one hour later, while the other genotypes had no significant changes. TNF-B1/B1 individuals had the lowest increase of AMG as compared to the other genotypes over the entire post-CPB course. No differences between the genotypes could be detected for CC.
Conclusion(s): These results may suggest an association between the TNF-β polymorphism and renal dysfunction after CPB. Our data could possibly result in an improved preoperative risk assessment and prophylaxis of renal complications in cardiac surgery.
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A-206

Adrenomedullin during renal transplantation

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Background and Goal of Study: Adrenomedullin (ADM) is known to be vasorelaxing and natriuretic peptide. ADM is increased in patients with

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hypertension, heart failure and heart transplantation. It was reported that circulating ADM was increased after renal transplantation (1). We investigated when ADM plasma level elevated during kidney transplantation.
Materials and Methods: We studied 7 ASA 2–3 adult patients (age 24–55) undergoing living-related renal transplantation in Hokkaido University Hospital. We measured ADM concentrations after inducing anesthesia (T0), just before reperfusion (T1), just after reperfusion (T2), 1 hour after reperfusion (T3), and at the end of surgery (T4). Repeated measures ANOVA was used for statistical analysis.
Results: Data (mean ± SD) are shown in Table.

	ADM (pmol/L)
T0	29.7 ± 8.3
T1	38.6 ± 7.4
T2	43.4 ± 9.5
T3	55.7 ± 19.3*
T4	77.2 ± 26.3*#

*$P < 0.05$ vs T0, #$P < 0.05$ vs T3.

ADM concentrations increased in the course of surgery. ADM at T3, 4 significantly elevated compared to ADM at T0. In previous report (1), the mean concentration of ADM after renal transplantation was 69.1 ± 10.6, and this value is similar to our result at T4 (77.2 ± 26.3).
Conclusions: Our study showed that ADM plasma level elevated from post-reperfusion, especially 1 hour after reperfusion, and continued to increase until the end of surgery. We suggest that circulating ADM increases after reperfusion and is kept at high level after kidney transplantation.
Reference:
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A-207

Predictors of atrial fibrillation following Off-pump CABG

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Background and Goal of Study: Postoperative atrial fibrillation or flutter (AF) is a common complication, with an incidence that is consistently reported to range between 20% and 40% of patients after CABG, with little change over the past 20 yrs. Postoperative AF is associated with increased risk of stroke, and longer hospitalization. The pathophysiology of postoperative AF is uncertain, and its prevention remains suboptimal. Age is the most consistent predictor of AF following on-pump CABG according to the previous reports. Recent study documented that off-pump technique does not reduce the incidence of AF. The aim of present study is to elucidate predictors of AF after off-pump CABG.
Materials and Methods: A total of 265 consecutive patients undergoing off-pump CABG surgery (Age 68 ± 9 yr, m:f = 190:75) between 2001 and 2003 in our institution were enrolled in this prospective observational study. Continuous ECG monitoring were performed at least 72 hr after surgery depending on patients condition. 12-lead ECGs were recorded if arrhythmia was suspected. Thereafter, intermittent ECG assessments were performed.
Results and Discussions: A total of 62 patients (31%) developed AF after off-pump CABG. Stepwise multivariate analysis identified increased age (OR 10.2, CI 1.9–60.4), intraoperative low cardiac output (OR 0.04, CI 0.002–0.5), and decreased intraoperative water balance (OR 0.07, CI 0.005–0.75) as the independent predictor of postoperative atrial fibrillation. No significant differences were found in postoperative AF incidence, and time distribution of AF onset between our present findings concerning off-pump CABG, and previous reports concerning on-pump CABG. Postoperative AF caused the extension of ICU stay in off-pump CABG patients.
Conclusion: Maintenance of cardiac output along with appropriate hydration is necessary to prevent perioperative AF following off-pump CABG. Larger patient numbers, and multi center studies are required to determine the precise risk factors.

A-208

Poor intraoperative blood glucose control is associated with a worsened hospital outcome after cardiac surgery in diabetics

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Background and Goal of Study: The perioperative glycemic control improves outcome of diabetic patients undergoing cardiac surgery (1). Most of these studies focused on postoperative period. However, severe hyperglycemia during on-pump cardiac surgery in despite insulin therapy has been reported (2). The aim of this study was to determine whether a poor intraoperative glycemic control could be associated with a worsened hospital outcome.
Materials and Methods: After approval by our ethical commettee, 200 consecutive diabetic patients undergoing on-pump cardiac surgery were included. The intraoperative insulin therapy was initiated as soon as blood glucose level (BGL) was ⩾180 mg/L according a standardized protocol. A poor intraoperative glycemic control was defined by a four consecutive BGL >200 mg/L without any decrease until the end of the surgery. The primary outcome was early postoperative morbidity recently defined (3). A multivariate logistic regression analysis between patient with or without severe morbidity during intensive care unit stay was performed. A *P* value of less than 0.05 was considered significant.
Results and Discussion: A Insulin therapy was intraoperatively required in 36% of patients, a poor intraoperative glycemic control was observed in 18% of patients. The poor intraoperative glycemic control was significantly more frequent in patients suffering from severe postoperative morbidity (37% versus 10%, $P < 0.001$). The adjusted odd ratio for severe postoperative morbidity among patients with a poor intraoperative glycemic control as compared with patients without was 7.0 (95% confidence interval 2.7–18.2).
Conclusion: In diabetic patients, the poor intraoperative glycemic control is significantly associated with a worsened hospital outcome. Our results suggest that a tight glycemic control should be initiated from intraoperative period in diabetic cardiac surgical patients.
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A-209

The erythropoietin receptor is expressed in the human heart and upregulated after cardio/pulmonary bypass: role of hypoxia and possible mechanism of myocardial protection

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Background and Goal of Study: Erythropoietin (EPO) administration in acute stroke revealed clinically significant neuroprotection. Recently, animal experiments showed superior cardiac function in EPO treated animals subjected to myocardial infarction. While in cell lines and rodent myocardium the EPO receptor had been described, for the adult human myocardium there is no such report to date. Therefore, we investigated adult human cardiac tissue for the presence of the EPO receptor and to identify the cell types expressing the EPO receptor.
Materials and Methods: After approval by the Institutional Review Board, ventricular tissue from the muscular septum obstructing the left ventricular out flow track (Morrow procedure) or right atrial tissue from the site of the venous canulation was obtained (n = 4 per group). Additional samples were obtained before and after cardio-pulmonary bypass (CPB). Tissue samples were investigated for the EPO receptor and the transcription factor HIF-1alpha by RT-PCR, Western blot and (double) immunohistochemistry.
Results and Discussions: We show for the first time that EPOR mRNA and protein is indeed expressed in adult human atrial and ventricular tissue. Cardiac EPO receptor positive cells were the cardiomyocytes of atrial and ventricular origin as well as vascular endothelial cells. To investigate if the EPO-receptor was hypoxia/HIF-1alpha regulated, tissue before and after CPB was analyzed. Prior to CPB, HIF-1alpha was strongly upregulated consistent with preexisting myocardial ischemia/hypoxia. After CPB HIF-1alpha was decreased due to the improved perfusion following CABG, and the EPO-receptor was markedly upregulated.
Conclusion(s): EPO-receptor is expressed in the human heart. These findings encourage to investigate the potential of EPO-induced myocardial cytoprotection in humans. The EPO-receptor in the heart appears not to be regulated by HIF-1alpha.
Acknowledgement: Bundessportinstitut (VF 07/03/65/2004–5, RD/KFW).
Reference:
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A-210

The perioperative renal function in cyanotic versus acyanotic children undergoing open heart surgery under sevoflurane anaesthesia

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Background and Goal of Study: There are few data on perioperative renal function in cyanotic children (1). We aimed to investigate the perioperative renal function in cyanotic versus acyanotic children undergoing open heart surgery under sevoflurane anaesthesia.

Materials and Methods: After receiving ethical committee approval, 12 acyanotic patients (preoperative oxygen saturation: $SaO_2 > 85\%$) and 12 cyanotic children ($SaO_2 < 85\%$) were included. Sevoflurane was given at concentration levels of 2% before cardiopulmonary bypass (CPB) and 1–2% during CPB with BIS monitorization after standard anaesthesia induction. Inorganic fluoride (IF), electrolytes, creatinine (Cr), urea nitrogen in serum and urine samples, N-acetyl-β-D-glucosaminidase (NAG) in urine samples were measured before induction (t1), before CPB (t2), during CPB (t3), after CPB (t4), at the end of the operation (t5) and 24 hours postoperatively (t6). T-test and chi-square tests were used for statistical analysis.

Results and Discussions: The levels of serum uric acid levels were higher in the cyanotic group ($p < 0.05$). While there were no differences in the levels of serum and urine IF between the groups, the levels of serum IF at t2, t3, t4, t5 and the levels of urine IF at t3, t4, t5, t6 were higher compared to t1 in the cyanotic group. No differences were found in the levels of serum and urine Cr, urea nitrogen and electrolytes and NAG levels between the two groups. Data is given as mean ± SD.

	Acyanotic	Cyanotic
Age(month)	55,8 ± 36,4	40,3 ± 23,1
Sex(F/M)	8/6	6/6
Weight(kg)	16,0 ± 6,7	14,4 ± 5,7
ACC time(min)	54 ± 15	60 ± 14
Anaesth.time(min)	215 ± 48	228 ± 33

Conclusion(s): We concluded that, renal function is affected similarly despite increases the levels of inorganic fluoride, in acyanotic and cyanotic children in sevoflurane anaesthesia undergoing open heart surgery.

Reference:

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A-211

Low cardiac troponin I elevations predict in hospital mortality after major vascular surgery

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Background: Cardiac Troponin I (cTnI) is the most reliable cardiac biomarker for the post operative period. Elevation upper than 1.5 ng/mL usually define myocardial infraction and are known to be associated with increased mortality. The aim of the study was to evaluate association between low cTni elevations (below 1.5 ng/mL) and in hospital mortality.

Material and Methods: All patients scheduled for abdominal aortic surgery from September 1995 to November 2002 were included. CTnI measurements were done for each patient at recovery and on POD 1 to 3, and in case of cardiac complication. Only peak values were retained in this study. Patients with major surgical complications were excluded. Multivariate analysis was performed to determine variables associated with in hospital mortality.

Results and Discussion: Global observed mortality is 4.2%. cTnI level, Age and Lee Risk Score[1] were independent predictors of in hospital mortality. Low cTnI elevations were associated with increased in hospital mortality:

Table: cTni levels association to in hospital mortality after abdominal aortic surgery

Variables	OR	95,0% C.I. for OR	p
Post Operative cTni Peak			
Upper than 1,5 ng/mL	8.1	2.9; 22.8	0.0001
Abnormal Below 1,5 ng/mL	3.9	1.8; 8.4	0.0001
Normal	1.0	–	–
Age (1 year increase)	1.05	1.03; 1.14	0.003
Lee Risk Score[1]			
(by 1 point increase)	2.7	1.6; 4.7	0.001

Hosmer Lemeshow statistic is 5,841 (p = 0,665; df:8).

Conclusions: Each cTni elevation was associated with increased mortality. Abnormal value of this biomarker, even low, should be considered as important postoperative adverse events, and should require adapted treatment.

Reference:

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A-212

Prevalence of genetic mutations and incidence of VTE in caucasian pregnant women

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Background and Goal of Study: Thromboembolic events are leading cause of maternal morbidity and mortality. The risk of venous thrombosis in women increases 5-fold during pregnancy: with any additional risk factors, this frequency increases further. Finally, women with a history of thromboembolic events are at an especially increased risk of recurrence when they become pregnant. (1)

Materials and Methods: From Jan 2002 to Jan 2003 were admitted to our department 2200 pregnant women. We screened for thrombophilic genetic mutations 600 women: 40% was non 0 blood type, 33% BMI >29, 27% age >35 years.

The patients underwent: Ultrasonography Duplex Scan; Colour Doppler Caval Vein; TC Spiral Scan Caval Vein, Iliac Veins, Femoral Veins, blood assays for S Protein, C Protein, ATIII, DDIMER cut-off line >500, thrombophilic agents (Factor II, Factor V Leiden, MTHFR).

Results and Discussions: Of 378 non mutated women (2.6%) (9 women) developed VTE – of 222 women were affected of genetic mutations for thrombophilia 23% (55 women) developed VTE. (chi-square 54.97; $P < 0.0001$.

Factor II	44 (19%)	
MTHFR	140 (63%)	
Factor V Leiden	38 (17%)	
	92.2% *Etherozygosis*	7.8% *Homozygosis*

Of the 3 women who developed proximal-high (femoral and iliac veins) VTE 1 was affected of Factor V Leiden homozygosis and MTHFR homozygosis, 2 were affected Factor V Leiden homozygosis and MTHFR heterozygosis. These women were treated with positioning vein caval filter for the presence of fluctuant thrombus. Other 52 women were developed proximal medium VTE (popliteal veins) were treated with conventional methods using LMWH and elastic stocks. (2)

Conclusion(s): Thromboembolic venous disease is multifactorial and increases in percentage in pregnant women over 35 years old with thrombophilic genetic mutations and also in overweight women during pregnant period.

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A-213

Oculocardiac reflex and $EtCO_2$ level during eye surgery

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Background and Goal of the Study: We noted that the severity of an oculocardiac reflex may be influenced by the expired carbon dioxide (CO_2) concentration(1). The diving reflex is increased by high CO_2 concentrations. We determined if high or low expired CO_2 affected the severity of the oculocardiac reflex.

Materials and Methods: With approval by our Department Committee, 30 pediatric patients having ophthalmologic survey were studied. A standard inhalation induction and maintenance of anesthesia with Halothane was performed. The patients were intubated and an intravenous catheter placed. No patients received any anticholinergic. The patients were then randomized to beginning with either a high (50 mmHg) or low (25 mmHg) expiratory CO_2 concentration as measured by Nardomed III Multispec spectrometer. The patients respirations were controlled. A standardized 200 gm traction was placed on an extraocular muscle while the electrocardiogram (ECG) was recorded. The opposite (low or high) expired CO_2 concentration was then obtained by controlled ventilation. The ECG was again recorded during a standardized 200 gm on an extraocular muscle. The location of the extraocular

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muscle under traction was noted for both episodes. The number of severe bradycardia episodes (<50% of baseline heart rate) with extraocular traction for each group was noted.

Results and Discussion: The mean age of the patients studied was 7.7 ± 7.2 years. The mean low and high expired CO_2 concentrations were 28.3 ± 4.1 and 48.8 ± 6.9 mmHg, respectively. Expiratory Halothane concentrations during the two episodes of testing were 1.4 ± 0.3 and 1.3 ± 0.4 (P = 0.1). There were three (10% of patients) episodes of severe bradycardia with extraocular traction during the high expired CO_2 concentration and only one (3.3% of patients) during the low. The mean change in heart rate with extraocular traction during the period of high and low expired CO_2 were 17.7 ± 18.2% and 12.1 ± 14.8%, respectively (P = 0.06)[2].

There were more clinically significant bradycardia episodes with high expired CO_2 concentration that during low (10% vs 3.3%) and there was a trend for a greater drop in mean heart rate with high episodes CO_2.

Conclusion: It may be benefical to avoid hypercardia during ocular surgery for not having severe oculocardiac reflex[3].

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A-214

Troponin-T for detecting myocardial ischemia in patients undergoing different anesthesia techniques for transurethral resection

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Background and Goal of Study: It is well known that cardiac complications are more frequently encountered in elderly patient population after transurethral resection of prostate (TUR-P) (1,2). The aim of the study was to assess the early recognition of myocardial injury in patients, scheduled for TUR operations under general, spinal or epidural anesthesia.

Methods: ASA I–II, 45 cases randomly divided into 3 groups to receive either general anesthesia, spinal anaesthesia or epidural anesthesia. Preoperative ECG, Creatinin kinaze muscle and brain (CK-MB), creatinin phosphokinaze (CPK) and Troponin-T (Tn-T) levels were evaluated in all patients. Intraoperative hemodynamic parameters were recorded at 5., 10., 15., 20., 30., 40., and 60. minutes. Laboratory tests were repeated in the postoperative period.

Results: CK-MB, CPK values of all cases have increased in the postoperative ($p < 0.05$). Clinical findings of ischemia were detected only in two cases. Tn-T tests were positive in 9 cases of the general anesthesia group, in 9 of the spinal anesthesia and in only one case of the epidural anaesthesia group.

Conclusion: We conclude that epidural anesthesia may be superior than general or spinal anesthesia in TUR-P operations when myocardial protective effect is considered.

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A-215

Comparison the effects of inhalation anaesthetics and TIVA on post-perfusion injury in cardiopulmonary bypass

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Background and Goal of Study: In our study, we searched the effects of inhalation anaesthesia and TIVA on ischemia-reperfusion injury during cardiopulmonary bypass surgery (CPBS). We aimed to compare the effects of two different anaesthetic methods on myocardial protection.

Material and Methods: The study were performed in 59 patients under open heart surgery. The patients were divided into three groups randomly. There were given desflurane in group I (n = 20), sevoflurane in group II (n = 20) and TIVA in group III (n = 19) patients. The patients were prepared for operation with standart method and were 5 mg diazepam premedicated preoperatively. There were given to patients 2 mg kg^{-1} propofol, 10–25 mcg kg^{-1} fentanyl for induction. Patients were intubated after 0.1 mg kg^{-1} vecuronium bromide injection.There were given to group I 1–4 mcg $kg^{-1}h^{-1}$ fentanyl by infusion and 1–3 MAC desflurane, to group II 1–4 mcg $kg^{-1}h^{-1}$ fentanyl by infusion and 1–1.5 MAC sevoflurane and to group III 0,3–12 mcg $kg^{-1}min^{-1}$ fentanyl and 0,07 mg $kg^{-1}h^{-1}$ midazolam by iv infusion for maintenance of anaesthesia. During the CPB perfusion pressure was hold same level (60–80 mmHg) in all patients. Patients were operated under moderate hypothermic (28–32°C) condition. Arterial blood samples were taken in preoperatif period (S_0), and 2nd hours (S_1), 24th hours (S_2) in post-pump period. Serum AST, ALT, CK-MB, cTnI and proinflammatory cytokine levels (IL-6, IL-8 and TNF-α) were analysed in blood samples.

Results and Discussion: Serum CK-MB, cTnI, ALT, AST, IL-6, IL-8 and TNF-α levels increased in all groups at 2nd and 24th hour after CPB ($p < 0.001$).

Conclusion: There was no difference between inhalation anaesthesia and TIVA, above myocardial protective and pharmacological preconditioning effects in CPBS (1).

Reference:

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A-216

Comparison between endocrine stress response and myocardial markers of cardiosurgical patients undergoing a total intravenous anesthesia (TIVA) with propofol and balanced anesthesia with sevoflurane under neurologic monitoring

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Background and Goal of Study: We investigated the course of stress response from patient undergoing a total intra-venous anesthesia (TIVA) compared to a balanced anesthesia with Sevofluran under Neurologic monitoring and its influence on myocardial ischemia parameters after coronary surgeries.

Materials and Methods: Prospectively randomised studies with two groups (A, B) of each 20 patients of ASA risk group III**,** who were undergoing coronary artery bypass graft surgery (CABG) using extracorporeal circulation (ECC). The study was approved by ethical committee and all patients gave their written consent. Group A balanced anesthesia with Sevofluran (0,5–2 vol%), Fentanyl and Pancuronium. Group B TIVA with Propofol ca. 3–10 mg/Kg/h, Fentanyl and Pancuronium. In both groups anesthesia was induced with propofol. Also during ECC anesthesia was maintained with Propofol in both groups. Concentration of anesthetic agents in all groups was titrated to maintain a BIS index value of 40. Additionally AEP and continous galvanic skin reflex measurements were carried out. Perioperatively epinephrine, norepinephrine, ADH, ACTH and cortisol were determined at seven particular points of time (T). Moreover, intraoperative hemodynamic parameters were registered as well as CK, CK-MB and troponin T at 3T postoperatively. Statistical evaluation by ANOVA. Level of significance was determined by $p < 0.05$.

Results and Discussions: Demography, hemodynamic data and neurologic monitoring parameters were comparable between both groups. Significant differences between ADH (pg/ml) T3 34.1 ± 46.8 (A) vs. 9.8 ± 7.0 (B), T5 58.7 ± 48.6 (A) vs. 38.5 ± 56.3 (B); epinephrine (pg/ml) T4 105.8 ± 146.8 (A) vs. 62.9 ± 105.8 (B), T5 307.7 ± 399.2 (A) vs. 66.9 ± 69.4 (B); norepinephrine (pg/ml) T5 3330.7 ± 5685.2 (A) vs. 621.3 ± 475.1 (B); as well as cortisol (μg/dl) T5 19.7 ± 7.9 (A) vs. 14.0 ± 6.6 (B) and T7 17.3 ± 7.2 vs. 12.0 ± 6.4.

Conclusion(s): Under comparable depth of anesthesia a TIVA with propofol, showed a minor course of endocrine stress response in comparison to a balanced anesthesia with sevofluran. In contrast to other studies, there was no significant difference between the groups concerning postoperative course of CK, CK-MB and troponin-T in coronary surgery patients.

A-217

What's the signification of very low increases of troponin Ic levels after vascular surgery? A retrospective study

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Background and Goal of Study: Troponin Ic is a highly sensitive marker of cardiac injury[1] including for postoperative myocardial infarction. Troponin Ic and outcome were closely associated in acute coronary syndromes, and the same results were observed during the early postoperative period[2]. The primary end-point of this retrospective study was to determine the impact of a very small postoperative increase in troponin Ic level to a value between 0.4 to 1.5 ng/ml on long term survival.

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Materials and Methods: We reviewed 1477 operations of vascular surgery from January 2001 to June 2004.

76 patients who had troponin Ic blood levels between 0.4 and 1.5 ng/ml during the first 72 postoperative hours, were matched with 76 patients who underwent the same surgery, and had the same demographic characteristics, but no troponin increase during the 72 first hours after surgery. The mortality and cardiac outcome after a one to three years follow-up period were studied.

Results and Discussions:

	Case n = 76	Control n = 76	P value	RR (%) (CI95)
All major cardiac events	25	9	0.00312*	278 (138;556)
ECG alteration	3	3	NS	100 (20.8;480)
De novo angina pectoris	10	2	0.03*	500 (113;2210)
Myocardial infarction	12	4	0.06	300 (101;889)
Death (all causes)	15	6	0.032**	250 (102;610)

*chi square test, **generalized Wilcoxon test.

Conclusion(s): Even small increases of troponin Ic levels were associated with an increased risk of mortality and cardiac events up to three years after vascular surgery.

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A-218

Extubate cardiac valve patients in the operating room: high thoracic epidural anesthesia (HTEA) in combination with minimal invasive surgical approach

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Background and Goal of Study: To assess the effectiveness, safety and advantages of High Thoracic Epidural Anesthesia (HTEA) combined with general anesthesia in terms of rapid extubation and post-operative pain control.

Materials and Methods: We retrospectively studied 19 patients (9 aortic, 9 mitral, 1 tricuspid valve) who underwent elective valvular cardiac surgery via right thoracotomy from 01.01.2003 to 01.12.2004. There were 12 male and 7 females. Mean age was 55.9 ± 7.9. Mean ASA Class was 2.6 ± 0.5 and mean Euroscore Class was 3 ± 2.3.

HTEA was performed by insertion of a 19G catheter at Th2–Th3 level the day prior to surgery.

Epidural anesthesia was maintained by boluses of ropivacaine 1% 4 ml and general anesthesia with propofol 4–10 mg/Kg/h.

Patients were extubated while still in the operating room if respiratory and hemodynamic parameters were acceptable. Epidural analgesia was maintained with continuous infusion of ropivacaine 0.2% with fentanyl 5 mcg/ml at a rate 4–8 ml/h for 48 hours.

Pain scores (0 = no pain, 10 = worst pain) were recorded for 48 hrs by a trained nurse.

Results and Discussions: Mean time of surgery and cardiopulmonary bypass were respectively 219 min ± 45 and 124 min ± 30, 16 patients (84.2%) were extubated in the OR. Mean time to extubation was 12 ± 7 min. No patient was reintubated. Mean pain scores were 1.8 ± 1.8 at 12 hrs, 1.2 ± 1.5 at 24 hrs and 0.8 ± 1.5 at 48 hrs. There were no adverse effects.

Conclusion(s): HTEA combined with general anesthesia in patients undergoing valvular surgery via right thoracotomy is safe, permits rapid extubation and guarantees optimal analgesia in the post-operative phase.

A-219

Lactate metabolism during SIRS induced by heated intraoperative intraperitoneal chemotherapy procedure

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Background and Goal of Study: Hyperthermic intraperitoneal chemotherapy (HIIC) for treatment of peritoneal carcinomatis is an aggressive therapy, and may induce metabolic disorders. The aim of this prospective study was to analyse the changes in lactate metabolism in splanchnic (S) and muscle tissue from (M) areas.

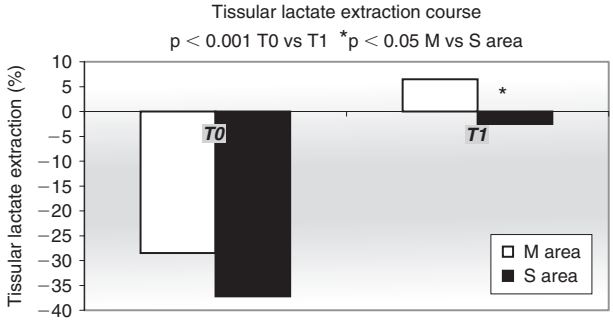
Materials and Methods: ASA 1 and 2 patients with cardiovascular or metabolic disease were excluded. The anaesthetic protocol was the same for all patients, no lactate solution was infused. Arterial and venous (basilic and splanchnic veins) lactate samples were drawn: just before the HIIC (T0) and after 90 min of HIIC (T1). Tissular Lactate utilization was estimated with lactate extraction: $Ex_{lactate}$ = Lactate arterio-venous gradient/[$lactate_{arterial}$]. 100 (%). A negative value means that the area is globally a lactate producer and conversely.

Statistics: Data (mean ± SD), Student *t*.

Results and Discussions: 43 patients included (7 M, 36 F)

(mmol/l)	T0	T1
Art. lactate	0.96 ± 0.43	2.99* ± 1.23
S veinous lactate	1.22 ± 0.38	3.1*° ± 1.1
M veinous lactate	1.1 ± 0.35	2.7* ± 1.1
Temperature (°C)	34.1 ± 0.8	38* ± 0.7
Vo2 (ml/min/m^2)	134 ± 22	171* ± 35

*$p < 0.05$ T0 vs T1, °$p < 0.05$ S vs M.



Conclusion(s): HIIC induced a mild hyperlactatemia that is correlated with temperature augmentation. S and M areas were both lactate producers before HIIC, but M area became lactate consumer during HIIC: this fact confirm hypothesis that resting muscle may play an important role in lactate removing during metabolic stress.

Respiration

A-220

Comparison of volume- and pressure-controlled ventilation during laparoscopic bariatric surgery

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Background and Goal: Obesity has become a worldwide endemic problem. More and more bariatric surgery is performed, on more and more compromised patients. There are several surgical techniques, but the laparoscopic method has gained in frequency. Management of such patients faces the anesthesiologist with complex ventilatory problems. The purpose of the present study was to evaluate two ventilatory techniques (pressure (PCV) vs. volume controlled (VCV)) during laparoscopic bariatric surgery.

Materials and Methods: After Institutional Review Board approval, 20 adult consenting patients, scheduled for elective gastric banding operation were studied. Anesthesia was standardized: induction with remifentanil, propofol and rocuronium, and maintenance with TCI remifentanil and sevoflurane. Rocuronium was added if necessary. After an initial period of VCV with a tidal volume of 10 ml/kg and at a respiratory rate (RR) of 12 and surgical insufflation, the patients were allocated randomly to two groups: Group VCV (n = 10) received a tidal volume (V_T) of 10 ml/kg (ideal body

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weight IBW) in VCV, and Group PCV (n = 10) with the airway pressure set to provide a V_T of 10 ml/kg IBW. RR was adjusted to maintain an $ETCO_2$ 35–40 mmHg. Ventilatory variables were kept constant. Electrocardiogram, invasive radial arterial pressure, expired end-tidal carbon dioxide tension ($ETCO_2$), airway pressures and arterial oxygen saturation were continuously monitored. The parameters were recorded with the Rugloop® software. Data were analyzed with the Tukey-Kramer test. Data are mean (SD).

Results: No differences were found in the demographic characteristics of the two groups, nor in the values obtained before insufflation. The hemodynamic characteristics remained stable in the two groups. The pH and PCO_2 values increased in both groups after surgical insufflation, but in the Group PCV this increase was higher as compared to the Group VCV (46.4 (3.72) vs. 43.5 (5.95) mmHg, $p < 0.01$).

Conclusions: Giving the difficulty of coping with CO_2 elimination during laparoscopic bariatric surgery, we conclude that volume controlled ventilation is better in these cases than pressure controlled ventilation.

A-221

Effects of total intravenous anesthesia vs balanced anesthesia on arterial oxygenation and shunt fraction during one-lung ventilation

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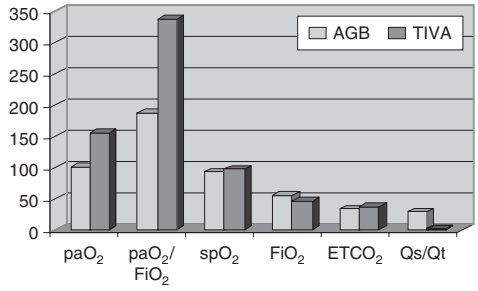
Background and Goal of Study: In vitro and in animal experiments halogenated agents reduce pulmonary vasoconstriction response to hypoxia. Clinical studies in patients undergoing one-lung ventilation (OLV) are less conclusive. The aim of the present study is to compare effects of balanced anesthesia and total intravenous anesthesia (TIVA) on arterial oxygen tension during OLV.

Materials and Methods: 45 patients requiring OLV for thoracic surgery were randomly assigned to receive TIVA (propofol + remifentanil) or balanced anesthesia (sevoflurane 1.5–2% + fentanyl). Exclusion criteria: renal insufficiency, liver dysfunction, ischemic or valvular heart disease. Arterial and mixed venous blood samples and hemodynamics were measured before and during OLV.

Results and Discussions: The 2 groups didn't differ in preoperative conditions. During OLV paO_2; paO_2/FiO_2; SpO_2; End-Tidal CO_2 and shunt fraction (Qs/Qt) were significantly different as summarized in the table (mean + SD) and shown in the graph:



	AGB	TIVA	*p*
paO_2 mmHg	100,56 + 37,7	155,58 + 28,8	<0,0001
paO_2/FiO_2	187,50 + 75,2	338,17 + 62,9	<0,0001
spO_2%	93 + 3,3%	97,52 + 2,1%	<0,001
FiO_2%	55 + 6	46 + 3	<0,01
$EtCO_2$ mmHg	33,82 + 3,0	36,82 + 3,0	<0,01

Conclusion(s): During OLV arterial partial pressure of O_2 values with TIVA were greater than those with balanced anesthesia. Propofol improved oxygenation and shunt fraction during OLV compared with sevoflurane.

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A-223

Intraoperative bronchoscopy prevents hypoxia during one lung anaesthesia for transthoracic oesophagectomy

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Background: Malposition of an endobronchial double lumen tube (DLT) can affect oxygenation during one lung ventilation (OLV). We investigated the incidence of hypoxaemia during OLV following fibreoptic bronchoscopy to verify or readjust DLT placement post patient repositioning for thoracotomy.

Methods: A total of 43 consecutive ASA physical status II–III patients undergoing oesophagectomy were studied. Patients were anaesthetised and the trachea was intubated with a left sided broncho-cath (Mallinckrodt). Following the abdominal stage of surgery patients were repositioned for thoracotomy. FOB was then performed to confirm a distance between the carina and the end of the tracheal lumen of 0.5–1.0 cm; to visualise the bronchial cuff inflation to ensure no herniation; to identify the left upper lobar bronchus and verify the distance from the origin of this and the end of bronchial lumen at 0.5–1.0 cm. Arterial blood gases were analysed ten minutes after onset of OLV and then at 30-minute intervals. If PaO_2 was <9.5 kPa, DLT position was rechecked by FOB. The single operator was asked to assess right-sided lung collapse using a 0–10 rating scale where 0 represented no deflation and 10 complete collapse.

Results: Following FOB readjustment of the DLT was performed in six cases (14%). In five cases the left upper lobe bronchus was not fully visualised and in one case there was herniation of the bronchial cuff. Ventilatory parameters were unchanged pre and post OLV except for instituting a PEEP of 5–10 cm H_2O to the left lung. Patients were haemodynamically stable throughout OLV. The single operator rated right lung collapse for all patients at either 9 or 10. One patient had profuse intraoperative secretions but none experienced severe arterial hypoxaemia ($PaO_2 < 9.5$ kPa or $SaO_2 < 94\%$).

Conclusions: The use of intraoperative FOB following patient repositioning for thoracotomy detects and leads to correction of DLT malposition potentially eliminating the associated complications of hypoxaemia and insufficient lung deflation during OLV. We would recommend the use of FOB to check DLT placement following patient repositioning for thoracotomy.

A-224

Lung preservation during cardiopulmonary bypass

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Background and Goal of Study: Lung preservation during cardiopulmonary bypass (CPB) is controversial. Several studies have examined the best treatment to minimize the respiratory failure after cardiac surgery. In this study, we investigated three modalities of lung preservation during CPB.

Materials and Methods: The local Ethics committee approved this randomized, controlled prospective study. Sixty adult (age 18–80) patients undergoing elective cardiac surgery were randomly divided into three groups (20 patients each). Continuous positive airway pressure with air or 100% oxygen was given during CPB to patients in groups 1 and 2 (G1-Air, $G2\text{-}O_2$). Patients in G3 were disconnected from the ventilator during CPB (G3-DC). Measurements and calculations of arterial blood gases (ABG), dynamic (Cdyn) and static Cstat lung compliance, PaO_2/FiO_2 ratio were performed after the induction of general anesthesia, prior to CPB and 30, 60, 120 and 240 minutes after discontinuation the CPB.

Differences between ABG and respiratory parameters, between the groups, were done by using ANOVA. $P < 0.05$ was considered statistically significant.

Results and Discussions: All patients completed the study. Demographic and surgery data were similar in all groups. Arterial blood gases, the PaO_2/FiO_2 ratio, Cdyn and Cstat were similar in all three groups at each time point. Compared with pre CPB values, the PaO_2/FiO_2 was lower in all groups after CPB ($P < 0.006$, 0.006, 0.003).

Conclusion: The three methods were found to provide similar lung preservation during CPB. The selection of each of the methods, have a minor impact on postoperative lung function.

A-225

Effects of almitrine during anesthesia with sevoflurane for one lung ventilation

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Background and Goal of Study: Almitrine attenuates hypoxemia induced by one lung ventilation (OLV).[1,2] Up to now, all the studies have been conducted during intravenous anesthesia, and there are not studies evaluating the association of sevoflurane and almitrine. Sevoflurane causes vasodilation and could counteract the vasoconstriction induced by almitrine. Our aim was to evaluate if almitrine can be useful to improve oxygenation during sevoflurane anesthesia for OLV.

Materials and Methods: Sixteen consecutive patients undergoing open chest surgery and anaesthesia with sevoflurane randomly received treatment (T) with placebo or almitrine (16 μg/Kg/min). Respiratory and hemodynamic parameters were determined at the following times: room air (C), lateral decubitus with 100% O_2 (2LV), after 20 minutes of treatment and before OLV (2LV + T), after 10, 20 and 30 minutes with open chest OLV

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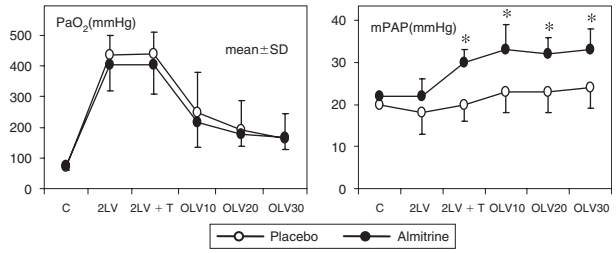
(OLV10, OLV20, OLV30). Student's *t*-test was used to compare groups in every control point.

Results and Discussion: No differences were observed in PaO_2 and shunt fraction between groups almitrine and placebo at the analyzed control points. However, mean pulmonary artery pressure (mPAP) increased in patients receiving almitrine ($p < 0.002$)*.



Conclusions: Preliminary data suggest that almitrine, when routinely administered during anesthesia with sevoflurane for OLV: 1 – does not attenuate hypoxemia, contrary to intravenous anesthesia; 2 – increases mPAP.

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Acknowledgement: Grant from FIS 01/1586, Spain.

A-226

Effect of positive airway pressure during cardiopulmonary bypass on post-bypass oxygenation

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Background: Atelectasis is found in as many as 64% of chest radiographs after CPB and may cause hypoxemia and shunt (1). It is controversial whether Continuous Positive Airway Pressure (CPAP) during CPB improves postoperative oxygenation (2). This study compared the effect of 0, 5 and 10 cmH_2O CPAP during CPB on post bypass oxygenation.

Methods: With Ethics approval, a randomised study of 48 patients having coronary artery bypass grafts was conducted. A standard anesthetic was given. The patients were in 3 groups receiving either 0, 5 or 10 cmH_2O CPAP at FiO_2 0.21 during CPB. In both 5 and 10 CPAP groups, 5 cm PEEP was used during reventilation. Arterial blood gas analysis was carried out at 30 min, 4 h and 8 h after bypass and $AaDO_2$ calculated. Kruskal-Wallis test was used for analysis and $p < 0.05$ considered significant.

Results: Median [inter-quartile range] $AaDO_2$.

	$AaDO_2$ (mmHg)		
CPAP (cmH_2O)	30 min	4 h	8 h
0	253* [185–339]	168 [127–218]	146 [107–221]
5	179 [110–264]	138 [87–221]	236 [121–354]
10	157 [131–212]	138 [100–159]	132 [91–196]

* $p = 0.012$.

Conclusion: Application of CPAP of 5 and 10 cmH_20 during CPB improves oxygenation immediately after bypass compared to no CPAP, but the improvement is not sustained at 4 or 8 h postoperatively.

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A-227

The effect of an alveolar recruitment strategy during one lung ventilation and the response to PEEP

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Background and Goal of Study: We studied the effect of the alveolar recruitment strategy (ARS) on gas exchange during OLV and the effect of the positive end expiratory pressure (PEEP) on the extravascular lung water (ELWI) in patients under thoracic surgery.

Materials and Methods: Prospective observational trial that includes 10 cases of thoracic surgery with OLV. These data are preliminary because the study is still open. The ARS was applied selectively to the dependent lung after the thorax opening with the patient on lateral position. Previously we maintained the OLV ventilation: IPPV, VT 6–8 ml/Kg, PEEP:0, FR 12–16. ARS protocol: Respiratory frequency 15 rpm, PIP and PEEP were sequentially increased from 30/10 to 40/20 in steps. After ARS we maintained PEEP of 6 in all patients. The FiO_2 was the necessary to keep Sat $O_2 > 90\%$. Data collected: demographic, ASA, arterial blood gases, haemodynamic parameters with PICCO Plus, and respiratory parameters. The patients were studied at: (A)15 min after open thorax with OLV and just before ARS, (B) 15 minutes after ARS, (C)At the end of the surgery.

Results and Discussions: There are not differences in the demographic data. 60% were right lobectomy and 40% left lobectomy.

	Before ARS	After ARS	End of surgery
PaO_2	117 ± 0.7	147 ± 10	140 ± 2.8
Compliance	20 ± 4	28.5 ± 2.12	29 ± 2
ELWI	9 ± 4	7.5 ± 3	8.5 ± 2

80% of the patients improve the PaO_2 after the maneuver, At the beginning ELWI decreases but at the end of the surgery is similar to the previous value.

Conclusion: Our ARS is effective to improve the oxygenation and the respiratory parameters during OLV.

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A-228

Pressure control versus volume control ventilation during anesthesia – preliminary study

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Background and Goal: Pressure control ventilation (PCV) is a widely used mode of ventilation in mechanically ventilated patients in ICU. The goal of this prospective study is to access respiratory mechanics and arterial oxygenation at different patients during anesthesia under PCV versus volume control ventilation (VCV).

Materials and Methods: 17 ASA I–III, mean age 61.53 years, undergoing general anesthesia were studied. Laparoscopic surgery was excluded. Preoperative PaO_2 (mmHg) was recorded. Patients were ventilated by a Julian-Drager anesthesia machine with either VCV at settings: $FIO_2 = 0{,}5\%$, tidal volume 8–10 ml/kg, time I:E = 1:2, PEEP = 5, for 30 minutes. PaO_2, $PaCO_2$ (mmHg), airway pressures (mbar), $ETCO_2$ (*mbar*) and pulmonary compliance (Compl-ml/mbar), were recoded. Then the machine was switched to PCV adjusting to deliver the same settings as for VCV for 30 min and the same set of measurements performed. The percentage of difference of parameters between the two modes was calculated.

Statistical analysis was performed by independent samples T-test and bivariate correlation tables.

Results and Discussion: Data results (mean (SD) are shown in the table:

	VCV	PCV	% Change at PCV vs VCV	Corr preop PaO_2
PaO_2	166.6 (61.9)	173.7 (53.7)	2.2 (28.1)	0.03
$PaCO_2$	31.2 (3.3)	30.7 (2.8)	−0.8 (6.5)	0.19
$ETCO_2$	26.1 (3.2)	25.5 (2.8)	−2.0(13.3)	−0.36
P Peak	24.4 (4.7)	21.3 (4.9)	−13.4 (8.5)	−0.29
Compl	44.7 (13.1)	45.2 (13.6)	−0.1(8.5)	−0.16

There was no significant difference ($p > 0.05$) of measured parameters between PCV vs VCV. There was a wide range of percentages of change of measured parameters as seen in the table. There was no correlation found between preoperative PaO_2 and % change of measured parameters at PCV.

Conclusions: PCV can be used during anesthesia, as it seems to be similar to VCV. Investigations to determine the population who may benefit from this mode of ventilation may be useful.

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A-229

A new software for computed tomography lung measurement

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Background and Goal of Study: The use of computed tomography (CT) in the management of ALI/ARDS patients is quite common, due to the possible

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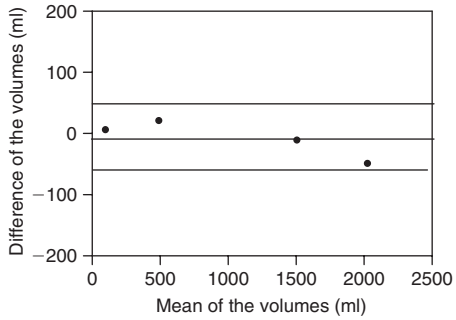
additional clinical informations and influence on patient's treatment. With the new spiral CT scan is possible to measure the total lung volume, the percentage of lung tissue and gas, being a linear correlation between the physical density and the CT coefficient of attenuation.

Aim of this study was to evaluate in vitro a new computer program "Maluna" (University of Mannheim, Germany) dedicated to measure the lung volume, weight and gas/tissue ratio.

Materials and Methods: A series of different known volumes of water (100, 500, 1500 and 2000 ml) were studied. In addition, the contrast material was diluted with water to obtain solutions of increasing concentrations (0, 0.5, 1, 1.5, 2.5 and 5%). The spiral CT was performed at 120 KV and 240 mA. Each CT section was manually delineated by a trained physician. The total volume was computed as the total number of voxels present in a given region times the volume of the voxels while the CT number was directly related to the physical density.

Results and Discussions: In the panel is shown the Bland Altman's analysis between the known volumes of water and the measured volumes by "Maluna". We found a linear correlation between the concentration of contrast material and CT attenuations read by Maluna ($r^2 = 0.99$, $Y = 2.6 + 83X$).



Conclusion(s): These data show that "Maluna" is able to correctly compute the volumes in a huge range and CT number.

A-230

Repeatibilty of the quantitative analysis of lung computed tomography in ALI/ARDS patients

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Background and Goal of Study: The CT scan allows an accurate morphologic analysis of an "ARDS" lung. In addition with the spiral CT it is also possible a quantitative analysis using dedicated software. However due to the necessity of a manually drawing of the lung (i.e., to include the lung parenchyma and to exclude big vessels, trachea, pleural effusion,…) it would be possible to increase the error of the analysis.

Aim of this study was to evaluate the accuracy of analysis between trained physician (4 medical doctor) and two radiology.

Materials and Methods: We enrolled 12 intubated sedated paralyzed ALI/ARDS patients (mean age 63.5 ± 16.9 years, BMI 24.1 ± 4.7 Kg/m^2, ventilated with a tidal volume of 532 ± 195 ml, PEEP 11.2 ± 1.9 cmH_2O, PaO_2/FiO_2 205 ± 57).

The CT scan was performed independently from this study.

CT scan was done, in static conditions, at end expiration 5 or 15 cmH_2O of PEEP and at end inspiration 45 cmH_2O of airway pressure. The exposures were taken at 120 KV and 250 mA.

The lung volume, weight and the distribution of lung weight between the different compartments was measured using the "Maluna" software (University of Mannheim, Germany).

Results and Discussions: Results are expressed as mean ± standard deviation.

	Physicians	Radiology
Total volume (ml)	3956 ± 1608	3598 ± 1654
Total weight (mg)	1419 ± 471	1391 ± 449
Weight hyperinflated (mg)	41 ± 79	41 ± 82
Weight normally inflated (mg)	442 ± 160	440 ± 164
Weight poorly inflated (mg)	439 ± 269	419 ± 270
Weight not inflated (mg)	496 ± 350	489 ± 362

Conclusion(s): These show that the quantitative analysis although required a physician to manually drawing the region of interest of the lung, present a very low of inaccuracy.

A-232

The variability of indices of oxygenation

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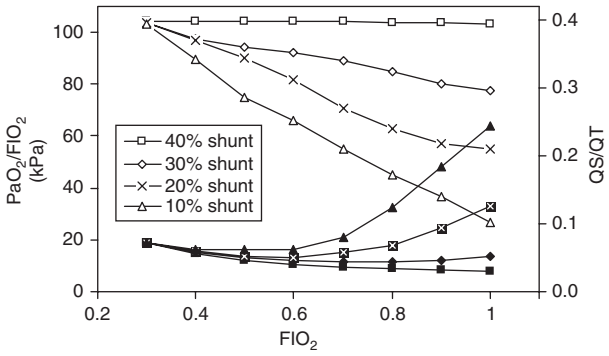
Background and Goal of Study: Quantification of the impairment of oxygenation allows monitoring of critically ill patients' disease severity and treatment efficacy and allows stratification for research. Current indices include PaO_2/FIO_2 and venous admixture (QS/QT). Although these have been shown to be dependent upon FIO_2,[1] they are widely used. Previous investigators used a lung model to examine the effect of FIO_2 on PaO_2/FIO_2 and QS/QT.[1] The model lacked tidal ventilation and hypoxic pulmonary vasoconstriction (HPV). Our aim was to re-examine the relationship using a sophisticated pulmonary model.

Materials and Methods: Extra-pulmonary shunt fractions of 10–40% of cardiac output were set in a validated, computational model of the human respiratory system,[2] and ventilation-perfusion defects were added to attain a measured shunt fraction of 40% of cardiac output at FIO_2 0.3. Tidal volume was adjusted to set $PaCO_2$ at 5.1 kPa at FIO_2 0.3. We varied FIO_2 from 0.3 to 1.0 and recorded the resulting values of PaO_2/FIO_2 and QS/QT.

Results and Discussion: In the figure, open symbols describe QS/QT and solid symbols describe PaO_2/FIO_2. Both varied with changing FIO_2. The induced variation in PaO_2/FIO_2 and QS/QT differed from previous findings.[1]



Conclusion(s): PaO_2/FIO_2 and QS/QT do not independently quantify oxygenation-defect. We suggest that our results disagree with previous work because of the incorporation into our model of HPV and tidal ventilation.

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A-233

Intraoperative lung water changes: correlation with pulmonary edema after liver transplantation

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Background and Goal of Study: In patients undergoing orthotopic liver transplantation (OLT), intrathoracic blood volume (ITBV) has been shown to increase after reperfusion and to influence pulmonary function (1). Pulmonary edema is common after OLT and will influence postoperative recovery in transplant patients (2). This study was designed to determine the incidence of radiological pulmonary edema in the first 24 hours after transplantation and its relationship with intraoperative extravascular lung water (ELWI) changes.

Materials and Methods: We reviewed 87 chest radiographs from 29 patients who had undergone OLT, obtained before surgery, immediately after surgery and 20–24 hours after surgery. Films were assessed for evidence of pulmonary edema using a standarized system (3). ITBV and ELWI were

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determined using the PiCCO system, pulmonary capillary wedge pressure (PCWP) was monitored through a pulmonary artery catheter. Volumetric, hemodynamic and oxygenation index changes (Δ) were collected intraoperative and at the times the 2 postoperative films were obtained. Blood loss, duration of ventilation and ICU stay was also recorded.
Results and Discussions: The incidence of postoperative pulmonary edema (PE) was 55%.

	No PE (n = 13)	PE (n = 16)
Child's class (A/B/C)	2/5/6	3/6/7
ICU stay (days)	8.4 ± 5	11.2 ± 8
Ventilation (hours)	5.5 ± 1.7	110 ± 117*
Blood loss (L)	3.5 ± 2	3.2 ± 1.9
ΔELWI (%)	16 ± 24	49 ± 49*
ΔPCWP (%)	37 ± 43	31 ± 26
ΔPaFi (%)	26 ± 16	34 ± 17

Results in mean ± SD. *P < 0.05.

Conclusion(s): Postoperative radiological edema was found in 55% of patients and was associated with longer ventilatory support and with intraoperative increases in ELWI. Monitoring ELWI changes may predict patients at risk for pulmonary edema after liver transplantation.
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A-234

The effect of lung-protective ventilation – a new viewpoint of pathological share forces

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Background and Goal of Study: "Open up and keep the lung open" (1) is a discussed concept in the last years of lung protective ventilation avoiding share forces by cyclic reopening of atelektasis. Explaining normal lung volume change by alveolar recruitment/decruitment (R/D), there is a discrepance for understanding ventilator induced lung injury (VILI).
Materials and Methods: In a mathematical model we define two populations with different surfactant concentrations, that means with a different opening and closing behavior. Pressure-dependent compliance curve represents a normal distribution of opening pressures. PV-Diagram represents the sigmoid integral curve of distribution, that means the number of opened/closed alveolar units at a defined transpulmonary pressure tp.
Results and Discussions: In a R/D-Model we have stable situations in the regions of the asymptotes of the PV-curve: most of alveolar units are opened or closed. The inflection point reflects the most instable state: a little drop of tp leads to a great change of opened or closed alveolar units. In a region with nearly the same surfactant content, this will not produce a great number of shear forces, so that a ventilation with a drop of tp within the mean alveolar opening pressure of the second population (high PEEP, low driving pressure) will have a lung-protective character. A ventilation with a drop of tp having a span from one mean alveolar opening pressure of the first population to the other of the second population, will produce pathological share forces with VILI.
Conclusion(s): Lung-protective ventilation can be explained by avoiding pathological share forces between two different populations (with their own R/D-behavior) maintening the simple R/D-Model for lung volume change in accord with visualizing studies of the last years (2,3).
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A-235

Functional residual capacity assessment during open and closed tracheo-bronchial suctioning

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Background and Goal of Study: The method of functional residual capacity (FRC) evaluation by oxygen washout is applicable routinely at bedside, in controlled ventilation as well as in spontaneous breathing patients (1). We studied the impact of two different suctioning methods on FRC.
Materials and Methods: The LUFU system (Draeger, Luebeck, Germany) estimates FRC by oxygen washout, a variant of multiple breath nitrogen washout. A sidestream O_2-analyser calculates FRC from the end-inspired and end-expired O_2 concentrations during fast changes of FiO_2. After approval of the local ethics committee and written informed consent we measured FRC six times (measuring interval 4 min.) in postoperative cardiac surgery patients without pre-existing lung diseases during 6 hours after surgery; 3 times before (the mean defined as basal value (pre)) and 3 times after (t1, t2, t3) a standard suctioning procedure (20 sec, 14 F catheter, 200 mmHg negative pressure). The patients were ventilated with biphasic airway pressure ventilation. The control group (n = 7) was disconnected from the ventilator during suctioning (Open suctioning [OS]), while in the intervention group (n = 7) a closed-suctioning system (Kendall Comp., Mansfield, USA) was used and so positive airway pressure was maintained (Closed suctioning [CS]).
Results and Discussions: There were no technical problems during measurements. FRC remained unchanged in group CS (3,3 ± 1,5 l (pre); 3,4 ± 1,2 l (t3) (n.s.)) and decreased significantly in group OS (3,3 ± 1,5 l (prä); 2,9 ± 1,5 l (t2), p = 0,028; 3,0 ± 1,3 l (t3), p = 0,018) (Mean ± SD, Wilcoxon-Test). There were no differences between the two groups at any time point. There were strong inter individual differences in both groups, not only in total values, but also concerning the time course after OS or CS.
Conclusion(s): OS reduces FRC immediately after suctioning. The consequences of different suctioning procedures cannot be predicted because of strong inter individual differences, so it seems to be of considerable interest to measure FRC in ventilated patients routinely. Larger studies are recommended to address this issue.
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A-236

Elimination of PFC during partial liquid ventilation in open and closed breathing systems

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Background and Goal of Study: So far, partial liquid ventilation has only been performed with open breathing systems. The elimination of perfluorocarbons (PFC), which is mainly due to evaporation via the bronchial system, is determined by its physical and chemical properties as well as the ventilatory settings (1). We tested the hypothesis that the amount of eliminated PFC can be significantly reduced by closed circle ventilation. Moreover, we examined whether the use of a heat and moisture exchanger (HME) influences the elimination rate. This is clinically relevant as the eliminated PFC volume needs to be replaced during partial liquid ventilation.
Materials and Methods: With approval of the local District Animal Investigation Committee, male Wistar rats (n = 7) were anaesthetised with ketamine. The trachea, heart and lungs were removed en bloc and suspended from a force transducer. The lungs were ventilated with a tidal volume of 10 mL/kg, a respiratory rate of 40 breaths per minute and an I/E-ratio of 1:1 with an open breathing system (FiO_2 = 0,21). Thereafter, PFC was instilled into the trachea (10 mL/kg) and the evaporative loss was determined by means of change in lung weight. After baseline values have been reached, the same amount of PFC was again instilled and the lungs were then ventilated with a closed circuit system. In additional pilot lungs (n = 3) the same amount of PFC was instilled and the lungs were ventilated with an open breathing system with an HME attached between the tracheal tube and the respirator.
Results and Discussions: The elimination half-life of PFC during partial liquid ventilation was significantly longer in a closed circle system than in an open breathing system. (557 ± 179 min. vs. 83 ± 7 min, mean ± SD; p < 0,001, t-test). Longer half-lifes (above 10 hours) were also observed with an HME.
Conclusions: Ventilation with a closed circle system significantly reduces perfluorocarbon elimination during partial liquid ventilation. Similar effects are observed with an HME.
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A-237

Combined application of perfluorohexan vapor and optimization of PEEP does not improve oxygenation significantly

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Background and Goal of Study: The inhalative application of perfluorohexan vapor (PFH) improves oxygenation and mechanical lung function in oleic acid-induced lung injury [1,2]. The surfactant-like characteristics of PFH have been discussed as a possible explanation. A study using a surfactant-depletion injury model showed less positive effects [3]. The aim of this study was to determine the effects of PFH on oxygenation and relative lung perfusion distribution (Qrel) at different PEEP levels.

Materials and Methods: All experiments were performed in accordance with local Government Guidelines. After induction of anaesthesia 15 rabbits were ventilated (volume controlled $FiO_2 = 1.0$; PEEP = 5 mmHg) and monitored. Lung injury was induced with NaCl-lavage. After randomization eight animals were treated with 18 vol% PFH, 7 animals served as control (CTR). Every 60 min PEEP was increased by 5 mmHg. The distribution of Qrel was determined with fluorescent microspheres. Statistical analysis was performed with ANOVA for repeated measures and Kaplan Meier survival rate analysis with Log-Rang-statistics. $p < 0.05$ was considered to be significant.

Results and Discussions: The increase of PEEP led to a significant increase in arterial pO_2 ($p < 0.001$, no between group difference). Lethal effects were observed only after an increase to a PEEP of 15 mmHg. Ventilation pressure was similar in both groups. CTR animals perished significantly earlier than CTR (5/7 vs. 1/8, $p = 0.03$). In the PFH group a Qrel equilibration between caudad and cranial and a redistribution from hilus to peripheral regions was observed ($p = 0.03$).

Conclusion: Additional application of PFH does not improve oxygenation while optimizing PEEP in comparison to control animals. PFH application with high PEEP leads to significant changes in Qrel. PFH treated animals tolerated higher PEEP levels than controls.

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A-238

Extrapulmonary effects of the oleic acid lung injury model

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Background and Goal of Study: Oleic acid (OA) lung injury is thought of as a local lung injury model. We tested the hypothesis that OA infusion, besides its pulmonary effects, has intrinsic effects on intestinal circulation, metabolism and oxygenation. Further, we aimed to study the distribution of OA to extrapulmonary tissues.

Materials and Methods: 17 juvenile female pigs were studied. 4 animals received ^3H labeled OA, 7 animals received OA and 6 animals served as controls. OA 0.1 ml/kg was given as a 30 minute infusion. In the 4 animals receiving ^3H OA the experiment was terminated 45 minutes after OA infusion, and tissue samples from lungs, liver, stomach, jejunum and colon was analyzed for ^3H OA radioactivity. In the other 2 groups animals were followed for 240 minutes with measurements of portal blood flow, jejunal mucosal perfusion, jejunal tissue oxygenation, mesenteric lactate flux and mesenteric oxygen delivery and extraction.

Results and Discussions: OA was found in all tissues studied, albeit in small amounts in the intestines (Table 1).

Table 1. % recovered ^3H activity of given dose.

Lung	16,6 ± 3,4
Liver	9,0 ± 0,5
Stomach	0,3 ± 0,1
Jejunum	1,0 ± 0,3
Colon	0,4 ± 0,1

OA infusion caused a moderate lung injury with expected pathophysiological circulatory and ventilatory derangements. For a given mesenteric oxygen delivery, mesenteric oxygen uptake was consequently higher after OA infusion in the OA group than in the control group.

Conclusion(s): OA is distributed in small amounts to the intestine in the OA lung injury model. We found an increase in mesenteric oxygen uptake relative to delivery in the OA group, possibly due to local inflammation.

Acknowledgement: We wish to thank Professor Gunilla Olivecrona and Professor Björn Biber for valuable exchange of ideas.

A-239

Endothelin-1 impairs alveolar liquid clearance and accelerates edema formation in normoxia and hypoxia

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Background and Goal of Study: Noncardiogenic pulmonary edema occurs in many clinical conditions associated with alveolar hypoxia (e.g. acute lung injury, drug side effects) or high-altitude exposure. The basic mechanisms leading to edema formation remain uncertain and might include increased capillary pressure, altered vascular permeability, and reduced alveolar liquid clearance. Because endothelin-1 (ET-1) plasma levels are elevated during hypoxia, we investigated the effects of ET-1 on hypoxic pulmonary edema formation in isolated ventilated and perfused rat lungs.

Materials and Methods: Lungs were perfused with albumin-containing salt solution at constant hydrostatic pressure and exposed to normoxia (N) or hypoxia (H, 1,5% O_2) with or without ET-1 (0,8 μM) added to the perfusate. To assess pulmonary edema formation, increases in lung weight and survival time (time until tidal volume decreased to 0) were monitored. Microvascular pressure was measured by double occlusion. In separate experiments, net fluid transport across alveolar epithelium was estimated by measuring the reabsorption of instilled buffer that contained FITC-dextrane as alveolar marker.

Results and Discussion: H and ET-1 accelerated lung weight gain (minutes ± SEM to reach 1000 mg: N 261 ± 17; H 175 ± 20, ET-1 157 ± 12; $p < 0{,}003$, One-Way ANOVA) and reduced lung survival time (H 53,4 ± 8,9% and ET-1 45 ± 3,4%; $p < 0{,}001$). Fluid reabsorption was +23,9 ± 9,7% in N. In contrast, H (−19,4 ±13,8%) and ET-1 (−23,1 ± 13,7%) caused net fluid accumulation ($p < 0{,}05$). These effects were aggravated by combination of H with ET-1. ET-1, but not H, increased microvascular pressure (11 ± 1,5 vs. N 1,5 ± 0,5 cm H_2O; $p < 0{,}001$) and alveolar protein concentration (236 ± 61% vs. N; $p < 0{,}05$), indicating that a hydrostatic component with increased vascular permeability contributes to ET-1-(but not necessarily to H-) induced pulmonary edema.

Conclusions: This is the first study indicating that ET-1 reduces alveolar liquid clearance, a mechanism that, in combination with increased pulmonary microvascular pressure and increased vascular permeability, might contribute to formation of pulmonary edema. Hypoxia seems to aggravate the effects of ET-1.

A-241

Increased pulmonary PDE activity is responsible for hyporesponsiveness to inhaled nitric oxide

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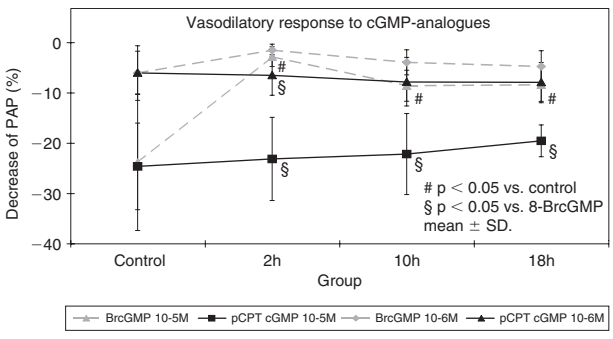
Background and Goal of Study: Pulmonary hyporesponsiveness to inhaled nitric oxide (iNO) is an unresolved clinical phenome (1). Pulmonary vasoreactivity (pVR) to iNO is impaired in rats 2–18 hours after Lipopolysacharid (LPS)-challenge (2). The goal o this study was to test the role of the PDE in endotoxemia by application one PDE sensitive (8-Br-cGMP) and one insensitive (8-pCPT-cGMP) cGMP analogue in isolated lungs over 24 h.

Materials and Methods: Adult Sprague-Dawley rats (300–350 gm BW) were injected i.p. with (n = 34) or without (n = 9) 0.5 mg/kg *E.coli* 0111:B4 LPS. 2, 10 and 18 h after LPS, lungs were isolated perfused. Then, pulmonary artery pressure (PAP) was elevated by 6–8 mmHg using U46619. Change of PAP (%) in response to 10^{-6} M and 10^{-5} M of cGMP analogues was measured.

Results and Discussions: In controls both analogues induce an equal pVR. In LPS-treated rats no change of pVR to 8-pCPT-cGMP at 2, 10 or 18 h compared to untreated controls was detected. In contrast, 8-Br-cGMP resulted only in a slight pVR 2, 10 and 18 h after LPS-challenge.



# $p < 0.05$ vs. control, § $p < 0.05$ vs. 8-B-rcGMP; mean ± SEM.

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Conclusion(s): The pVR after 8-Br-cGMP in isolated perfused lungs after LPS-stimulation is reduced compared with lungs treated with 8-pCPT-cGMP indicating an increased PDE activity in the lung in endotoxemia over 18 h. Especially in early endotoxemia this mechanism could play an important role in the development of hyporesponsivenss to iNO.

References:

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A-242

Anti-inflammatory effect of sevoflurane in endotoxin-induced lung injury

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Background and Goal of Study: Endotoxin-induced lung injury is a very useful experimental system for the characterization of immunopathogenic mechanisms in acute lung injury. The inflammatory response of alveolar epithelial cells (AEC) to lipopolysaccharide (LPS) has been shown in previous studies (1). Although tracheal, bronchial and alveolar epithelial cells are exposed to volatile anaesthetics throughout the duration of anaesthesia, only rare data exist about the effect of anaesthetics on these lung cells. The purpose of this study was to investigate the effect of the volatile anaesthetic Sevoflurane on LPS-injured AEC.

Materials and Methods: AEC cells were exposed to 1.1 Vol. % Sevoflurane for 0.5 h (control group without Sevoflurane), followed by LPS stimulation for 5 h (or stimulation with phosphate-buffered saline as a control). Proteins from chemoattractant protein-1 (MCP-1), cytokine-induced-neutrophil-chemoattractant-1 (CINC-1), and macrophage inflammatory protein-1β (MIP-1β) were analysed in the supernatant with ELISA and Western blot technique. In addition, chemotaxis assays were performed with neutrophils. Analysis of variance (ANOVA) was used to assess the statistical significance of differences.

Results and Discussions: Exposing cells to Sevoflurane showed a 50% downregulation of MCP-1 protein in the Sevoflurane-LPS group compared to Non-Sevoflurane-LPS cells ($p < 0.05$). CINC-1 concentration in LPS-stimulated cells decreased by 20% ($p < 0.05$) with Sevoflurane pre-treatment, MIP-1β concentration by 32% ($p < 0.05$). Chemotaxis assays showed less chemotactic activity in Sevoflurane-treated LPS cells (33% decrease, $p < 0.001$).

Conclusion(s): This study shows for the first time a protective effect of the volatile anaesthetic Sevoflurane regarding production of inflammatory mediators in the LPS-induced lung injury.

Reference:

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Acknowledgement: This grant was supported by Abbott, Switzerland, and the Lungenliga, Switzerland.

A-243

Regulation of the cellular expression of the new lung-specific protein hypoxia-induced mitogenic factor (HIMF)

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Background and Goal of Study: In chronic hypoxia, the integrity of the alveolar-capillary unit of the lung is disturbed. Hypoxia Induced Mitogenic Factor (HIMF) has been implicated in the cellular proliferation during lung maturation as well as in chronic hypoxic lung disease. To date, little is known about the factors regulating HIMF.

Materials and Methods: Therefore, cell line screening for HIMF expression, recombinant HIMF over-expression, siRNA and two-hybrid analysis were employed to approach HIMF expression regulation.

Results and Discussions: Recombinant, tagged HIMF was produced in a cartridge system. To standardize the different batches of recombinant HIMF a bioassay using adipocytes was developed. Primary rat type II pneumocytes showed little HIMF expression at baseline but hypoxia (3% O_2) significantly induced HIMF protein. Since HIMF has a n-terminal secretion sequence we were interested to analyze the cellular pathways of HIMF secretion. Using siRNA technology we investigated the effect of a knock down of components of the protein transport pathway on HIMF secretion.

Conclusion(s): We characterized in detail factors of the regulation of HIMF expression. Interference with HIMF secretion might prevent pulmonary remodeling characteristic of chronic obstructive lung disease.

Reference:

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Acknowledgement: Supported by the University Luebeck (KFW) and the NIH (to DL, KFW R01 HL75755-01).

A-245

The influence of acute hypercapnia and priming of 10 ng/kg endotoxin on oxidative metabolism of bronchoalveolar lavage-derived alveolar macrophages in mechanically ventilated rabbits

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Background and Goal of Study: Permissive hypercapnia can attenuate tissue injury connected with phagocyte stimulation and respiratory burst. It is also known that endotoxin (LPS) translocation and mechanical ventilation might modify the function of phagocytes and reactive oxygen intermediates (ROI) production. In this study we investigated endotoxin priming stimulation on rabbit's alveolar macrophages (AM) derived from bronchoalveolar lavage (BAL) after normocapnic and isooxic hypercapnic mechanical ventilation.

Materials and Methods: The 40 Chinchilla rabbits were randomised into 4 groups: normocapnia (N), normocapnia with endotoxin (NE), hypercapnia (H), hypercapnia with endotoxin (HE) were anaesthetised with sodium pentobarbital and intubated. After 30 min 10 ng/kg LPS Escherischia coli was intravenously injected in the NE and HE groups. In the H and HE groups 5% CO_2 was added to the mixture of air and O_2 during ventilation and created $PaCO_2$ between 8–10.7 kPa. After 4 hrs of mechanical ventilation the bronchi were rinsed with 40 mL of isotonic saline. BAL cells were counted. Luminol-dependent chemiluminescence (ChL) was used to estimate the hydrogen peroxide production with activating stimuli: zymosan (ZY), phorbol myristate acetate (PMA) and N-formylmethionyl-leucyl-phenylalanine (fMLP). Results were analysed by Kruskal-Wallis and Dunn tests.

Results: Data (Mean and SD) are shown in the table.

	AM/BAL 1×10^6/mL	ChL ZY (Vs)	ChL PMA (Vs)	ChL fMLP (Vs)
N	$0.7 \pm 0.51^{*\#}$	9.97 ± 9.57	4.25 ± 5.67	4.62 ± 5.98
NE	$2.47 \pm 0.84^{\#}$	30.04 ± 17.01	10.76 ± 10.77	11.10 ± 13.11
H	$0.31 \pm 0.34^{*\#}$	21.93 ± 27.75	14.66 ± 11.00	8.12 ± 5.23
HE	$1.8 \pm 1.30^{*}$	8.78 ± 5.41	2.07 ± 1.98	3.0 ± 0.82

$^{*}p < 0.005$ HE vs N and H; $^{\#}p < 0.005$ NE vs N and H.

Conclusions:

1. Acute hypercapnia does not influence the alveolar macrophages count and hydrogen peroxide production.
2. Priming with 10 ng/kg of LPS increased the alveolar macrophages number in BAL, in mechanically ventilated rabbits without direct impact on BAL cells oxidative metabolism.

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Transtracheal ventilation at different degrees of upper airway obstruction evaluated with a mechanical lung model

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Background and Goal: In a "can't intubate, can't ventilate" crisis insertion of an endotracheal tube (ETT) through the cricothyroid membrane can be live-saving (1). We studied the performance of 4.0 and 6.5 uncuffed ETTs at different degrees of upper airway obstruction and lung conditions using a mechanical lung model (VT-1).

Materials and Methods: The VT-1 (Bio-Tek, USA) can simulate normal lung, COPD and emphysema. Corrugated tubing was used as a tracheal model and connected to the inlet (internal diameter (ID) 12 mm) of the VT-1. A Y-piece was attached to the top of the "trachea". Through one arm ETTs were inserted via a seal until tip was mid trachea. At the other arm different degrees of outflow obstruction from total to no obstruction were set. Ventilation was with an Ambu Bag, using both hands, and uncuffed ETTs size 4.0 and 6.5.

Results and Discussions: With 100% outflow obstruction both ETTs 4.0 and 6.5 provided adequate ventilation regardless of the underlying lung condition. With an ETT 4.0 tidal volumes of over 750 mls and minute volumes of over 8 l/min were achieved. ETT 6.5 achieved similar tidal volumes, but higher minute volumes of over 12 l/min. With less obstruction more air bypassed the ETT on inspiration with decrease in lung ventilation. Ventilation of normal lungs with an ETT 4.0 and 50% obstruction (ID 6 mm) reduced tidal volumes to around 200 mls with a corresponding minute volume of

around 6.5 l/min. 50% obstruction in COPD and emphysema caused a drop in tidal volumes to around 100 mls and 80 mls respectively. Minute ventilation dropped below 2 l/min. At low levels of obstruction minute volume approached zero. A similar pattern of worsening ventilation was recorded for the ETT 6.5 although the critical level of obstruction at which ventilation becomes inadequate is lower.

Conclusion: The use of uncuffed ETTs (4.0, 6.5) in transtracheal ventilation with partial or no upper airway obstruction led to ineffective ventilation, in particular with pre-existing lung disease. Complete upper airway obstruction or the use of cuffed ETTs resulted in effective ventilation.

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A-247

High frequency jet ventilation for airway control in patients with short fat neck

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Background and Goal of Study: Standard mechanical ventilation (SMV) through endotracheal tube (ETT) is widely used for percutaneous tracheostomy (PCT). Short fat neck (SFN) is considered as a relative contraindication for PCT, mainly because of possibility for airway complications. We decided to examine our experience of airway control and ventilation by SMV and by high frequency jet ventilation (HFJV) during PCT in patients with SFN and to determine which is more effective.

Materials and Methods: From January 1998 to June 2000, 23 patients (pts) with SFN underwent PCT by Griggs technique with SMV and from July 2000 to November 2001, 25 pts with HFJV. One trained team performed all the PCT. In the HFJV group, a Cook catheter was inserted through the existing ETT into the upper part of trachea and HFJV was initiated by a special ventilator AMS-1000 ACUTRONIC. Then ETT was withdrawn into the mouth along the catheter. When PCT was finished, the Cook catheter was removed together with ETT. During PCT continuous routine monitoring and repeated blood gases were performed.

Results and Discussions: There was no significant statistically difference between the two groups in the sizes of the neck (mean, median, range, $p = 0.9$) and distance between cricoid and sternal notch (mean, median, range, $p = 0.8$) Duration of the procedure for the two groups was identically. When SMV was used, impaling of ETT and cuff rupture has happened in one case, displacement of ETT into the pharynx took place in 3 cases (due to short larynx). Air leak from larynx around ETT and additional egress of air from tracheotomy site during the time of the dilation was the reason for pronounced desaturation in 7 pts. PCT with HFJV passed smoothly: small air leak did not influence on the level of oxygenation, only an increase in $PaCO_2$ values in acceptable limits was found. The difference between SMV and HFJV was statistically significant ($p < 0.001$).

Conclusion(s): SMV can not always supply necessary conditions for PCT in pts with SFN and there are possibilities for development of serious complications. HFJV through Cook catheter provides optimal conditions for manipulation on SFN, secures success of the procedure and prevents potential airway complications.

A-248

Measurement of movement of field of illumination provided by laryngoscope blades under tension

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Background and Goal of Study: Direct laryngoscopy is the most common technique used to intubate the trachea. In recent years concerns about risks of cross-infection have led to the increasing use of disposable laryngoscope blades. The International Organization for Standardization (ISO) proposed a working draft to measure the movement of the field of illumination provided by laryngoscope blades under tension [1]. We carried out this test on both metal and plastic disposable blades.

Materials and Methods: We assessed 14 adult and 12 paediatric laryngoscope blades from various manufacturers comparing the shift in illumination under tension (58 N) to that recommended in the ISO draft. The draft proposed that there should not be more than 12 mm shift of luminal edge. The shift in the tip of illuminated edge was manually measured by using standard graph paper marked in millimetres.

Results and Discussions:

Type of Blades	Range of shift of luminal edge (mm)
Disposable plastic adult blades (9)	11–29
Disposable metal adult blades (4)	4–15
Re-usable metal adult blade (1)	5
Disposable plastic paeds blades (6)	8–37
Disposable metal paeds blades (6)	5–9

Conclusion(s): This study suggests that the disposable blades especially the plastic ones did not meet the standard test for movement of the field of illumination as proposed by the ISO draft. In addition the test for illumination at rest for the disposable blades did not produce a well demarcated luminal edge. In conclusion most plastic blades would not comply with the standard if it were accepted.

Reference:

1 ISO TC 121/SC 2/N778; www.iso.org

A-249

Evaluation of disposable Miller 1 laryngoscope blades

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Background: Disposable laryngoscope blades have been introduced into the market to reduce risk of cross-infection. However, the performance of these blades may vary [1]. Our study evaluated user satisfaction and performance offered by different disposable metal (m) and plastic (p) Miller 1 blade.

Materials and Methods: 36 participating anaesthetists were asked to perform laryngoscopy to achieve a Cormack and Lehane Grade 1 view of the vocal cords in a Laerdal paediatric intubating manikin. Time taken to achieve the best view at laryngoscopy was recorded. Anaesthetists also made subjective assessments on a visual analogue scale (0–100 mm) for field of view (FOV), perceived build quality (BQ) of the blade and their willingness to use the blade in an emergency situation (ES).

Results: Median [IQR]

Blade	m/p	FOV	BQ	ES	Time [s]
Timesco Europa	m	86 [9]	86 [16]	81 [16]	4 [1]
Timesco Callisto	m	86 [15]	84 [20]	77 [26]	4 [2]
Proact M'max 100	m	83 [18]	86 [19]	79 [29]	5 [1]
Truphatek Greenlite	m	82 [14]	80 [16]	70 [21]	5 [1]
Reusable Miller 1	m	81 [13]	83 [14]	78 [22]	5 [2]
Proact Metalmax 90	m	80 [13]	85 [17]	77 [20]	4 [2]
Proact M'max GS90	m	77 [25]	80 [23]	69 [33]	4 [1]
Timesco Optima	p	67 [33]	40 [41]	37 [36]	5 [2]
Penlon Crystal	p	64 [50]	37 [35]	33 [33]	6 [2]
Vitalview	p	57 [45]	22 [29]	24 [35]	5 [3]
Intersurgical	p	55 [51]	33 [39]	27 [37]	6 [4]
Truphatek Liteblade	p	46 [39]	36 [30]	23 [36]	7 [5]
Friedman	**p=**	**<0.001**	**<0.001**	**<0.001**	**<0.001**

Conclusion: Not all disposable blades offer similar performance. Anaesthetists appear to prefer metal over plastic disposable blades.

Reference:

1 Anderson, KJ. *Anaesthesia* 2002; **57**: 773.

Acknowledgement: Grant from Royal College of Anaesthetists, Great Britain.

A-250

Laryngoscope assisted orotracheal fibreoptic intubation in anticipated difficult airways

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Background and Goal of Study: Orotracheal fibreoptic intubation (OFI) under general anaesthesia, without the use of intubating airways, requires manoeuvres or instruments to clear the airway (1, 2). The study compared OFI when using the Macintosh laryngoscope (ML) or lingual traction plus jaw thrust (LT) to clear the airway.

Materials and Methods: Following ethics committee approval and informed consent, 30 adult ASA class I or II, patients with at least one difficult intubation criteria (3), received standardized general anaesthesia (comprising fentanyl, propofol, atracurium, oxygen, nitrous oxide, isoflurane) and were randomly allocated to the ML or LT groups for OFI. A stopwatch (lap) recorded preparation time (from mask removal to starting endoscopy),

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endoscopy time, railroading time and total intubation time (to CO_2 detection). Cardiovascular responses were recorded for each group.

Results and Discussions: Time data, in seconds, are shown in the table (Mean (SD) [range] *P < 0.05):

Time phase	LT	ML
Preparation	13 (2.3)[9–17]	9.6* (2.9)[6–16]
Endoscopy	11 (3)[6–17]	8.7* (2.1)[6–13]
Railroading	7.1 (1.7)[5–10]	5.5* (2)[2–9]
Total intubation	35 (3.9)[26–41]	28* (5.8)[22–41]

All phases of the intubation were completed more quickly when using the ML to clear the airway during OFI. There were no significant differences in cardiovascular responses between the two groups.

Conclusion(s): The ML facilitates the location of the glottis with the fibrescope, insertion of the scope into the trachea and reduces difficulty in railroading the tracheal tube. The ML technique appears to be a useful and more familiar alternative for managing difficult intubation than the lingual traction plus jaw thrust technique, though two anaesthetists are required to carry it out.

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A-251

Efficacy of the intubating laryngeal mask and direct laryngoscopy for airway management by inexperienced personnel

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Background and Goal of Study: Establishing a patent airway is the primary aim during general anesthesia as well as in emergency medicine. While tracheal intubation is considered the "gold standard", it requires adequate skill to secure the airway. We compared the ability of inexperienced personnel to intubate the trachea using a laryngoscope or an intubating laryngeal mask (ILM).

Material and Methods: Before commencing the study, the investigator explained the theoretical use and practice of both techniques and demonstrated it on an airway management trainer manikin. 38 health workers with no intubating experience attempted tracheal intubation using in turn a laryngoscope and an ILM on the airway management trainer manikin. The variables recorded were the number of attempts to achieve correct placement and the time taken to achieve the first two adequate ventilations with both devices. Ventilation was deemed satisfactory when there was visible chest expansion.

Results and Discussion: Of the 38 participants, 34 (89.5%) correctly positioned the ILM on their first attempt while the other 4 were successful on their second attempt. 32 participants (84.2%) successfully intubated via the ILM on their first attempt and 6 on their second. Of the intubation attempts using direct laryngoscopy, 24 participants (63.2%) were successful on their first attempt, 10 (26.3%) on their second and 4 (10.5%) on their third attempt. The mean time for effective intubation and adequate ventilation via the ILM was 21.8 s while mean time for intubation via direct laryngoscopy was 36.2 s ($p < 0.05$). In the questionnaires, most participants indicated that they found tracheal intubation easier with the ILM than with direct laryngoscopy.

Conclusions: Taking into consideration our results it seems that the ILM is a more effective mean of airway management and tracheal intubation when used by inexperienced health workers.

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Which of cricoid pressure techniques is better in order to laryngoscopic view and intubation time?

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Background and Goals: Cricoid pressure (Sellick's maneuver) may alter laryngoscopic view during tracheal intubation (1, 2). This study was performed to compare the different techniques of cricoid pressure (CP) with regarding to the laryngoscopic view and intubation time.

Material and Methods: After ethics committee approval and informed consent, this clinical-trial study was performed on 142 patients, aged 18–65 years of ASA I, II presenting for routine surgery requiring tracheal intubation. These patients randomly divided to 4 groups based on types of CP (A: one-handed CP using thumb, index and middle fingers, B: one-handed CP using index and middle fingers and the heel of hand on the sternum, C: two-handed CP using A technique with another hand below the neck, D: two-handed CP using C technique with a pillow below the neck). Laryngoscopic view was determined after induction, laryngoscopy and CP. All patients were checked for intubation time, Mallampatti score, thyromental distance and teeth condition. Statistical analysis was performed by using chi-squared, wilcoxon and kruskal-wallis test.

Results: Data (N, %) are shown in the table based on changes of views grading. There was no difference between all groups in order to intubation time.

	A	B	C	D	Total
One grade worse	1(3)	1(3.2)	0	2(6.1)	4(3.1)
No change	15(45.5)	24(77.4)	18(60)	21(63.6)	78(61.4)
One grade improve	15(45.5)*	6(19.4)	11(36.7)	10(30.3)	42(33.1)
Two grade improve	2(6.1)	0	1(3.3)	0	3(2.4)
Total	33	31	30	33	127(100)

*P < 0.05 vs other groups, Kruskal-Wallis test.

Conclusions: Cricoid pressure is likely to improve the laryngoscopic view. The one hand CP in which downward pressure was applied with the index finger over the cricoid cartilage, with the thumb and middle finger either side can cause the best views at laryngoscopy without significant effect on time to intubation.

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A-253

A simple technique to correct malpositioning of a left-sided double-lumen tube by paradoxical fiberoptic guidance

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Background and Goal of Study: Deviation of the double-lumen tube from a bronchus during differential ventilation is not unexpected, frequently causing hypoxemia and cardiovascular instability. Since repositioning of this tube is not so easy, we designed a new, simple technique for correct re-insertion of the left-sided double-lumen tube (LsDLT).

Materials and Methods: Patient requiring one-lung ventilation (lobectomy, partial resection and lung biopsy) were intubated using a left-sided double-lumen tube (Broncho-Cath™; Mallinckrodt Anesthesiology, St-Louis MO, USA) in Shinshu University Hospital. The correct position of the LsDLT was verified by bronchoscopic inspection. In 13 patients, a secondary dislocation of the LsDLT occurred. The following technique was designed:

First, we inserted a fiberoptic bronchoscope (Olympus LFTP; diameter = 28 mm; Olympus Optical Co Ltd, Tokyo, Japan) into the *tracheal lumen* without removal of LsDLT. Next, this fiberscope was advanced 2–3 cm into the *right bronchus*. This bronchus was "blocked" by the fiberscope and we were able to re-insert the LsDLT correctly into the left bronchus.

Results and Discussions: This technique was successful in all cases (15 re-insertions in 13 patients). Specifically, it was useful in the patients in the lateral decubitus position. The flexibility of the LsDLT and of the fiberoptic bronchoscope may make re-insertion with standard technique more difficult. We saw no bronchial perforation or mucosal bleeding. Displacement of the LsDLT was caused by extension of the neck (1) or by decubitus position (2). If the neck movement can be anticipated, an insertion of the LsDLT more deeply is an alternative measure (3).

Conclusion: This technique was always successful to re-insert the LsDLT into the left bronchus.

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A-254

Smoke and CO_2 elimination during laser microsurgery on the larynx with HFJV. The preliminary report of the study

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The Goal of Study: The gases exchange and elimination of CO_2 during HFJV in the presence of burning tissue smoke are not very well described.

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The goal of this study was to investigate the changes ($\pm\Delta$) of P_aCO_2 levels during anesthesia and HFJV for the laser microsurgery on the larynx (LML).
Material and Method: After obtaining an approval of the local Ethics Committee, 14 ASA I–II patients were included in the study. General anaesthesia in all patients was induced with alfentanil (30 mcg/kg), propofol (2 mg/kg) and mivacurium (0,15 mg/kg). After obtaining muscle relaxation, the tip of the Hunsaker jet catheter was placed about 2 cm above carina. The HFJV was then commenced (frequency – 150/min, FiO_2 – 0,4, inspiration time – 40%, driving pressure – 2 bars). The arterial blood samples were taken for P_aCO_2, P_aO_2, S_aO_2 and pH analysis prior to the start of HFJV, at 5 and 15 min. during LML with jet ventilation and 10 min. after of LML (still jet ventilation). We calculate the average increase or decrease (mean $\pm$ standard deviation) of P_aCO_2 between 5 and 15 min. of LML (period 1) and between 15 min. during LML and 10 min. after LML (period 2). Statistical analysis was performed with Mann-Whitney U test.
Results and Discussion: There was significant difference in changes of the levels of P_aCO_2 (kPa) between period 1 and period 2, (0,184 $\pm$ 0,596 increase in period 1 and 0,515 $\pm$ 0,876 decrease in period 2, $p < 0,03$) respectively. There was also significant difference in pH changes between periods, (0,003 $\pm$ 0,032 decrease in period 1 and 0,039 $\pm$ 0,049 in period 2, $p < 0,04$) respectively.
Conclusion: The presence of burning tissue smoke with the high concentration of CO_2 is the serious barier for CO_2 elimination during laser microsurgery on the larynx with high frequency jet ventilation. Our study will be continued with special exhaust tube for the smoke.
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A-255

Superimposed high frequency jet ventilation (SHFJV) for endoscopic laryngotracheal surgery, experiences with 1515 patients

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Background and Goals: Superimposed high-frequency jet ventilation (SHFJV), which does not require any endotracheal catheters, was developed especially for application in laryngotracheal surgery. SHFJV uses two jet streams with different frequencies, which are simultaneously applied, in the supraglottic space, using a jet laryngoscope and a new jet ventilator.
Patients and Methods: Between 1990 and 2003, SHFJV was used consecutively in 1515 patients, including 158 children requiring laryngotracheal surgery. Ventilation was performed with an air/oxygen mixture and anesthesia with intravenous agents. In 632 patients, arterial blood gas analyses were carried out (mean PaO_2 133.8 $\pm$ 39.4 mmHg and mean $PaCO_2$ 42.3 $\pm$ 10.1 mmHg).
Results: In 1512 patients, adequate oxygenation and ventilation was achieved ($p < 0.05$). No complications due to the ventilation technique were observed, especially no barotraumas. In only 3 patients endotracheal intubation was necessary ($p < 0.05$). SHFJV was also successfully applied for laser surgery ($n = 312$). It was a safe ventilation mode without any complications such as airway fire, major hemorrhage or aspiration of debris.
Conclusions: SHFJV represents an enhanced ventilation mode, which, in fact, plays a pivotal role in the open ventilation of patients with laryngeotracheal stenosis. It is especially indicated in cases of severe stenosis, and offers optimal conditions for the laryngotracheal surgery, including the laser surgery and stent implantation techniques.

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Pulmonary functions after coronary artery bypass surgery

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Background and Goal of Study: Coronary artery bypass graft surgery (CABG) adversely affects pulmonary function tests (PFTs). The purpose of the present study was to assess changes in pulmonary function following CABG and to identify factors that may influence these changes.
Materials and Methods: The subjects were 41 cardiac surgery patients, 36 men and 5 women, mean age 53 years. Vital capacity (VC), force vital capacity (FVC), residual volume (RV), force expiratory volume first second (FEV1), force mid expiratory flow (FEF25-75) were measured preoperatively, 1 and 12 week postoperatively, and radiographs were taken at the same points in time.
Results and Discussions: All pulmonary function measurements except the FEV1/FVC showed a significant decrease and a restrictive pattern compared with preoperative values. On the first postoperative week, the FVC decreased to 30% of the pre-operative value. The changes in FVC were not significantly related to sex ($P = 0.07$), smoking history ($P = 0.15$) or pump time (0.29). But FVC changes were related to age ($P = 0.05$) and Extubation time ($P = 0.01$). The decreases in spirometry on postoperative one week (FVC 1.95 $\pm$ 0.63; FEV1 1.45 $\pm$ 0.46 liters) were greater ($p < 0.001$) in the late extubation group. However, on the 3rd postoperative months, the FVC remains less than 20% below preoperative values.
Conclusion(s): A severe, reversible restrictive pulmonary function change follows coronary artery bypass grafting. This change affected by age and extubation time.
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Lung function and prevention of respiratory disturbances at surgery concerning huge abdominal hernias

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Background and Goal: Acute respiratory failure due to increase of intra abdominal pressure during surgical reposition of hernia contents into abdominal compartment is frequent complication in patients with huge abdominal hernias. An excessive pain and compression of intestines additionally aggravate the postoperative course. Mortality rate achieves 20%. Perioperative estimation of a lung function and prevention of respiratory failure were the aim of this study.
Materials and Methods: 103 patients with huge abdominal hernias (35 men and 68 women of 25–78 years old) undergoing surgery were studied. 79 patients had morbid obesity, 29 – CAD, 66 – arterial hypertension, 31 – COPD, 7 – diabetes. The computer hernioabdomenometry (CHAM) was carried out in 79 patients before operation to estimate an abdominal/hernia size ratio (AHR). Forced expiratory F/V curves were analyzed in all patients before and after surgery. Combined preemptive analgesia – prolonged epidural and non steroid antiinflammatory medication along with séances of noninvasive lung ventilation and early activation was performed after surgery.
Results and Discussion: Patients were divided in three groups on the base of CHAM data: 1 – middle hernias 46 (58,2%) pts-AHR = 5–14%; 2 – large hernias 14 (17,7%) patients – AHR = 15–18%; 3 – huge hernias 19 (24,1%) patients-AHR > 18%. All patients of groups 2 and 3 had demonstrated restrictive lung disturbances; in 11 patients restrictive lung disturbances were combined with obstructive ones. Adaptation of abdominal wall structures was functionally tolerable only in patients with AHR < 18%. Violent trial connection of a hernia gate edges in spontaneously breathed patients with AHR > 18% and in patients with AHR > 14% associated with morbid obesity and COPD induced increase of intra abdominal pressure along with increase of respiratory rate (+30–35%) the impossibility of a deep breath and performance of the test "the forced exhalation", decrease of SpO_2 (−8–10%), nausea and desires to urinate. C rs decreased by 45–60%. Modeling parameters of abdominal compartment with predetermined muscles diastases determined on the basis of respiratory mechanics data. Mortality rate – zero.
Conclusion: Preoperative estimation of AHR and the control deep monitoring of respiratory mechanics during operation allowed correctly to choose the type of reconstructive intervention in patients with huge abdominal hernias and high risk of lung complications. The combination of such approach with comprehensive intensive postoperative therapy has allowed to reduce mortality to zero.

A-259

Forced vital capacity (FVC): Normative data obtained in anaesthetised infants and children

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Background and Goal of Study: Forced deflation from total lung capacity is regarded as the gold standard for the generation of maximum expiratory

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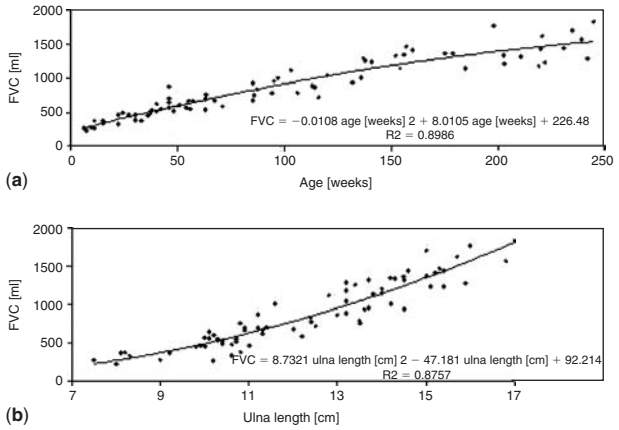
flow-volume (MEFV) curves in intubated infants. Normal data still needs to be defined in a large population of healthy children.
Materials and Methods: We measured MEFV curves in 75 intubated children (mean [range] age = 101 [6–245] weeks, weight = 18.8 [4–23.5] kg) without lung disease undergoing elective surgery. Anaesthesia was standardised. All patients received atracurium prior to intubation with a cuffed endotracheal tube. Respiratory system mechanics (compliance, resistance) were measured by single-breath occlusion and MEFV curves were generated by forced deflation from total lung capacity (+40 cmH_2O inspiratory pressure) using a deflation pressure of −40 cmH_2O. The lung function data were correlated to weight, height and ulna length measured by use of precision callipers.
Results and Discussions: The mean (SD) of all children was 1.13 (0.31) ml/cmH_2O/kg for compliance, 0.055 (0.04) for resistance, 70.6 (14.6) ml/kg for FVC and 12.4 (5.7) ml/kg/s for MEF_{10}.



Conclusion: The normal data obtained serve as a reference for predicting pulmonary function in infants as well as objectively assessing deviations from normal. These values should help to assess the presence and development of respiratory impairment in infants as well as the effect of respiratory therapies.
Acknowledgement: The study is sponsored by the Department of Anaesthesia, University of Basel.

A-260

Epidural analgesia and pulmonary function after major surgery – a meta-analysis

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Background and Goal of Study: A previous meta-analysis suggested a favourable effect of epidural analgesia on postoperative pulmonary outcome [1]. The aim of our study was to update this analysis, and to concentrate on surgeries that are prone to postoperative pulmonary complications.
Material and Method: Systematic search (Medline, Cochrane Library, EMBASE, bibliographies, no language restriction, to 10.2004) for randomised trials that compared epidural *versus* systemic analgesia in adults undergoing major abdominal, thoracic, aortic, or gynaecological surgery. Trials with a modified Oxford score = 1 and with data on postoperative respiratory function and/or pulmonary complications were included. Data on lung function (FEV_1, FVC), oxygenation, pulmonary complications (atelectasis, pneumonia, pleural effusion), and adverse effects will be extracted from eligible trials, and homogenous data will be combined using classic methods of meta-analysis (Revman Software).
Preliminary results: Of 1,347 retrieved reports, 61 trials published between 1969 and 2004 (6,267 patients) were included. Of these 61 trials, 42 had not been included in the previous meta-analysis [1]. Thoracic epidural analgesia was evaluated in 50 studies, and lumbar in 14. Procedures were abdominal (26 trials), aortic (6), cholecystectomy (6), thoracotomy (21), and oesophageal surgery (2). Quantitative analyses will be available in early 2005.
Conclusion: Meta-analysis is a powerful tool to obtain reliable information when individual trials are too small to provide valid estimates of clinically important but rare events. Our meta-analysis has been designed to inform rational decision-making as to whether epidural analgesia is a worthwhile intervention in patients at particular risk for postoperative pulmonary complications.
Reference:
1 Ballantyne et al, An & An 1998;86:598–612.
Sponsorship: The International Open Forum on **P**ost-**O**perative **P**ain is a joint ESA-EAA project that is sponsored by an educational grant from Bristol-Myers Squibb.

A-261

Prevalence of obstructive sleep apnea syndrome (OSAS) and the influence of a premedication with flunitrazepame on the respiration during the night

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Background and Goal: Obstructive sleep apnea syndrome (OSAS) is common in obese patients and frequently leads to cardiovascular diseases like arterial hypertension (AH) [1]. The prevalence of undiagnosed OSAS is not known. The study was performed to determine the prevalence of OSAS and the influence of flunitrazepame as premedication.
Methods: With IRB approval and written informed consent, 89 male patients without formerly diagnosed OSAS were included and distributed to three groups:

1. study group 1 (SG1): BMI ≥ 28 kg/m^2 and AH
2. study group 2 (SG2): BMI ≥ 28 kg/m^2 without AH
3. control group (CG): BMI < 28 kg/m^2 without AH

In the preoperative night, the patients received randomized 1 mg of flunitrazepame (F) orally or an oral placebo (P). Afterwards, sleep apnea screening was done with SomnoCheck effort® (Weinmann GmbH&Co. KG, Hamburg/Germany) during the night. From the number of the registered apneas, the AHI (apnea hypopnea index = apneas and hypopneas per hour) was calculated. OSAS was defined as AHI > 5/h [2].
Results: The prevalence of OSAS and the mean AHI (±SD) are shown in the following table (n = number of patients):

	SG1-F	SG1-P	SG2-F	SG2-P	CG-F	CG-P
n	14	13	10	9	21	22
BMI (kg/m^2)	30.6 ± 2.3		30.2 ± 1.9		24.7 ± 2.0	
Preval. (%)	85.7	84.6	50.1	44.5	19.4	13.6
AHI (1/h)	16.1 ± 9.9	13.2 ± 7.8	9.4 ± 10.5	5.3 ± 4.7	4.8 ± 7.6	1.8 ± 2.3

Conclusion: The prevalence of OSAS in obese patients with arterial hypertension is extremely high (84.6% in SG1-P; 85.7% in SG1-F). The use of flunitrazepame seems not to lead to a significantly higher prevalence of OSAS and AHI.
References:
1 Shahar E et al. Am J Respir Crit Care Med 2001; 163 (1): 19–25.
2 Richard A et al. Chest 2003; 123: 244–260.

A-262

Comparative study of two types of anesthesia (TIVA and balanced NLA) in asthmatic patients undergoing functional endoscopic sinus surgery (FESS)

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Background and Goal of Study: Objective of the study is the analysis of effect of two types of general anesthesia to peri and postoperative hemodynamic stability of asthmatic patients during FESS.
Materials and Methods: Clinical prospective study included 60 patients, ASA I and II, aged 35 ± 15 years, without any significant difference of sex, body height and weight. The patients were divided in two groups according to the type of anesthesia: Group N-balanced neuroleptic (NLA); Group T-total intravenous anesthesia (TIVA). The number of patients was identical in both groups (N = 30), as well as the severity of respiratory obstructive insufficiency. Premedication, which was the same for both groups, included i.m. midazolam and atropin as well as non-depolarizing muscle relaxant cis

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atracurium. For introduction of anesthesia, group N was administered midazolam, thiopental and alfentanil and inspired 50% N_2O in O_2. Group T was given propofol and alfentanil, and air mixture was inspired. The indicators of preoperative respiratory and hemodynamic stability were as follows: SaO_2, $PaCO_2$, EKG, NIBP. Spirometry was used of measurement of global respiratory function.

Results and Discussions: During surgery, hemodynamic stability was significantly better in group T, while there was no significant difference of respiratory stability between these groups, what was all illustrated in the following Table:

	NLA	TIVA	t	p
	x ± sd	x ± sd		
puls	91,2 ± 13,2	70,9 ± 10,1	6,674	$p < 0,01$
SaO_2	99,1 ± 1,3	99,3 ± 1,2	0,728	$p > 0,05$
$PaCO_2$	3,5 ± 0,3	3,5 ± 0,2	0,315	$p > 0,05$
FEW1	93,0 ± 23,1	94,2 ± 21,6	0,201	$p > 0,05$
PaO_2	11,3 ± 1,9	12,0 ± 1,6	1,57	$p > 0,05$

There was highly significant diffrence of pressure values (NIBP) between first and second measurement, as well as the interaction ($F = 30.586$; $p < 0.01$) between time factor ($F = 28.5$; $p < 0.01$) and type of anesthesia ($p < 0.01$). Significantly higher pressure value was found in group N in relation to group T.

	N	T
NIBP1	93,5 ± 9,4	76,8 ± 7,5
NIBP2	104,6 ± 10,2	77,7 ± 10,5

Conclusion: Our study verified that TIVA had indisputable advantage over balanced NLA anesthesia in asthmatic pacients undergoing FESS for nasal polyposis.

A-263

Prophylactic respiratory physiotherapy after abdominal surgery – sytematic review

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Background and Goal of study: Respiratory physiotherapy is thought to prevent pulmonary complications after abdominal surgery. To test efficacy and safety of prophylactic respiratory physiotherapy after abdominal surgery.

Material and Methods: Comprehensive search in multiple databases and bibliographies, all languages, to 07.2004. Randomised trials testing prophylactic respiratory physiotherapy after abdominal surgery, with = 2 days' follow-up, and reporting on pulmonary outcomes. Information on study quality, physiotherapies, pulmonary outcomes, and adverse events was extracted by one investigator and cross-checked by two. For identical interventions and endpoints, data were combined using a fixed effect model, and expressed as relative risk (RR) with 95% confidence interval (CI) and number-needed-to-treat (NNT).

Results and Discussion: Thirty-two trials, most of poor methodological quality, tested intermittent positive pressure breathing, incentive spirometry, continuous positive airway pressure, and multiple physical therapies. Nine trials (1,364 patients) only had a no intervention control group. Deep breathing with directed cough decreased the incidence of pneumonia (2 trials, 194 patients; RR 0.11, 95% CI 0.02–0.61; NNT 18), and the incidence of unspecific pulmonary complications (3 trials, 530 patients; RR 0.30, 95% CI 0.19–0.55; NNT 5). One trial each reported on a beneficial effect of incentive spirometry, deep breathing with directed cough, or intermittent positive pressure breathing on atelectasis or unspecific pulmonary complications. None reported on improved PaO_2/FiO_2 ratios or vital capacity values. Positive trials were more likely to report on unusually high control event rates. Twenty-three trials (2,804 patients) compared physiotherapies with each other; no conclusions could be drawn. Physiotherapies were accompanied by discomfort, claustrophopia, nose ulcer, abdominal distension, and hernia.

Conclusion: The evidence to support the usefulness of prophylactic respiratory physiotherapy after abdominal surgery is scarce.

A-264

Mallampati score improvement after removing total dental prosthesis

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Background and Goal of Study: In the outpatient preoperative evaluation, Mallampati class in patients using dental prosthesis is usually evaluated with their artificial teeth on site. However, before tracheal intubation dental prosthesis are always removed. Our hypothesis is that the Mallampati score is different when it is evaluated with or without dental prosthesis, and this study was designed to demonstrate this fact.

Materials and Methods: Consecutive patients admitted in our hospital with total dental prosthesis entered the study. Mallampati score was first evaluated with the dental prosthesis placed, and repeated after removing the artificial teeth. Weighted kappa coefficient was calculated to know the agreement between both measurements.

Results and Discussions: 120 patients (age 77 ± 8 yr, gender 57/68 M/F, BMI 26 ± 4 kg/cm^2) entered the study. Kappa value was 0.28, showing "poor agreement" (1) between both measurements. Figure shows the distribution of the patients according to Mallampati class determined with or without dental prosthesis. Data in the cells indicate the number of patients for every possible combination. In only 43 patients (36%) Mallampati class was the same when evaluated with or without teeth (bold data on the diagonal). In all the remaining patients, Mallampati class was lower without teeth.

		Mallampati class WITH dental prosthesis				
		I	II	III	IV	n
Mallampati class WITHOUT dental prosthesis	I	**9**	12	10	2	33
	II	0	**20**	25	14	59
	III	0	0	**11**	14	25
	IV	0	0	0	**3**	3
	n	9	32	46	33	120

These results indicate that Mallampati score has to be performed without teeth, because this is the clinical situation in the operating room.

Conclusion: In patients with total dental prosthesis, the Mallampati score might be evaluated without teeth because otherwise the risk of difficult intubation could be overestimated.

Reference:

1 Seigel DG et al. Am J Epidemiol 1992;135: 571–578.

Acknowledgment: JM Manresa (IMIM).

A-265

Prediction and management of difficult intubation

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Background and Goal of Study: Prediction and management of difficult intubation (DI) according to specific plan is the base of safe anesthesia. We worked out and evaluated system of tests for prediction of DI.

Materials and Methods: In 3192 cases for general surgery (GS) and 500 cases for maxillofacial surgery (MFS) probability of DI was evaluated. We used Mallampathi-test alone and system of 7 tests: Mallampathi + mouth opening, head flexion/deflexion, jaw advancing, thyromental distance, clinical signs (impaired maxillofacial anatomy, obesity with BMI > 0.26 or weight >90 kg, hypersthenic type with short neck) and anamnesis (sleep apnea, difficult intubation, snoring). Predicted and actual difficulties were compared after intubation. The ASA definition of "difficult intubation" was used; all the cases with alternative methods of intubation were considered to be difficult. In cases with confirmed DI quantitative evaluation of preoperative evaluation data was performed. Mallampathi-test was stratificated as: 1–2 class – 0 point, 3rd class – 1 point, 4th class – 2 points; each other test was 0 or 1 point ("no" or "yes"). We named the sum of points "Index of Difficult Intubation" – IDI. Effectiveness was evaluated by tests of specificy (Sp), sensitiveness (Sen), positive predicted results (PPR) and negative predicted results (NPR). Chi-square test was used to evaluate correlation of single results of tests and result of intubations.

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Results and Discussions: Occurrence of DI during GS was 0.62%, during MFS – 5.6%. Effectiveness of Mallampathi-test was: Sen – 80%, Sp – 96%; PPR – 44%, NPV – 48.6%. Mallampati-test was effective for prediction of easy intubation and not often – for DI. All used test had strong correlation with results of intubation ($p < 0.005$). Effectiveness of IDI was: Sen – 96%, Sp – 98%; PPR – 75%, NPV – 99%. When IDI was 5 or more points (3.6% of patients), we used alternative methods of intubation. On IDI 3–4 points (2.2% patients) actual DI was in 1.2%, on IDI 1–2 points (2.8%) actual DI was in 0.8% of cases. When IDI $\geq$ 5 points – obligate DI, on IDI 3–4 points – DI is highly possible, on IDI = 1–2 DI is possible, on IDI = 0 there is no difficulties.
Conclusion(s): System of 7 tests allows to effectively predict DI, evaluation of IDI allows to choose rational method of tracheal intubation.

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Locoregional anesthesia of upper airways vs IV sedation in patients with prolonged postoperative intubation

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Background and Goal of Study: After maxillofacial (MFS) surgery extubation should be performed after guaranteed ability of patient to manage airways himself. IV sedation is widely used for adaptation of patient to tracheal tube, this make difficult to evaluate level of consciousness, can cause respiratory depression and prologs ICU stay. The goal of study was to evaluate locoregional anesthesia of upper airways (LAURA) as an alternative of IV sedation in a cases of prolonged intubation postoperatively.
Materials and Methods: 147 patients (15–74 yr., ASA I–II) after reconstructive MFS needed prolonged intubation. In 1st group (n = 127) we used LAURA, in 2nd group (n = 10) we used IV sedation (midazolam, 0.06 $\pm$ 0.056 mg/kg). LAURA for awake intubation was performed by bilateral block of superior laryngeal nerve and glossopharyngeal nerve with 2% lidocaine with epinephrine 1:200 000 and transtracheal anesthesia with 4% lidocaine. Clinical signs and length of block, changes in oxygenation and system hemodynamics, level of sedation (Ramsay) were controlled after operation, before transporting from operation room, on admission to recovery room or ICU and before extubation. Results were statistically processed (T-test).
Results and Discussions: On admission to ICU or recovery room on tracheal tube traction coughing reflex was absent in 60% in 1st group and in 15% in 2nd group; no motion excitement was noticed in 84% in 1st group and in 40% in second group. Level of sedation (Ramsay scale) in 2nd group was 4 points in 20%, 5 points in 55% and 6 points in 25%; 4 patients needed respiratory support. In 1st group level of sedation was 1 point in 6%, 2 – in 16%, 3 – in 50%, 4 – in 22% and 5 – in 6%. No significant differences were noted in hemodynamics. SpO_2 level was lower in 2nd group ($p < 0.005$). Length of postoperative tracheal intubation was 173 $\pm$ 35 min in 1st group, 194 $\pm$ 28 in 2nd group.
Conclusion(s): LAURA can be rational alternative for IV sedation for patients with prolonged tracheal intubation.

A-267

Utility of lateral-view neck radiography for airway assessment

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Background and Goal of study: Preoperative prediction of potential difficulties with intubation can reduce risks associated with anesthesia, particularly in patients undergoing cervical spinal surgery. Although several clinical criteria exist for airway assessment on patients, including mouth Mallampati classification and thyromental distance, no sufficient systematic multivariate analyses have been reported. We investigated the utility of information including pharyngeal airway space, position of epiglottis and neck flexibility obtained from lateral-view neck radiography.
Materials and Methods: Subjects comprised 100 orthopedic patients who underwent cervical anterior decompression or laminoplasty for cervical myelopathy or ossification of the posterior longitudinal ligament. Vertical distance between the epiglottis and retropharyngeal wall, height of the epiglottis compared to the vertebrae, and angle of the lower endplane line of C1 and C4 were evaluated from preoperative lateral-view neck radiography in the extension position.
Results and Discussions: Poor evaluation of intubation or other factors affecting tracheal intubation resulted in the exclusion of 26 subjects. Tracheal intubation was difficult in 19 patients (26%), and easy in 55 (74%). Such difficulties were detected using pharyngeal airway space (<16 mm; sensitivity, 53%; specificity, 89%; accuracy, 80%), position of epiglottis (lower than C3; sensitivity, 100%; specificity, 64%; accuracy, 73%), and neck flexibility (<25°; sensitivity, 53%; specificity, 89%; accuracy, 80%). Patients displaying these factors experienced difficulty with tracheal intubation (sensitivity for 3 factors: 100%; 2 factors: 92%; 1 factor: 13%; 0 factors: 4%).
Conclusion(s): Information on pharyngeal airway space, position of epiglottis and neck flexibility from lateral-view neck radiography in the extended position could greatly facilitate airway assessment prior to anesthesia.

A-268

Anaesthesia experience improves a good ability to find out difficult airway

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Background and Goal of Study: Anaesthesiologists with long history of working experience ought to have a good ability to find out difficult airway by just looking at the patient's face. We tried to verify this hypothesis by using the method of ranking averaged pictures of patient's faces which were classified by the Cormack & Lehane's grade (Cormack grade).
Materials and Methods: Patients who were scheduled to undergo general anaesthesia were involved in this study. After obtaining informed consent, pictures of the patient's front and side of face were taken by a digital camera. Patients were classified into 4 groups according to Cormack grade determined by skilled anaesthesiologists. Average pictures of the faces combined were synthesized in each Cormack grade by computer software.

Anaesthesiologists were classified into 5 groups according to their experience (1–5, 6–10, 11–15, 16–20, or over 21 years) and asked to rank the averaged face pictures to agree with Cormack grade. Disagreements between the picture's order and its Cormack grade were scored and recorded.

The score was compared using the Kruskal–Wallis test and Mann–Whitney test among the experienced groups.
Results and Discussions: During the experimental period, there were no Cormack graded 4 patients. Twelve averaged face pictures (male front face Cormack 1–3, male side face Cormack 1–3, female front face Cormack 1–3, female side face Cormack 1–3) were synthesized.

The pictures ranked by the experienced anaesthesiologist groups were correctly ranked with the Cormack grade, However the unexperienced groups did not match correctly ($p = 0.048$).
Conclusion: Anaesthesiologists with experience might have an ability to find out which patient have difficult airways by just looking at their faces, as compared with unexperienced anaesthesiologists.

A-269

Ultrasound quantification of anterior soft tissue thickness fails to predict difficult laryngoscopy in obese patients

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Background and Goal of Study: Morbid obesity is associated with difficult laryngoscopy and intubation;[1] however, the best way to predict airway difficulties remains unknown. An abundance of pretracheal soft tissue anterior to the vocal cords, as quantified by ultrasound, was a better predictor of difficult laryngoscopy than body mass index (BMI) in Israeli patients.[2] We sought to confirm this finding in our patients.
Materials and Methods: In 64 morbidly obese patients (BMI > 35 kg/m^2), we used ultrasound to quantify neck soft tissue from the skin to the anterior aspect of the trachea at the vocal cords. Thyromental distance, mouth opening, jaw movement, limited neck mobility, modified Mallampati score, abnormal upper teeth, neck circumference, history of obstructive sleep apnea (OSA), BMI, age, and sex were assessed as predictors of difficult laryngoscopy.
Results and Discussions: Twenty patients were classified with difficult laryngoscopy; they were older (47 $\pm$ 9 *vs*. 42 $\pm$ 11 years; $P = 0.048$; mean $\pm$ SD) and had *less* soft pretracheal tissue (20.4 $\pm$ 3.0 *vs*. 22.3 $\pm$ 3.8 mm; $P = 0.049$) than did easy laryngoscopy patients. A multivariable regression model indicated that a history of OSA was the only independent predictor of difficult laryngoscopy (Odds ratio [95% CI] of 2.48 [1.03–5.96]; $P = 0.042$).

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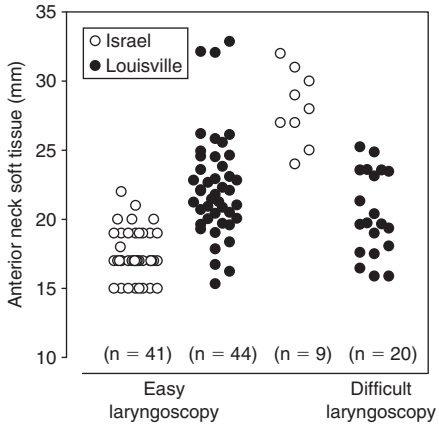

Figure. The amount of zone 1 soft tissue (circles) in individual patients whose tracheas were easy or difficult to intubate. The open symbols show the data from a study performed in Israel.[2] The filled symbols show the data from Louisville, KY.

Conclusion(s): We conclude that the thickness of pretracheal soft tissue at the level of the vocal cords is not a good predictor of difficult laryngoscopy in obese patients in the United States.

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2 Ezri T, Gewurtz G, Sessler DI, et al. Anaesthesia 2003;58:1111–4.

A-270

Age related incidence and complications of difficult intubation in 25,040 general anaesthetics in a tertiary hospital

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Background: Difficult intubations carry a higher risk of morbidity and mortality. Studying its incidence and predisposing factors is essential for its prediction.

Aim: To determine the incidence of complications of difficult intubation and its relationship to age in a tertiary hospital.

Method: Data was collected prospectively from 25,040 non-cardiac anesthetics (1994–1999). Demographic characteristics of patients and Cormack and Lehane laryngoscopic view classification, methods of management and complications were encoded using a customized database program and analyzed with SAS software.

Results: The incidence of difficult intubations was (0.96%), (14.8%) were grade 2, (59.9%) grade 3, and (25.2%) grade 4. In pediatric age group <1 year. (1%), from ($1 \leq 5$) (0.95%), (from $5 \leq 10$) (0.59%) and from ($10 \leq 15$) (.3%) indicating decreased incidence with age .The pearsons correlation $= 0.94$ and the P value (-0.34). In the adult age groups (15–20 yrs) was (0.65%), (20–40 yrs) was (0.47%), (40–50 yrs) was1.38%., (50–60 yrs) was 1.85% and >60 yrs was 1.9%. Pearsons correlation was positive $r = 0.85$ (p value $= 0.023$). The incidence of failed ventilation and intubations was 0.004%. The following complications were increased in difficult intubations: reversible cardiac arrest (0.8%, compared with 0.004% in easy intubations; $p < 0.001$) and dental injuries (2%, compared with 0.07% in easy intubations $p < 0.00001$). Failed ventilation and intubations was 0.004%. There was no aspiration or death.

Conclusion: Difficult intubations are infrequent (0.96%), but are associated with a higher incidence of major anaesthetic adverse outcomes. There is a negative correlation with age in pediatric group and a positive one in adult groups. Prediction of difficult intubation in the high-risk age groups would help to improve the outcome.

A-271

Does tracheal transverse diameter predict accurately the choice of double lumen tracheobronchial tube for one-lung ventilation?

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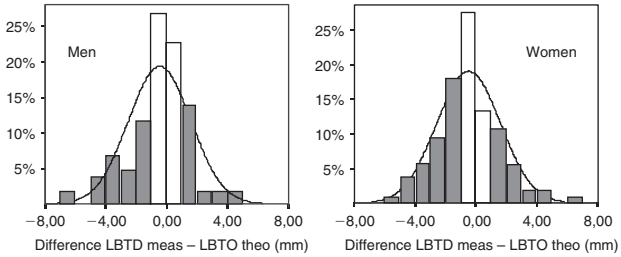
Background and Goal of Study: To make easier the choice of a left double lumen tracheobronchial tube for one lung ventilation, Brodsky proposed to assess the diameter of the left main bronchus (LBTD) with the tracheal transverse diameter (TTD): the LBTD-to-TTD ratio was consistent for men (0.75 ± 0.09) and women (0.77 ± 0.10)[1]. The aim of study was to analyse the relationship between LBTD and TTD with use of tri-dimensional chest computed tomographic scan.

Materials and Methods: 206 chest computed tomographic scans were analysed with measure of LBTD 1 cm away from the carina. A tri-dimentional correction of declination was performed. The difference between measured value (LBTD meas) and theoric value (LBTD theo) was calculated for each observation. A difference up to 1 mm was considered as significant resulting in change of 2 sizes of double lumen tube [2].

Results and Discussions:

	TTD meas	LBTD meas	LBTD theo
Men 101	17,0 ± 3,6	13,4 ± 2,3*	12,8 ± 2,6*
Women 106	15,7 ± 2,1	11,6 ± 2,0#	12,1 ± 1,6#

Résults in mm, mean ± SD. *p = 0,02 #p = 0,012.



Distribution of differences between measured and theoric values.

Difference between measured and predictive values with Brodsky model is up to 1 mm in 61% of men and in 59% of women (hatched columns).

Conclusion(s): Formula based on DTT measure can induce to fail in accurate choice of size of double lumen tracheobronchial tube.

References:

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2 Russell WJ, Anaesth Intensive Care 2003; 31: 50–3.

A-272

Edema risk of endotracheal intubation in rabbits with cessation of steroid therapy

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Background and Goal of Study: Laryngeal edema is a life threating risk of intubation (1). Rebound edema of tissues is also a well defined complication of cessation of steroid therapies (2). We want to study if laryngeal edema increases after intubation when it is established after steroid therapy is stopped.

Materials and Methods: Thirty-six adult female New Zealand rabbits (1.8–2.8 kg) were randomly divided into six groups. We modelled chronic obstructive pulmonary disease therapy as a steroid therapy. We gave 1 mg/kg methyl prednisolone intraperitoneally to four steroid groups for ten days. Another group received % 0.9 sodium chloride (SF) for ten days and last group was control group (cont) that was intubated only. Rabbits that received steroid therapy are intubated one day (st 1d), one week (st 1w), two weeks (st 2w) and a month (st 1 m) after stopping steroid therapy. Rabbits that are intubated are kept under anaesthesia for an hour. They are extubated and kept on spontaneous respiration for two hours. They are sacrificed and their larynxes are taken for histopathological examination. Percentage of cross section area of larynx lumen to their own larynx tissues surrounded by thyroid cartilage and esophagus are studied by stereological methods. Statistical analysis was by a one-way ANOVA with Tukey's test. Values are expressed as mean ± SD, and $n = 6$ for all groups.

Results and Discussions: Larynx lumen of two steroid groups (st 1d, st 1w) were significantly narrower ($p < 0.05$) than SF and cont groups while it was not narrower in other two steroid groups statistically ($p > 0.05$). These results suggests that one day and one week after stopping steroid therapy may be a hazardous time for tracheal intubation.

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Conclusion(s): We conclude these results should be confirmed in humans as well. These results should alert anaesthesiologists for laryngeal edema when they would intubate patients that quitted steroid therapy in one week.

References:
1 Kambic V, Radsel Z. 1978. Intubation lesions of the larynx. *Br. J. Anaesth.* 50: 587–590.
2 Odland R, Wýgley T, Kým T, Kýzzýar R, Davamony D. 2000. Quantification of rebound edema after steroid treatment. Otolaryngol Head Neck Surg 123:44–7.

A-273

Clinical evaluation of a new disposable airway device: The Ambu Laryngeal Mask

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Background and Goal of Study: The major interest of single use airway devices is the prevention of transmission of infectious agents. The Ambu™ Laryngeal Mask is a new disposable supraglottic airway device. It consists in a pre-angled moulded airway tube to fit the anatomical structure of the patient's throat. The goal of this prospective open study was to evaluate Ambu™ Laryngeal Mask for airway management during elective surgery.

Materials and Methods: After Ethics Committee approval and written informed consent, 60 adult patients, ASA grade 1–2, scheduled for short-lasting anaesthesia were studied. Patients with BMI $> 30 \cdot kg \cdot m^{-2}$ or predicted difficult airway were excluded. After induction of anaesthesia, Ambu™ Laryngeal Mask (size 4 or 5) was inserted in strict accordance with the manufacturer's recommendations. Three attempts were allowed. The proper position of the device was checked by easy bag ventilation without leak and presence of a capnogram with a plateau. The lungs were ventilated with volume-controlled ventilation. Tidal volume (VT) was set at $10\,mL \cdot kg^{-1}$, the respiratory rate at $12 \cdot min^{-1}$ and the inspiratory/expiratory ratio at 1 : 2. The fresh gas flow was set at $1{,}5\,L \cdot min^{-1}$ (O_2/air 1/1). Success and insertion time, oropharyngeal leak pressure (OLP), peak airway pressure (PAP), per and postoperative side effects were recorded. Results given are the median (25–75%) or the mean (±SD) when data were normally distributed.

Results and Discussions: The median age, height and weight were 39.6 yr (21–63), 172 cm (155–198) and 78 kg (54–98), respectively. Insertion was successful in 59 patients (98.3%) (first attempt n = 51, second n = 6, third n = 2). The mean insertion time, OLP and PAP were 27 (±6) s, 23 (±5.8) cmH_2O and 14.3 (±3) cmH_2O respectively. Neither desaturation nor gastric insufflation were noted. Occurred bloodstain was found in only two (3%) cases.

Conclusion(s): The Ambu™ Laryngeal Mask is a non-traumatic, easily inserted and efficient device to perform volume-controlled ventilation. These results are similar to preliminary results reported for Laryngeal Mask Airway Unique™ or Soft Seal™ Laryngeal Mask (1).

Reference:
1 Brimacombe J et al. *Anesth Analg* 2004; 99: 1560–3.

A-274

The Solus: clinical evaluation of a new disposable supraglottic airway device

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Background and Goal of Study: The Solus™ Laryngeal Mask Airway (SLMA) is a new disposable supraglottic airway device. The goal of this prospective open study was to evaluate the SLMA for airway management during elective surgery.

Materials and Methods: After ethics committee approval and written informed consent, 35 patients, ASA grade 1–2, scheduled for short-lasting anaesthesia were studied. Patients with BMI $> 30\,kg \cdot m^{-2}$ or predicted difficult airway were excluded. After induction of anaesthesia, SLMA (size 3, 4 or 5) was inserted with LMA finger insertion technique. Three attempts were allowed. The proper position of the device was checked by easy bag ventilation without leak and presence of a capnogram with a plateau. The lungs were ventilated initially with volume-controlled then pressure-controlled ventilation. Tidal volume (VT) was set at $8\,mL \cdot kg^{-1}$, I/E at 1/2 and respiratory rate was set to provide 40 ± 5 mmHg $ETCO_2$. The fresh gas flow was set at $1.5\,L \cdot min^{-1}$ (O_2/air 1/1). Success and insertion time, oropharyngeal leak pressure (OLP), peak airway pressure (PAP), per and postoperative side effects were recorded. Manual and mechanical ventilation were assessed as easy, moderate or difficult. Results are given as median (range) or mean (±SD).

Results and Discussions: The median for age and weight were 23.6 yr (6–72) and 61.2 kg (30–94), respectively. Insertion was successful in 32 patients (91.4%) (first attempt n = 26, second n = 4, third n = 2). Mean insertion time, OLP and PAP were 27 (±6) s, 22.8 (±5.8) cmH_2O and 14.3 (±3.1) cmH_2O respectively. Manual, volume and pressure-controlled ventilation were easy in 97, 84 and 100%, respectively and moderate in 3, 16 and 0% of cases. Neither desaturation nor gastric insufflation were noted. Occurred bloodstain was found in only one case.

Conclusion(s): The Solus™ Laryngeal Mask Airway is a non-traumatic, easily inserted, efficient device to perform pressure- or volume-controlled ventilation. These results are similar to preliminary results reported for Laryngeal mask airway Unique™ or Soft Seal™ laryngeal mask (1). Further comparatives studies are needed to compare the SLMA with other disposable supraglottic airway devices.

Reference:
1 Brimacombe J et al. *Anesth Analg* 2004; 99: 1560–3.

A-275

Proseal-laryngeal mask vs endotracheal tube during gynaecological laparoscopy in Trendelenburg position

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Background and Goal of Study: To assess the insertion conditions, airway seal and efficacy of ventilation with the Proseal laryngeal mask (PLMA) during gynaecological laparoscopy with pneumoperitoneum and Trendelenburg position compared to endotracheal tube (ETT).

Materials and Methods: Prospective, controlled and unblinded clinical study. Thirty non-obese women (ASA I–II) undergoing laparoscopic surgery with no contraindications to the use of the PLMA were studied. Anaesthesia was induced with propofol/fentanyl and maintained with desflurane/air. Patients were randomized to receive mechanical ventilation (V_T: 8 ml/Kg^{-1}) through the PLMA (n = 15; size 4 and equipped with a gastric tube)[1] or the ETT (n = 15; size 7.5). Ventilatory settings were adjusted according to lean body weight. Number of insertion attempts and time to establish an effective airway were recorded. Each cuff was inflated to the manufacture's recommended volume and afterwards cuff pressure was measured and adjusted to the ideal pressure. Airway leaks were detected by pharyngeal auscultation through a stethoscope, and leak fraction was measured as the difference between inspiratory and expiratory V_T divided by inspiratory V_T[2]. Airway pressures (P_{AW}), E_TCO_2, minute ventilation (V_M) and respiratory compliance (C_{RS}) were recorded at rest, after pneumoperitoneum and after Trendelenburg position. Differences were assessed with *t* tests and χ^2 tests.

Results and Discussions: Number of insertion attempts was greater with the PLMA (1.4 vs 1) but time to establish an effective airway was similar (23 s vs 22 s for the PLMA and ETT, respectively). Mean cuff volume and pressure used were 27.5(3.3) ml and 3.1(0.3) ml, and 78.3(24) cmH_2O and 37(3) cmH_2O for the PLMA and ETT, respectively. Five leaks were detected by auscultation in the PLMA group but not with ETT ($p < 0.05$). In spite of the audible leaks detected, the leak fraction was similar in both groups [4.4(2)% PLMA; 5(2)% ETT]. P_{AW}, E_TCO_2, V_M and C_{RS} were similar in both groups at different moments studied.

Conclusion: The PLMA provides a practical way to establish an airway for laparoscopic surgery in Trendelenburg position.

References:
1 Kihara S. Anesth Analg 2003; 97(1):280–4.
2 Natalini G. J Clin Anesth 2003; 15(6):428–32.

A-276

The LMA classic and LMA–ProSeal are effective alternatives to tracheal intubation for laparoscopic cholecystectomy

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Background and Goal of Study: We compared gastric distension, regurgitation and arterial blood gas tensions with endotracheal tube (ETT) or classic laryngeal mask airway (LMA) or ProSeal laryngeal mask airway (PLMA) during laparoscopic cholecystectomy (1).

Materials and Methods: One hundred fifty-nine ASA I–II adults were scheduled, patients with risk of gastroesophageal reflux were excluded. Patients ingested methylene blue capsules 10 minutes before the induction of anesthesia. Anesthesia was induced with propofol and cisatracurium and maintained with sevoflurane in N_2O and O_2. Gastric distension was scored on a scale of 0–10 at insertion of laparoscope and immediately before removal. Hypopharynx was inspected for blue dye considered to be sign of gastric regurgitation at the end of operation. Arterial blood gas analyses were performed before and at the end of pneumoperitoneum.

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Results: Incidence of gastric distension and blue dye in hypopharynx (6.1% in Group ETT; 13.7 in Group LMA; 6.7% in Group PLMA) were similar in all groups ($p > 0.005$). Mean $P_{ET}CO_2$ values were increased significantly in all groups and highest in Group PLMA ($p < 0.005$). Mean $PaCO_2$ values were increased significantly in all groups ($p < 0.05$). At the end of the pneumoperitoneum mean pH values were decreased significantly in all groups and lower in Group PLMA than Group ETT ($p < 0.05$).

	Group ETT		Group LMA		Group PLMA	
	t_1	t_2	t_1	t_2	t_1	t_2
$P_{ET}CO_2$ mmHg	34.1 ± 0.6	37.3 ± 0.8*	35.6 ± 0.7	38.6 ± 0.8*	34.5 ± 0.6	41.8 ± 0.7*#
$PaCO_2$ mmHg	35.3 ± 0.8	39.4 ± 1.2*	36.5 ± 0.6	40.7 ± 1.0*	34.9 ± 0.7	41.3 ± 1.2*
pH	7.44 ± 0.0	7.39 ± 0.0*	7.43 ± 0.0	7.38 ± 0.0*	7.43 ± 0.0	7.38 ± 0.0*#

*,#$p < 0.05$.

Conclusion: It is concluded that gastric distension and regurgitation risks were similar and arterial blood gas tensions were in normal ranges with either airway device during laparoscopic cholecystectomy.

Reference:

1 Maltby RJ, Beriault MT, Watson NC, et al. *Can. J. Anesth*. 2002; 49:857–62.

A-277

LaryVent and Laryngeal Mask Airway: a comparison during routine surgical procedures

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Background and Goal of Study: Reusable supraglottic airway devices have been established in clinical anesthesia for years and were previously shown to be safe and efficient (1). The purpose of the present prospective, randomised, controlled trial was to assess two disposable devices, the newly developed LaryVent® (LV) and Laryngeal Mask Unique™ (LMA-U) in routine clinical practice.

Materials and Methods: After approval of our IRB and written informed consent was obtained, in 60 patients (ASA 1–3), undergoing minor routine surgery, standardised anaesthesia was induced (Remifentanil, 0.5 μg/kg/min; Propofol, 2 mg/kg). Patients were randomly allocated to controlled ventilation (FiO_2, 0.4; V_T, 7 ml/kg; respiratory rate, 10 min^{-1}) with the LV (n = 30) or LMA-U (n = 30). Cuff inflation was performed with 100 ml (LV) or 20 ml (LMA-U) of air, as recommended by the manufacturers. After 5 and 10 minutes of ventilation with the LV or LMA-U, SpO_2, $etCO_2$, V_{Tex} and P_{aw} were recorded. Capillary blood gas samples were taken before induction of anaesthesia, and after 10 min of ventilation. Time of insertion and airway leak pressure (2) of each device were measured. Occurence of gastric inflation was assessed with a stethoscope placed on the epigastrium. Patients were asked about sore-throat, dysphonia, and dysphagia 24 hours after surgery

Results: There were no differences in demographic data between groups at baseline. Time of insertion was comparable with the LV and LMA-U (Median: 24 vs. 23 s; P = ns; failures: LV 10/30 vs. LMA-U 3/30. Blood gas samples and ventilation variables revealed sufficient ventilation and oxygenation with either device (P = ns). P_{aw} (LV, 14 ± 3 cm H_2O; LMA-U, 15 ± 3 cm H_2O) was comparable and airway leak pressure (LV, 33 ± 7 cm H_2O; LMA-U, 17 ± 5 cm H_2O) was significantly ($P < 0.05$) higher with the LV compared to the LMA-U. Post-operative sore throat and dysphagia were graded significantly ($P < 0.05$) higher with the LV than with the LMA-U. No gastric inflation occured with either device.

Conclusions: Significantly higher failure rate and post-operative patient discomfort suggest that the LaryVent® may not be the first choice in routine clinical practice.

References:

1 Anesth Analg 2002;95:1094–7.
2 Br J Anaesth 1999;82:286–7.

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PA_{Xpress} vs. Laryngeal Mask Unique: evaluation of modified ventilatory devices

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Background and Goal of Study: For emergency airway management there was increasing demand for disposable supraglottic airway devices. The purpose of the present prospective, randomised, controlled trial was to assess the recently developed Laryngeal Mask Unique™ (LMA-U) and the PA_{Xpress} (PA) in routine clinical practice.

Materials and Methods: After IRB approval and written informed consent was obtained, in 60 patients (ASA 1–2), undergoing minor routine surgery, anaesthesia was performed as TIVA with propofol and remifentanil. Patients were randomly allocated to controlled ventilation (FiO_2, 0.4; V_T, 7 ml/kg; respiratory rate, 10 min^{-1}) with the LMA-U (n = 30) or PA (n = 30). Cuff inflation was performed with 20 ml (LMA-U) or 30 ml (PA) of air. After 5 and 10 min of ventilation with the LMA-U or PA, SpO_2, $etCO_2$, V_{Tex} and P_{aw} were recorded. Capillary blood gas samples were taken before induction of anaesthesia, and after 10 minutes of ventilation. Time of insertion and airway leak pressure (1) of each device were measured. Occurence of gastric inflation was assessed. Patients were asked about sore-throat, dysphonia, and dysphagia 24 h after surgery.

Results: There were no differences in demographic data between groups at baseline. Time of insertion was comparable with the LMA-U and PA (Median: 23 vs. 24 sec; P = ns; failures: LMA-U 3/30 vs. PA 11/30). Blood gas samples and ventilation variables revealed sufficient ventilation and oxygenation with either device (P = ns). P_{aw} (LMA-U, 15 ± 3 cmH_2O; PA, 14 ± 2 cmH_2O) was comparable, while airway leak pressure (LMA-U: median, 15 cmH_2O; range, 10 to 25 cmH_2O vs. PA: 22, 12 to 40) was significantly ($P < 0.05$) higher with the PA compared to the LMA-U. Post-operative sore throat and dysphagia were graded significantly ($P < 0.05$) higher with the PA than with the LMA-U. No gastric inflation occured with either device.

Conclusions: The LMA-U and PA were proven in a clinical trial to effectively ventilate and oxygenate patients. Significantly higher failure rate and post-operative patient discomfort suggest that the PA may not be the first choice in routine clinical practice.

Reference:

1 Br J Anaesth 1999;82:286–7.

A-279

Comparison of new perilaryngeal airway (Cobra PLA) with laryngeal mask airway (LMA) and laryngeal tube (LT) in short surgical procedures

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Background and Goal of Study: Perilaryngeal airway (Cobra PLA) is a new supraglottic device and is an alternative to endotracheal intubation in short surgical procedures. This study was designed to evaluate new Cobra PLA and compare it with LMA and LT.

Materials and Methods: After ethical approval and patient written consent, 90 ASA I–II status, aged between 18–65 patients scheduled for short surgical procedures were included. After standard premedication patients were monitored for mean arterial pressure, heart rate and SpO_2. After standard anesthesia induction all patients were ventilated by mask and et-CO_2 pressure was monitored, inspiratory and expiratory anesthetic concentration was observed. Patients were randomly divided into three groups, to I group CobraPLA, II group LMA, III group LT was inserted by an experienced anesthetist, time and number of attempts were recorded. Maintanance of anesthesia was done by 50%O_2/N_2O and 2% sevoflurane, muscle relaxation was fasciliated by mivacurium. In all the groups mean arterial blood pressure, heart rate, SpO_2 and et-CO_2 pressure measurements were recorded. Intraperative complications, manoeuvres made for ventilation and desaturation (SpO_2 < 95%) were recorded. In postoperative period blood contamination on removed airway, nausea and vomiting, coughing and sore throat was recorded in 1 h and at 24 hrs.

Results and Discussions: When groups were compared for airway insertion time, haemodynamic parameter values at all the measurement times, desaturation number and end-tidale CO_2 pressure values and intraoperative side effects were similiar. Intraoperative additional manoeuvre need in group III (20%) significantly lower ($p < 0.05$) when compared with groups I (40%) and II (40%). When blood contamination on applied airway devices were compared; in group III (50%) was determined to be significantly higher when compared with group I (16.7%) and II (16.7%). There was no difference between three groups according to other side effects.

Conclusion: As a result, three devices are safe and efficient in airway management of short surgical procedures. Perilaryngeal airway (CobraPLA) can be an alternative to laryngeal mask and laryngeal tube.

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Addition of remifentanil to etomidate to facilitate the LMA insertion conditions

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Background and Goal of Study: Etomidate as it doesn't depress the laryngeal reflexes, it's difficult to insert laryngeal mask airway (LMA) (1). To facilitate the LMA insertion, remifentanil addition to etomidate induction was investigated in this prospective, randomised study.

Materials and Methods: After ethics committee approval and informed consent ASA I–II, 57 unpremedicated adult patients (26–73 years) undergoing cystoscopy were recruited.The groups were; Group PF: Induction with propofol (2.5 mgkg^{-1}) and fentanyl (1 μgkg^{-1}), Group PR: Induction with propofol (2.5 mgkg^{-1}) and remifentanil loading with 0.5 μgkg^{-1} in 2 min followed by 0.05 μgkg^{-1}min^{-1}, Group ER: Induction with etomidate (0.3 mgkg^{-1}) and remifentanil at the same dose. Anaesthesia was maintained with 2–3% sevoflurane, 50% O_2 and 50% N_2O. LMA was inserted by the blinded anaesthetist to assesse the parameters on the table and any unwanted responses such as gagging, coughing, hiccough, chest rigidity and limb movement. Anova test, Tukey HSD, Kruskal Wallis test, Mann Whitney U test, Pearson Chi Square test were used for statistical analysis. The results are given as percentages, 95% confidence interval.

Results and Discussions: The results are shown in the Table (*$p < 0.05$, **$p < 0.05$ compared to Group 1).

	Group PF (n = 19)	Group PR (n = 16)	Group ER (n = 22)
Jaw opening (open/partially open)	19/0 (100%/0%)*	11/5 (68,8%/31,3%)	10/12 (45,5%/54,5%)
Ease of LMA insertion (good/poor)	19/0 (100%/0%)	15/1 (93,8%/6,3%)	15/7** (68,2%/31,8%)
Number of attempts (1/2/3)	19/0/0	16/0/0	11/10/1*
Gagging (no/yes)	18/1 (94,7%/5,3%)	14/2 (87,5%/12,5%)	14/8 (63,6%/36,4%)**
Additional propofol	19/0 (100%/0%)	15/1 (93,8%/6,3%)	12/10 (54,5%/45,5%)*

Heart rate was decreased in all groups within clinical limits but it was not significant ($p = 0{,}563$).

Conclusion: Co-administration of etomidate-remifentanil doesn't facilitate the LMA insertion conditions.

Reference:

1 Hilbert G, Gruson D, Vargas F et al. Crit Care Med 2001; 29: 249–55.

A-281

Prospective comparison of Ambu Laryngeal Mask and LMA-Classic in patients with immobilized cervical spine

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Background and Goal of Study: LMA-Classic (LMC, LMA Company) and the single-use Ambu Laryngeal Mask (ALM, Ambu) are compared for ventilation in patients with simulated impaired cervical spine mobility. Ease of insertion and quality of airway seal are assessed in a prospective clinical trial.

Materials and Methods: After approval of the local ethics committee and written consent, 60 patients scheduled for elective ambulatory interventions were randomized to be ventilated with either LMC or ALM. Following standardized induction of general anaesthesia with fentanyl and propofol and immobilization of the cervical spine with an extrication collar (Ambu Perfit ACE), direct laryngoscopy was performed and view was graded using the Cormack and Lehane classification. Airway devices were placed according to manufacturer's instructions. Number of attempts (maximum 2), time until first tidal volume and intraoperative tidal volumes (goal: $etCO_2$ of 35 mmHg) were recorded. Airway leak pressure was measured with cuff pressures adjusted to 60 cmH_2O. Devices were inspected for traces of blood after removal. Patients were questioned for postoperative complaints.

Results and Discussions: 30 patients were ventilated with ALM or LMC. Demographic data as well as, BMI, baseline heart rate, blood pressure and peripheral oxygen saturation were comparable for both groups. Insertion was successful in all patients (first attempt LMC 30, ALM 28).

Time until first tidal volume for ALM and LMC was 15.6 ± 4.4 and 15.5 ± 4.9 seconds. Tidal volumes were 8.1 and 8.0 ml kg^{-1} for ALM and LMC with resulting peak airway pressures of 14.5 and 14.1 cmH_2O. Airway leak pressures were comparably high: 25.6 ± 5.2 cmH_2O for ALM and 26.5 ± 6.5 cmH_2O for LMC. Traces of blood were found in 6 devices in the LMC group and in 3 devices in the ALM group. Mild complaints (soar throat, VAS 2 on a scale of 1 to 10) were stated in the recovery room and after 24 hours by 2 patients in the LMC group and 1 patient in the ALM group.

Conclusion(s): In patients with reduced cervical spine mobility simulated by an extrication collar, a patent airway can be established rapidly with both LMA-Classic and Ambu Laryngeal Mask. Ventilation parameters, success rates and airway seal are comparable, postoperative complaints are infrequent.

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Comparison of LMA-Unique and Laryngeal Tube Disposable (LTD) in patients undergoing short gynaecological interventions

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Background and Goal of Study: For the reusable LMA-Classic (LMA Company) and the Laryngeal Tube (VBM Medizintechnik), differences in airway leak pressure have been described by several authors (1–4). The single-use PVC products LMA-Unique (LMU) and Laryngeal Tube Disposable (LTD) are compared to test the hypothesis, that a difference in airway leak pressure can be found in these supraglottic devices as well.

Materials and Methods: After obtaining approval of the local ethics committee and patient consent, 40 women scheduled for elective short gynaecologic interventions, were randomized to be ventilated with either LMU or LTD. After induction of general anaesthesia with fentanyl and propofol, airway devices were placed according to manufacturer´s instructions. Number of attempts (maximum 2), insertion time, time until first tidal volume and intraoperative tidal volumes (goal: $etCO_2$ 35 mmHg) were recorded. Airway leak pressure was measured with cuff pressures set to 60 cmH_2O. After removal, devices were inspected for traces of blood and patients were questioned for hoarseness or soar throat.

Results and Discussions: 20 women were ventilated with LMU and 20 with LTD. Demographic data as well as baseline heart rate, blood pressure and peripheral oxygen saturation were comparable for both groups, mean age was 32.5 (±13) years for LMU and 34.5 (±12) years for LTD. Insertion was successful in all patients, a second attempt was necessary in 2 patients with LMU. Time until first tidal volume was 21.5 (±7.6) seconds for LMU and 13.8 (±2.8) seconds for LTD ($p < 0.05$). Peak airway pressures were 15.6 and 16.2 cmH_2O with tidal volumes of 8.7 and 9.2 ml/kg for LMU and LTD. Airway leak pressure with LTD was higher than with LMU: 31.6 (±2.2) vs. 20.9 (1.8) cmH_2O ($p < 0.01$). No traces of blood after removal were found. Mild complaints (2 on a ten point VAS scale) of trouble swallowing were stated in the recovery room and after 24 hours by one LMU patient.

Conclusion(s): Both single-use supraglottic airway devices allow sufficient ventilation in the patients studied. A difference of airway leak pressure as described for the reusable models can be found in the PVC variants as well.

References:

1 Asai. Br J Anaesth 2002;89:729.
2 Cook. Br J Anaesth 2003;91: 373.
3 Ocker. Anesth Analg 2002;95:1094.
4 Wrobel. Anaesthesist 2004;53:702.

Transfusion and haemostasis

A-283

Electric field can preserve red blood cells in stored blood preparations

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Background and Goal of the Study: In stored blood preparations, hemolysis increases according to the duration of the storage. To inhibit hemolysis, various solutions have been investigated[1]. In the present study, the effects of an electric field, which is used to keep freshness of the food in the freezer, on hemolysis in the stored blood preparations were investigated.

Materials and Methods: Fifteen packs of 2-day-old red blood cell concentrates (CRC) in 400 mL each of mannitol, adenine, glucose, phosphate, and citrate (MAP-CRC) were obtained from the Japan Red Cross Society. Each preparation was divided into 4 packs of equal amount and kept in a refrigerator at 4 · exposed to 0, 500, 1500 or 3000 V electric field for 30 days. Serum

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concentrations of sodium (Na), potassium (K), free hemoglobin (fHb) and total haptoglobin (Hp) and pH of the MAP-CRC were measured every 5 days. An electron microscopic examination was also performed.

Results and Discussion: Hp was 0 in all the packs during the study. K and fHb increased according to the duration of the storage, but 0 V had significantly higher K and fHb values than 500, 1500 and 3000 V. Na decreased in all preparations with significantly lower values with 0 V compared to 500, 1500 and 3000 V. No differences were observed among 500, 1500 and 3000 V in K, fHb, and Na. The pH decreased according to the duration of the storage, and 1500 and 3000 V showed significantly lower values than 0 and 500 V. The pH in 0 V was significantly higher than 500 V. Exposing to the electric field during storage of MAP-CRC could decrease hemolysis in the preparation, while no voltage dependency was observed. Considering the pH decrease, 500 V might be the choice, though the life span of the transfused red blood cells and other effects on human should be investigated before its clinical application.

Conclusions: To keep MAP-CRC in the electric field could decrease hemolysis in the preparation during storage.

Reference:

1 Nishiyama T, et al. Crit Care Med 2001; 29: 1979–82.

A-284

Fluids and coagulation in lower limb arthroplasty

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Background and Goal of Study: A prospective, randomized clinical trial to investigate whether the choice of perioperative fluid affected the procoagulant effect of haemodilution, or perioperative coagulation.

Materials and Methods: After Ethics approval and with informed consent, 60 patients presenting for hip or knee arthroplasties were randomized into 3 groups of fluid therapy viz. crystalloid, gelatin or starch. All patients received LMWH 12 hours before surgery. Exclusions: Known abnormality of haemostasis, IV fluids prior to arrival in OR, drug allergy or hypersensitivity to study solutions and severe intercurrent disease. TEG, FBC, INR, PTT, D-Dimer and TAT (thrombin–antithrombin complexes) were measured as follows: after cannula insertion, 30 minutes later after receiving 500 ml of colloid or 1000 ml of crystalloid (presurgery), at the end of surgery and 24 hours after induction of anaesthesia.

Results and Discussions: There were no significant differences between groups or from control after fluid loading. All groups became hypercoagulable at the end of surgery and at 24 hours as evidenced by shortened r and k times (Fig. 1) and increased α angles. This study did not confirm a previous study[1] that enhanced perioperative coagulation was triggered by rapid crystalloid haemodilution. However this effect may have been attenuated by the administration of prophylactic LMWH.

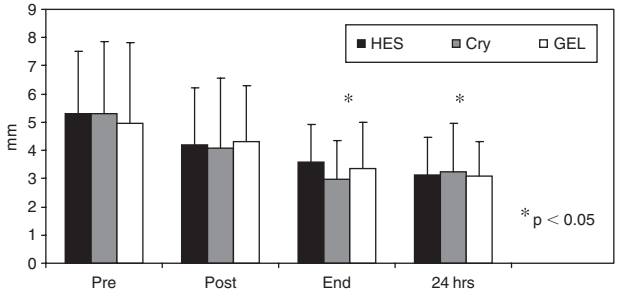

Figure 1. k-time

Conclusion: Surgery itself had a far greater effect on coagulation than the type of fluid used in this study.

Reference:

1 Ruttmann TG. *Br J Anaesth* 2002; 89(2): 1–5.

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A-285

Increased blood loss in portal thrombosis does not affect outcome after liver transplantation

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Background and Goal of Study: Portal thrombosis (PT) in orthotopic liver transplantation (OLT) is a contingency that may increase surgical difficulty and patient morbidity and mortality. Recent data with new surgical technique suggest that favourable results may be achieved (1,2). The aim of our study was to analyse intra and postoperative complications of patients with PT undergoing OLT.

Materials and Methods: A two-year's period retrospective study was performed in patients undergoing OLT. They were distributed in group 1 (no thrombosis), group 2 (partial PT) and group 3 (total PT). Piggy-back with temporal portocava shunt was performed in all patients. Thrombectomy and portal end to end anastomosis were performed in patients with PT. We recorded duration of surgery, total blood loss, packet red blood cells (PRBC), fresh frozen plasma (FFP) and platelets transfused, ICU and hospitalization stay and 6 month mortality. For statistical analysis Kruskal-Wallis and χ^2 tests were used. Descriptive statistics were expressed in median and interquartile range (IQR).

Results and Discussions: 90 patients were included, 13 of them (14%) had total PT and 11 patients (12%) had a partial PT.

	Group 1	Group 2	Group 3
Patients (n = 90)	66	11	13
Duration of surgery (min)	365 (112)	320 (75)	500 (127)*
Blood loss (L)	3.4 (3.3)	2.7 (3.7)	6.9 (4.1)*
PRBCs (units)	5 (6)	4 (6)	10 (9)*
FFP (units)	7 (4.5)	6 (6)	10 (3)*
Platelets (units)	5 (10)	6 (10)	10 (5)*
ICU stay (days)	6 (5)	5 (6)	6 (13)
Hospital stay (days)	19 (15)	20 (10)	19 (16)
6 month mortality	5 (8%)	0%	2 (15%)

*P < 0.05.

Conclusions: Patients with total PT had longer duration of surgery and significant increase in total blood loss and transfusion than patients with partial or no PT. There were no difference in ICU, hospital stay and 6 month mortality.

References:

1 Robles R. Clin Transplant 2004;18:79–84.
2 Dumortier J. Am J Transplant 2002; 2:934–938

A-286

Lowfrequency hemoviscoelastography in monitoring coagulation disorders after abdominal surgery for cancer

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Background and Goal of Study: Venous thromboembolism is of the most common complications in cancer patients and may be due to the hypercoagulable state of malignancy and to it's surgical treatment.

Materials and Methods: Patients undergoing planned curative open surgery for abdominal cancer received MEDNORD (Ukraine Coanalyser) analysis (HVG), a viscoelastic test, measures clot formation and includes information on the cellular as well as the plasmatic coagulation system. We examined the efficacy of a variety of coagulation tests. A complete coaguation screen, activated clotting time (ACT), thromboelasthgraphy (TEG) and haemoviscoelastography (HVG) were performed before surgery, at the end of surgery, and on postoperative days 1, 2, 3, and 7; they were analyzed for the reaction time and the maximal amplitude (MA).

Results and Discussions: We calculated the elastic shear modulus of standard MA (Gt) and HVG MA (GH), which reflect total clot strength and procoagulatory protein component, respectively. The difference was an estimate of the platelet component (Gp). There was a 14% perioperative increase of standard MA, corresponding to a 48% increase of Gt ($P < 0.05$) and an 80%–86% contribution of the calculated Gp to Gt. We conclude that serial standard thromboelastography and HVG viscoelastic test may reveal the independent contribution of platelets and procoagulatory proteins to clot strength. Using multiple linear regression, all coagulation, TEG and HVG variabities were used to model postoperative hypercoagulation. However, 3 components of the routine coagulation assay, including bleeding time, prothrombin time and platelet count could be modeled to show prolonged postoperative hypercoagulability ($P < 0.01$). We conclude that all components of the HVG test reflect postoperative coagulopaties, these results suggest that it may be useful in determining the coagulation status of cancer patients perioperatively.

Conclusion: Postoperative hypercoagulability, occurring for at least 1 week after major cancer abdominal surgery, may be demonstrated HVG viscoelastotest. This hypercoagulability is not reflected completely by standard coagulation monitoring and TEG HVG viscoelastotest provides a fast and easy to perform bedside test to quantify in vitro hemocoagulation.

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Novel polyanionic starches: pharmacokinetics and effect on blood coagulation

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Background and Goal of Study: Linkage of carboxy-methyl (CM) residues to the glucose units of starch results in CM starch (CMS) and – when combined with hydroxyethylation – in CM-hydroxyethyl (HE) starch (CM-HES). These polyanionic starches are more hydrophilic than conventional HES and might be promising alternatives as plasma substitutes. The goal of this study was to investigate the pharmacokinetics of these novel starches and to study their impact on blood coagulation.
Materials and Methods: This trial was conducted as a randomized controlled in vivo study in 30 pigs (40 ± 5 kg). After infusion of 20 ml/kg of HES (130/0.4) (control), CMS or CM-HES (6% each) over 30 minutes, serial blood samples were obtained over 20 hours. Plasma concentration was determined and blood coagulation was assessed by Thromboelastograph® (TEG®) analysis and plasma coagulation assays. Pharmacokinetic (PK)-pharmacodynamic (PD) analysis was performed based on a two-compartment model, using a linear model relating predicted concentration values to the observed effects. PK-PD parameters were compared by one-way ANOVA followed by Scheffé's multiple comparisons test.
Results: Data are given as mean (SD).

	HES	CMS	CM-HES
Pharmacochemical parameters			
In vitro mean molecular weight (kD)	139	129	138
Molar substitution with CM groups	–	0.3	0.06
Molar substitution with HE groups	0.42	–	0.34
Pharmacokinetic parameters			
Area under the curve (min·g/L)	442 (94)	2959* (287)	2469* (283)
Terminal half-life (min)	185 (117)	525* (75)	561* (78)
Maximal concentration (g/L)	4.0 (0.5)	8.0* (0.6)	6.6* (0.4)
Central distribution volume (L)	9.1 (1.4)	5.2* (0.6)	6.5* (0.7)
Clearance (L/min)	0.115 (0.032)	0.016* (0.001)	0.019* (0.003)
Steady-state volume (L)	18.7 (5.4)	10.2* (1.5)	12.7* (1.5)
Pharmacodynamic parameters			
Coagulation index¶/(g/L)	−0.23 (0.08)	-0.26^{ns} (0.09)	-0.20^{ns} (0.09)
Maximal amplitude¶ (mm)/(g/L)	−0.83 (0.33)	-1.12^{ns} (0.29)	-0.70^{ns} (0.38)
Prothrombin time (s)/(g/L)	−0.01 (0.14)	-0.14^{ns} (0.13)	-0.12^{ns} (0.15)
Antigenic vWF level (%)/(g/L)	−1.88 (1.67)	-0.69^{ns} (0.57)	-1.11^{ns} (1.11)

PD parameters indicate the decrease in the respective coagulation parameter *per* g/L plasma concentration of the colloid; *$p < 0.001$, ^{ns}not significant compared to HES; ¶TEG ®parameter; vWF, van Willebrand factor.

Conclusion: CMS and CM-HES have a significantly longer intravascular persistence compared to HES but do not exhibit a stronger effect on blood coagulation at a given plasma concentration in mass units.

A-288

Comparison of two methods of warming intraoperatively infused fluids in regard to their effectiveness in maintaining temperature and reducing postoperative shivering (Preliminary study)

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Background and Goal of Study: The temperature of infused fluids is important for heat and temperature homeostasis. This study compares the intraoperative changes of temperature and postoperative shivering when fluids are infused through a warming device to those observed when fluids are only prewarmed.
Materials and Methods: 30 ASA I–III patients, undergoing abdominal surgery under combined anaesthesia, were randomized in two groups to receive all fluids either prewarmed at 38°C or warmed at a constant temperature of 41°C by flowing through a warming device. Temperature was recorded 15 min intraoperatively, using oesophageal and skin thermometers. Postoperative shivering was rated 0–3 (0 = none, 1 = mild, 2 = moderate, 3 = severe).
Results and Discussions: The two groups presented equal demographic data, type and duration of operation, anaesthetic management and environmental conditions. There was no significant difference in the rate of mean temperature fall during the first 30 min [rate (prewarmed) = −0,78°C/L vs. rate (device) = −0,64°C/L, Correlation coef ≥ 0,99 for each]. Thereafter, in the device group, mean temperature ceased to fall over the next 15 min, and remained almost constant until 100 min [rate (30–100 min) = −0,077°C/L, CC = −0,95)]. At 100 min, it even turned increasing [rate (100–180 min) = 0,15°C/L, CC = 0,99]. In contrast, mean temperature continued to decrease in the group of the prewarmed fluids [rate (30–180 min) = −0,36°C/L, CC = −0,95]. The difference of mean temperature between groups was significant at 60 min (dev = 35,9°C vs. prew = 35,5°C, $p < 0,05$) and increased as time passed (mean Temp at 180 min: 36,2 vs. 34,7°C). Postoperative shivering was less in the device group [median = 0, max shivering = 2 in 2/15 patients] than in the group of the prewarmed fluids [median = 1, max shiv. = 3 in 4/15 patients, while 7/15 patients of this group presented shivering 2 or greater].
Conclusion(s): Continuous warming at a constant temperature of intraoperatively infused fluids, by means of a warming device, maintains temperature significantly better and results in significantly less postoperative shivering compared to merely prewarming them.

A-289

Effects of gelatin solutions on polymorphnuclear cells

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Background and Goal of Study: Physicochemical characteristics of colloids determine their side effects on platelets (1,2). The goal of the present experiments was to compare various gelatin solutions on their side effect on polymorphnuclear cell (PMN) function.
Materials and Methods: After IRB approval and informed consent were obtained, citrated whole blood from 9 healthy volunteers was haemodiluted *in vitro* (0%, 40%) with oxypolygelatin (Gelifusin®, Braun Austria, Maria Enzersdorf, Austria), modified gelatin (Gelifundol®, Biotest Pharmazeutika, Vienna, Austria), polygeline (Haemaccel®, Aventis Pharma, Vienna, Austria), and normal saline (Braun 0.9%®, Braun Austria, Maria Enzersdorf, Austria). An undiluted sample served as a control. Expression of Mac-1 receptor fragment CD11b was evaluated as a marker for PMN activation using the monoclonal antibodies anti-CD11b and anti-CD45. Expression of CD11b was analyzed with and without agonist-stimulation using N-formyl-Met-Leu-Phe (fMLP; 100 nM). A lyse-wash procedure was performed before flow cytometric analysis using FACSCalibur™ and CellQuestPro™ software (Becton Dickinson Immunocytometry Systems, San Jose, USA). Statistical analysis: one-way ANOVA ($P < 0,05$).
Results and Discussions: Oxypolygelatin and modified gelatin had no effect, whereas polygeline significantly increased CD11b expression after 40% haemodilution in both resting and fMLP-activated PMN when compared to controls.
Conclusion(s): Our results indicate that structural characteristics of gelatin molecules modulate their influence on PMN function. Oxypolygelatin and modified gelatin seems to exert no relevant side effect on the inflammatory response even at 40% haemodilution. The PMN-activating effect of polygeline may, at least in part, be induced indirectly by platelet stimulation (2) and platelet–PMN interaction.
References:
1 Franz A, Bräunlich P, Gamsjäger T, et al. *Anesth Analg* 2001; 92: 1402–7.
2 Thaler U, Deusch E, Kress HG, et al. *Anesthesiology* 2003; 99: A636.

A-291

Comparison of perioperative volume requirements of HES 130/0.42 and HES 200/0.5 in major urological surgery

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Background and Goal of Study: The effectiveness and tolerability of hydroxyethyl starch formulations depends mostly on the mean molecular weight and the degree of molar substitution. Because of this different volume effects could result. We compared a new HES 130/0.42 formulation (Venofundin®, B. Braun Melsungen AG, Germany) with an established HES

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200/0.5 (Infukoll® HES, Serumwerk Bernburg, Germany) with respect to perioperative volume requirements, haemodynamic effects, safety and tolerability.

Materials and Methods: After approval of the local ethics committee we investigated in a prospective, randomized double-blinded clinical trial 100 adult patients scheduled for elective major urological surgery with expected large volume requirements. The study fluids were administered according to patients' individual needs to sustain adequate haemodynamics from induction of anaesthesia until 24:00 h on the day of surgery. Infusion trigger were mean arterial pressure, central venous pressure, heart rate, or other clinical reasons. The required volume of study medication served as primary endpoint.

Results and Discussion: There were no differences in demographic and baseline characteristics between the groups. In both groups intraoperatively and during ICU stay equivalent volumes were administered to maintain or achieve haemodynamic stability (OP: HES 130/0.42: 1150 ± 574 ml; HES 200/0.5: 1070 ± 572 ml, $p = 0.0002$; ICU: HES 130/0.42: 1390 ± 955 ml; HES 200/0.5: 1245 ± 715 ml [Mean ± SD] $p = 0.0196$). Course and values of haemodynamic parameters between groups were comparable. There was no difference in total fluid balance. Routine chemistry and blood coagulation did not vary considerably. Over the entire observation period no serious adverse event occurred. In group HES200/0.5 intraoperatively red blood cells were administered more frequently (HES130/0.42: 4 patients; HES200/0.5: 11 patients; $p = 0.0499$).

Conclusions: The new HES 130/0.42 is equivalent to HES 200/0.5 with regard to volume requirements, safety and tolerability during surgery and ICU stay. The reason for the significant higher transfusion rate in group HES 200/0.5 cannot be explained by the study results.

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Substantial donor red blood cell transfusion reduction by a combination of blood saving techniques

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Background and Goal of Study: Until 1999 no special blood saving techniques were used in our 300 bed general hospital, apart from loco-regional anaesthesia techniques. Realising the risks of donor blood transfusions, a blood transfusion reduction programme was started.

Materials and Methods: Introduction of the following blood saving measures and techniques:

- *2000*: The so-called 4-5-6 transfusion protocol;[1]
- *2000*: Active patient temperature control, aiming at a perioperative temperature loss less than 1°C;
- *2000*: Surgical damage-control strategy;
- *2000*: Peroperative and postoperative cell saving in all major surgery (hip/knee/vascular/trauma);
- *2001*: Introduction symposium on the subject of blood saving techniques to increase awareness;
- *2003*: 4-week preoperative epoetin alfa treatment in total hip/knee surgery for patients with Hb 10–13 g/dl at preoperative screening visit.[2]

Results and Discussions: Both in overall hospital and in total hip and knee replacement surgery allogenic transfusion needs decreased considerably from the introduction of the first measures onward, despite increasing operation production figures (see Table). Particularly in total hip and knee replacements the effects are clear, changing from 2.0 units per patient in 1999 to 0.4 units in 2003.

	1999	2000	2001	2002	2003	2004 (*prognosis*)
Overall hospital						
Surgery patients (n)	6473	7116	7509	7972	8837	*9100*
RBC use (units)	3883	3214	2550	2839	2364	*2000*
Total hip and knee replacements only						
Patients (n)	286	308	322	389	434	*451*
RBC use (units)	571	358	322	369	184	*136*

Conclusion: Combination of blood management measures can induce a huge allogenic transfusion reduction.

References:

1 Slappendel R, et al. Acta Orthop Scand 2003;74:569–75.
2 Goldberg MA, et al. Am J Orthop 1996;25:544–52.

A-294

Is the postoperative drained blood a good monitor for estimating the total blood loss following knee arthroplasty?

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Background and Goal of Study: Although a great percentage of the total postoperative bleeding corresponds to a hidden blood loss in the tissues and joint[1,2], visible blood from the drainage is considered the gold standard for monitoring blood loss after a knee arthroplasty. Only one study was not able to find a consistent relationship between the total blood loss and postoperative drained blood[3]. The aim of our study was to assess the usefulness of a postoperative drainage as a monitor of bleeding following a knee arthroplasty.

Materials and Methods: Fifty patients undergoing unilateral knee arthroplasty from March to November 2004, were prospectively followed until the fourth postoperatively day. Drained red blood cell (RBC) loss was assessed by multiplying the visible blood volume by an haematocrit (Hct) of 30% from a pilot study. Total RBC loss was calculated by multiplying the patient blood volume (PBV) by the difference between the preoperative and fourth-day postoperative Hct, and compensated with the volume of RBC transfused; [PBV × ($Hct_p - Hct_{4th}$) + RBC transfused]. Hidden RBC loss was determined by subtracting the visible RBC loss from the total RBC loss. Regression analysis was performed to assess the relationship between the total RBC loss and drained RBC loss.

Results and Discussions: The average age of the fifty ASA 2 patients was 72 ± 7 years. Nearly all the procedures were performed under intradural anaesthesia. Cemented technique and tourniquet were used in all cases. The mean total RBC loss was 615 ± 197 ml. The mean drained RBC loss was 206 ± 113 ml, and mean hidden RBC loss was 414 ± 194 ml. Thus the hidden loss was 67% of the total blood loss. Regression analysis shown a poor correlation coefficient between the total RBC loss and visible RBC loss ($r = 0.31$, $p < 0.03$).

Conclusions: After knee arthroplasty, the total RBC loss can not be estimated by the visible blood from drainage probably due to the hidden RBC loss (67% of the total blood loss).

References:

1 Sheat, KR, et al. *The Knee* 2000; 7:151–155.
2 Sheat, KR, et al. *J Bone Joint Surg (Br)* 2004; 4:561–565.
3 Umlas, et al. *Transfusion* 1994; 34:402–406.

A-295

Correct assessment of blood loss and haemoglobin levels for good postoperative management after knee arthroplasty

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Background and Goal of Study: Major blood loss from drainage occurs during the first 3–6 hours after knee arthroplasty[1]. The drop in haemoglobin (Hb) is not only explained by drained blood loss, because hidden blood in the tissues and joint can be 50% of total blood loss.[2,3] The purpose of the study was to determine the blood losses distribution and the postoperative Hb level which could better estimate the total blood loss during hospitalisation.

Patients and Methods: Fifty patients undergoing unilateral knee arthroplasty from March to November 2004 were prospectively followed until the fourth postoperative day. Baseline and postoperative Hb levels at 3–6 hours, 24 hours and the fourth day were recorded. Drained red blood cell (RBC) loss was assessed by multiplying the visible blood volume by an haematocrit (Hct) of 30% from a pilot study. Total RBC loss was calculated by multiplying the patient blood volume (PBV) by the difference between the preoperative and fourth postoperative Hct, and compensated with the RBC mass transfused; [PBV × ($Hct_p - Hct_{4th}$) + RBC transfused]. Hidden RBC loss was determined by subtracting the visible RBC loss from the total RBC loss.

Results: The average age of the fifty ASA 2 patients was 72 ± 7 years and 68% of them were women. Nearly all the procedures were performed under intradural anaesthesia. Cemented technique and tourniquet were used in all cases. The mean total RBC loss was 615 ± 197 ml. The mean drained RBC loss was 206 ± 113 ml, and mean hidden RBC loss was 414 ± 194 ml. Thus the hidden loss was 67% of the total blood loss.

Hb values are shown in the Table (g/dL, mean ± SD):

Baseline	3–6 h	24 h	4th day
13.9 ± 1.2	11.3 ± 1.6	10.2 ± 1.3	9.9 ± 1.1

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Conclusions: Postoperative haemoglobin at 24 hours is a proper indicator for estimating the total RBC loss after knee arthroplasty. The 1.1 g/dL fall in Hb between 3–6 and 24 hours, suggests an inaccurated reposition of fluids derived from the unknown hidden blood loss (2-fold drained RBC loss).

References:

1 Umlas, et al. *Transfusion* 1994;34:402–406.
2 Sheat, KR, et al. *The Knee* 2000;7:151–155.
3 Sheat KR, et al. *J Bone Joint Surg (Br)* 2004;4:561–565.

A-296

Preoperative haemoglobin optimization in total knee arthroplasty

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Background and Goal of Study: Interdisciplinary coordination is necessary for patient's preoperative optimization, going to be submitted to a potential bleeding surgery. One of the most important predictive transfusional factors is preoperative haemoglobin (Hb) (1).

The aim of our study is to evaluate if preoperative haemoglobin optimization reduces transfusional index in patients undergoing total knee artrhoplasty.

Materials and Methods: The study was approved by the Ethical Committee of the Institution. We included 353 patients. Group 1 (n = 105) without Hb optimization. Group 2 (n = 248) the haemoglobin was optimized. Patients with level of Hb < 13 g/dl were studied by the Department of Haematology to determine what treatment would be necessary: oral iron (Fe) ± Epoetin alfa (EPO). The data collected were: demographics, anaesthesia risk, Hb levels and transfusion index.

Student T and Chi squared tests were used for statistical analysis.

Results:

	Transfusion	Fe	EPO + Fe	Hb i	Hb p	Hb d
G 1 (n = 105)	16 (15.2%)	–	–	13.6*	13.6*	9.1*
G 2 (n = 248)	11 (4.4%)	51	22	13.7*	14.1*	10*

Hb: haemoglobin, *media, EPO: epoetin alfa, Fe: oral iron.
Hb i: initial, Hb p: post-treatment, Hb d: discharge.

Conclusions: Preoperative Hb patient optimization leads us to reduce transfusion. Ferritin and plasma iron levels determination in preoperative laboratory tests are necessary to optimize Hb and also to reduce transfusion index. EPO administration has been necessary in only 22 patients.

Reference:

1 Salido JA, Marín LA, Gómez LA et al. Preoperative hemoglobin levels and the need for transfusion after prosthetic hip and knee surgery: analysis of predictive factor. J. Bone Joint Surg Am 2002; 84: 216–20.

A-297

A new and less invasive approach for the management of blood volume loss/restitution during major trauma surgery

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Background and Goal of Study: We have shown in both man and animal models that cardiac filling pressures are equivocal monitors of acute blood loss and its restitution (1,2). We propose a model based on three parameters, that is, non-invasive cardiac index (nCI), central venous pressure (CVP), and venous central oxygen saturation ($ScvO_2$), to accomplish this goal.

Materials and Methods: After institutional approval, 12 major trauma surgical patients were studied. Monitoring consisted in MAP, HR, CVP and continuous $ScvO_2$ by means of a central fiberoptic catheter (Edwards preSep), nCI was continuously measured by an esophageal "ODM" Doppler probe (Abbott lab). The changes in HR, MAP, CVP, $ScvO_2$ and nCI were recorded every 15 minutes, and blood samples for Hb/Hto levels were taken hourly. Blood volume restitution was accomplished by the maintenance of a CVP > 5 mmHg, nCI > 2,5 l/min/m^2 and $ScvO_2$ > 70 with the infusion of crystalloid/colloid solutions. Allogeneic blood transfusions were administrated when Hb < 9 gr/dl. Statistical analysis was performed using ANOVA and linear regression analysis.

Results and Discussions: Mean age = 47 ± 19 yrs; weight = 75 ± 13 Kg; height = 172 ± 10 cm. There was a negative correlation between CI vs Hb (r = 0.41; p = 0.01), but none between CI vs CVP and/or $ScvO_2$ values.

	Control	Low Hb level	End surgery
CVP mmHg	7 ± 3	9 ± 4	9 ± 5
nCI l/min/m^2	2.69 ± .7	3.35 ± 0.9*	3.45 ± 0.9*
$ScvO_2$%	79 ± 5	74 ± 5	78 ± 5
Hb gr/dl	10.4 ± 1.2	7.5 ± 1*	8.9 ± 1*

*p < 0.05 vs control.

Conclusion(s): Our data suggests that a model based in a pressure, CVP, a volume, nCI, and a parameter that assesses tissue oxygenation, $ScvO_2$ may accomplish the needs for a correct blood volume status during major surgery. It is important to note, that, this model avoids the use of a PA catheter, since $ScvO_2$ is a valid alternative to SvO_2 for such approach (1,2).

References:

1 Anesthesiology, 1997.
2 BJA, 1999.

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A-298

Controlled low central venous pressure and its effect on blood loss in hepatic resection

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Background and Goal of Study: Hepatic resection results in significant morbidity and mortality related to intraoperative blood loss. Any strategy to reduce blood loss and blood transfusion would be of benefit to the patient. This study aims to asses the influence of central venous pressure (CVP) level on intraoperative blood loss in hepatic parenchymal transection.

Materials and Methods: This is a prospective, randomized study, that took place in the operative theater, as approved by the ethics committee. The study enrolled 40 consecutive patients ASA I–III, who underwent hepatectomy. All patients received general anesthesia with isoflurane, fentanyl, atracurium as required. We monitored invasive arterial blood pressure and central venous pressure (radial artery, internal jugular vein). The patients were assigned to two groups: the first group L1 = 20 patients who had their CVP level maintained at 0–6 mmHg through the liver resection procedure and the second group L2 = 20 patients in whom the CVP level was above 6mmHg. Both groups had blood loss monitored (suction systems, compresses). The data underwent statistical analysis: average, standard deviation, Student's test.

Results and Discussions:

Group	Average bleeding (ml)	Stdev (ml)
L1	1059	± 855,36
L2	1790	± 1366,38

*p < 0.05.

The patients who had the CVP maintained between 0–6 mmHg had a lower average blood loss.

Conclusion(s): Maintaining a low CVP is a good tool in reducing blood loss intraoperatively but not enough, losses being still higher than those in literature references.

Reference:

1 Jones R McL, Moulton C E, Hardy C J – Central venous pressure and its effect on blood loss during liver resection. British Journal of Surgery, 1998, 85, 1058–1060.

A-299

Perioperative erythropoietin administration in patients undergoing radical retropubic prostatectomy

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Background and Goal of study: The aim of this study was to investigate the effect of recombinant human erythropoietin (r-HuEPO) administration on perioperative haemoglobin concentrations and on the number of blood transfusions in patients undergoing radical prostatectomy.

Materials and Methods: In this double-blind placebo – controlled study 30 patients received subcutaneous r-HuEPO in a dose of 600 IU/kg body weight plus iron supplementation with 300 mg ferrous sulphate orally beginning on preoperative day 10 and 30 patients received placebo medication iron (control group).The patients received erythropoietin on preoperative day 10,7 and 4 provided their baseline haemoglobin value level 8,5–13 gr/dl. Intraoperative blood loss was estimated by the amount of blood collected in

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the aspirator and by the weight of the gauzes used. The indication of blood transfusion was haemoglobin value of 8,5 gr/dl or less. In all patients blood cell counts and serum chemistries were performed every second day until discharge. In addition reticulocytes ferritin and iron were measured at admission, the day of operation and at discharge. For statistical analysis the student t test was used to compare means of measures. The paired sampled t test was used to compare values of hematocrit, haemoglobin, and reticulocytes, in all the patients. Statistical significance was achieved at $p < 0,05$.

Results and Discussion: Patients who received erythropoietin received significantly fewer transfusion intraoperative and postoperatively (10 patients with a total of 20 units vs 21 patients with a total of 48 units) $p < 0,05$. In addition during the postoperative period a markedly increased number of patients ($n = 10$) from the control group received an allogenic transfusion compared to two patients in the study group who were transfused. $p < 0,05$. Postoperatively the study group had significantly higher haematocrit, haemoglobin and reticulocytes count values compared to the control group.

Conclusion: Patients who underwent radical prostatectomy benefit from perioperative erythropoietin administration in terms of stimulated erythropoiesis and reduction of blood transfusions.

Reference:

1 Nieder A, Rosenblum N, Lepor H. Urology 2001; 57: 737–741.

A-300

New data management solutions improve the logistic and safety of blood transfusion

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Background and Goal: The safe production and application of blood products demands high quality logistics. Since the seventies computers and barcodes are used in transfusion medicine for the improvement of the safety of processed data. Now a new technology was developed: radio frequency identification (RFID). The aim of our study was to check, whether RFID can be used reasonably in transfusion medicine.

Material: In the Donation Service in Dresden 1070 passive RFID smart labels were tested under real production conditions. In Vienna 100 RFID smart labels with a multi-sensor system measuring also the temperature of the blood product were tested under simulated "real" conditions, although without patient contact. The data collected were transferred to a new handheld PC software "LabelView", developed to allow for the monitoring of all steps around the transfusion, including patient identification and the processing of haemovigilance data.

Results and Discussion: Both types of RFID labels survived all steps during the processing of whole blood (e.g. centrifugation) storage, transport and transfusion. The chips even survived under conditions normally not encountered by RPC's (e.g. freezing in liquid nitrogen). The semiactive label also showed a good correlation ($r^2 = 0.98$) between temperature measured via the chip sensor and via an external infrared sensor. The contactless identification and data storage is of great help in handling documentation of all processing steps according GMP and to provide a means to make transfusion safer.

Conclusion: For a host of problems around blood product use various single point solutions such as patient-wristband, bed-side test, double check of blood group typing and donor-donation registry exist, but for the first time a single system comes into use to combine documentation, safe identification and reporting of haemovigilance data. Additionally, the temperature readings are a means to reduce the disposal rate of RPC's due to unknown storage conditions. Our investigation shows that the RFID's and the software used performed flawlessly even under harsh conditions.

Reference:

1 Knels R; Computer assisted logistic in transfusion medicine. TransfusMedHemother 2004;31(S 3):52.

Acknowledgements: We thank KSW Microtec AG Dresden for providing the RFID-labels and Novatech Research GmbH Vienna for development "Label View".

A-301

Transfusion requirements and practices in Austrian hospitals: a prospective benchmark study

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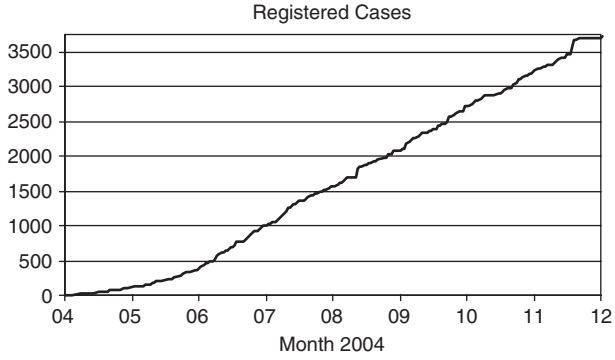
Background and Goal of Study: Despite detailed transfusion guidelines and continuous educational efforts transfusion practice still varies substantially between hospitals. To assess and optimise the current perioperative use of blood components in public hospitals the Austrian Ministry of Health and Women initiated this study.

Materials and Methods: 18 hospitals were selected by stratified randomisation. Strata were three geographical regions and three levels of care. The study group investigated 4 surgical procedures: primary noncemented hip replacement, primary knee replacement, CABG, and hemicolectomy. The number of cases to be studied was estimated at 6000 over an 8 month study period. The estimation was based on data of the Ministery of Health and Women collected in 2001. In each of the hospitals an appointed physician – mostly a member of the anesthesia department – entered the data into the central database via web. An independent contract research organisation was responsible for data monitoring. This was done on-line as well as by visiting the study sites. Study variables include preop. Hb, Hb on POD 3 and 5, blood conservation methods, blood components given, complications, length of ICU- and hospital stay.

Results and Discussions: Recruiting started in April 2004 and reached a rate of 550 cases per month after a 2-month run-in phase. More than 60% of the estimated 6000 cases could be included into the study. As of December 2004 more than 80% of the registered cases have been completed and can be evaluated now.



Conclusion(s): Using the above mentioned methods a representative sample of operations could be obtained.

A-302

The impact of acute hypervolemic haemodilution on ELWI, ITBI, CVP, and $rcSO_2$

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Background and Goal of Study: The aim of this study was to evaluate the impact of acute hypervolemic haemodilution on Extravascular Lung Water Index (ELWI), Intrathoracic Blood Index (ITBI), CVP, and regional cerebral oxygen saturation ($rcSO_2$) in burned patient surgery.

Materials and Methods: 30 patients with major burns (>15% BSA) were enrolled in the study. Before the beginning of surgery 6% HES 130/0.4 was infused in a quantity enough to achieve a calculated final haematocrit of 25%. ELWI, ITBI, CVP and $rcSO_2$ were determined at the beginning and at the end of haemodilution. Results were compared using the repeated measures ANOVA.

Results and Discussions: During burned patient surgery major blood loss occurs. Hypervolemic haemodilution has been described as an alternative to reduce hemoglobin loss[1]. However, large volume infusion may cause fluid overload and even pulmonary oedema. In this study, patients were infused 500 to 2500 ml of HES. All patients showed an increase in CVP, ELWI and ITBI. Only ELWI showed a correlation with final haematocrit. HES infusion had to be stopped in 3 cases because of increased ITBI. $rcSO_2$ decreased during haemodilution.

Conclusion(s): ELWI and ITBI are useful indexes of volume load during hypervolemic haemodilution[2]. In contrast to CVP these indexes reflect more accurately the cardiac preload and alert about the risk of pulmonary oedema caused by a fluid overload. In a context of haemodilution and further bleeding as this is, $rcSO_2$ could be used as a transfusion trigger[3] provided the depth of anaesthesia, FiO_2, ventilation, and haemodynamics were kept stable.

References:

1 Mielke LL, Entholzner EK, Kling M et al. Anesth Analg 84:26, 1997.
2 Lichtwarck-Aschoff M, Beale R, Pfeiffer UJ. J Crit Care 11:180, 1996.
3 Torella F, Cowley R,Thorniley MS, et al. Comp Biochem A Mol Integr Physiol 132:199, 2002.

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A-303

The role of antifibrinolytic agents in gynecologic cancer surgery

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Background and Goal of Study: The purpose of this study was to compare the effects of the preoperative use of crystalloids, colloids, tranexamic acid and epsilon-aminocaproic acid on bleeding in gynecologic cancer surgery.
Materials and Methods: 105 ASA I–II patients undergoing gynecologic cancer surgery were included in the study. Group I (crystalloid) were given crystalloid solutions, Group II (colloid) were given colloid solutions, Group III (Tranexamic acid) were given 10 mg/kg tranexamic acid, and Group IV (epsilon-aminocaproic acid) were given 100 mg/kg epsilon-aminocaproic acid. All patients' bleeding amount were measured and recorded perioperatively, and at the 12th and 24th hours postoperatively. All patients' hemoglobin, hematocrit, aPTT, INR, fibrinogen, and thrombocyte count and symptoms of pulmonary embolism were evaluated preoperatively and at the 12th and 24th hours postoperatively. One-Way analysis of variance, Duncan test and Kruskal-Wallis variance analysis were used to compare the variables in the four groups. Time related variables were analyzed using paired t-test and Wilcoxon test. The differences in variables related to time and coagulation values were analyzed with Chi square and Kappa tests. $p < 0.05$ were considered as significant.
Results and Discussions: In comparison of the amount of bleeding, the bleeding in the tranexamic acid group was 30.8% less than crystalloid group ($p < 0.05$), 33.3% less than colloid group ($p < 0.05$), and 23.9% less than epsilon aminocaproic acid group ($p < 0.05$). The bleeding in the aminocaproic acid group was 9% and 14% less than the crystalloid and colloid groups but the difference was not significant. In the comparison of tranexamic acid preincisional procedure with acute normovolemic hemodilution and epsilon-aminocaproic acid administration, it clearly decreased the bleeding in gynecologic cancer surgery.
Conclusions: When the negative effects of blood transfusions are considered tranexamic acid administration can be recommended for decreasing the need for blood transfusion in gynecologic cancer surgery.

A-304

The effects of aprotinin on perioperative hyperglycemia in patients undergoing cardiac surgery

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Background and Goal of Study: Hyperglycemia during cardiac procedures and cardiopulmonary bypass (CPB) may be severe.[1] The etiology of the disturbance of the plasma glucose-insulin relationship includes inadequate insulin secretion and decreased endogenous insulin activity. It has been postulated that aprotinin may increase the biological effectiveness of insulin by the inhibition of insulin degradation or by decreasing insulin resistance.[2] This putative effect of aprotinin, however, has not been evaluated in cardiac surgical patients.
Materials and Methods: A systematic review of an existing database of cardiac surgery patients at a major U.S. tertiary care medical center was performed. Patients selected met all of the following criteria: the use of CPB, preoperative serum creatinine ⩽1.2 mg/dl, no history of diabetes mellitus, no perioperative insulin or steroid therapy. Patients were then divided into 3 groups; no aprotinin (control), full dose aprotinin (FDA) or half dose aprotinin (HDA). Glucose levels were obtained at predetermined intervals.
Results and Discussions: 96 patients met all of the criteria. Of these, 61 received aprotinin (FDA = 28, HDA = 33) and 35 did not. The only significant demographic difference between the groups was fewer reoperations in the control group. The FDA group had significantly lower plasma glucose levels than both the control group and HDA group. (Fig 1.)

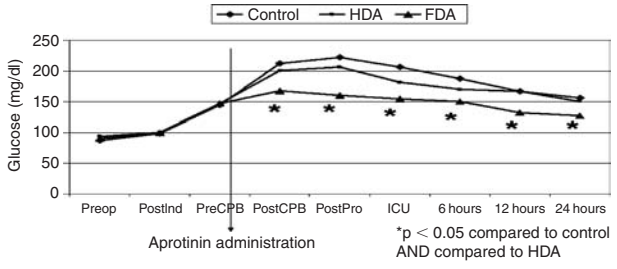

Figure 1.

Conclusion(s): In this study, patients receiving aprotinin were found to have significantly lower glucose levels when administered full-dose compared to control and to the half-dose regimen. Further study is warranted to evaluate the clinical relevance of this finding.
References:
1 Carvalho G, Anesth Analg 2004; 99: 319.
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A-305

Tranexamic acid reduces blood loss in knee arthroplasty

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Background and Goal of Study: Total knee arthroplasty is carried out by using tourniquet, which enhances certain fibrinolytic effect, specially during the first postoperative hours. Tranexamic acid (TKA), antifibrinolytic agent, reduces blood loss in total knee arthroplasty[1], but its effect in continuous infusion during the immediate postoperative period has never been tested in this kind of surgery.

The objective of our study was to evaluate the effect of TKA on blood loss and its influence in the transfusional needs.
Method: Double blind prospective study. Patients scheduled for total knee arthroplasty were randomly assigned to two different groups. Group TKA: 30 minutes before the tourniquet liberation, a 10 mg/kg bolus of TKA was given, and a 1 mg/kg/h perfusion was started for 6 hours. Group control: SSF was given in the same manner. Blood loss (expressed with drainage volume and total calculated bleeding at fourth day – ml of red blood cell units, hematocrit 100%), allogenic or autologous transfusion, and complications were registered. T-test was used for quantitative variables and Chi-square test for qualitative variables.
Results: 33 patients were included (TKA 18, control 15). Groups were similar in sex, age, preoperative hematocrit and coagulation parameters. No significant differences were found in fluid administration during perioperative period. No thrombogenic events were observed. Mean (SD) values are summarized below.

	Drainage blood loss (<6 h) (ml)	Drainage blood loss (6–96 h) (ml)	Calculated bleeding: ml RBC units, Ht 100%	Allogenic transfusion (red blood cells units)
Gr. TKA	186(119)	120(134)	387(163)	0
Gr. control	542(437)	130(119)	527(136)	5
Sig $p < 0.05$	0.010	0.83	0.011	0.173

Conclusion: Tranexamic acid use before the release of tourniquet and in perfusion during 6 hours after the surgery of knee arthroplasty, reduce the drainage blood loss and the total calculated bleeding at fourth day significantly. Allogenic transfusion index is reduced too, but not signficantly in our study.
Reference:
1 Hippala ST, et al. Tranexamic acid radically decreases blood and transfusions associated with total knee arthroplasty. Anest. Analg. 1997; 84: 839–44.

A-306

Factor VII administration attenuates deleterious consequences of consumptive coagulopathy following amniotic fluid embolism

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Background and Goal of Study: Amniotic fluid embolism (AFE) is a deleterious, often lethal, pregnancy complication. In as much as 83% of cases, AFE is followed by consumptive coagulopathy, manifested by persistent massive bleeding. During delivery, the management of the latter includes transfusion of large quantities of whole blood and blood components, frequently followed by surgical intervention. We propose a simple method, attenuating the severity of labor-associated, AFE-induced bleeding, and reducing the quantities of blood/blood component transfusions.
Materials and Methods: A 40-year-old female was admitted to the labor ward at the 42nd week of her 12th pregnancy. After 2 h of labor, at full dilatation of the cervix, she suddenly developed typical AFE. She was immediately treated for cardiac complications, and finally the fetus was successfully delivered by forceps extraction. Several minutes after delivery, a severe postpartum hemorrhage and bleeding from the vein puncture sites started,

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urging immediate laparotomic hysterectomy. The hemorrhage persisted, despite oxytocin administration and massive blood/blood component replacement. At this point, the patient was administered two successive doses of recombinant activated factor VII (Novoseven), 7.4 mg and 3.7 mg, respectively.
Results: The hemorrhage stopped, the patient's hemodynamics, coagulation and metabolic parameters became stable. By the end of laparotomy, 5.5 h' after the initial collapse, she was transferred to the Intensive Care Unit.
Conclusions: We suggest that repetitive administration of factor VII at the early stages of AFE might significantly attenuate the severity of AFE-induced bleeding during delivery. In addition, the timely use of factor VII would significantly reduce the massive quantity of blood/blood component replacement needed, thus proving cost-effective and, at least in some cases, prevent surgical intervention, i.e. hysterectomy, in still young and fertile female patients.

A-307

Additional aspirin effectively shortens bleeding time prolonged by daily low-dose aspirin

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Background and Goal of Study: Discontinuation of anti-platelet drugs several days before surgery increases the risk of ischemic events. Conversely, patients on low-dose aspirin treatment risk of excessive bleeding during emergency surgery. Our preliminary report found that additional 660 mg of aspirin shortens bleeding time prolonged by low-dose aspirin (1). The purpose of the present study was to verify this effect in additional subjects in comparison with a placebo group.
Materials and Methods: Subjects comprised 50 healthy male volunteers (mean age, 24 $\pm$ 3 years) who were administered aspirin 81 mg every morning for 7 days. On day 7, Group A (n = 25) received aspirin 660 mg, and Group C (n = 25) received placebo. Bleeding time, maximum platelet aggregation rate induced by adenosine diphosphate (ADP) or collagen, platelet count, prothrombin time (PT), and activated partial thromboplastin time (APTT) were measured before the study (baseline), and before and 2 h after test drug administration.
Results and Discussion: Bleeding time was significantly prolonged after aspirin 81 mg administration for 7 days, from 3.1 $\pm$ 0.7 min to 6.1 $\pm$ 1.4 min in Group A ($P < 0.01$), and from 2.9 $\pm$ 0.9 min to 6.1 $\pm$ 1.5 min in Group C ($P < 0.01$). Additional aspirin decreased bleeding time to 4.5 $\pm$ 1.3 min ($P < 0.01$) in Group A, while bleeding time was unchanged in Group C. Platelet count decreased significantly from 25.2 $\pm$ 5.7 $\times$ 10^4 mm^{-3} to 19.5 $\pm$ 2.5 $\times$ 10^4 mm^{-3} for a week in Group A, but PT and APTT showed no significant changes. Maximum platelet aggregation rate induced by collagen was significantly decreased, and that induced by ADP also tended to decrease in both groups.
Conclusion: Incremental administration of 660 mg of aspirin could shorten bleeding times prolonged by daily low-dose aspirin.
Reference:
1 Yokoyama T, Yamashita K, Yamasaki F, et al. *Masui.* 2003; 52: 399–401.

A-308

Additional aspirin shortens bleeding time in patients taking daily low-dose aspirin, but prolongs it in patients treated with ticlopidine

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Background and Goal of Study: Ticlopidine and low-dose aspirin are often used as anti-platelet drugs. Both drugs are usually discontinued several days before surgery to avoid excessive bleeding during surgery. During emergency surgery, the risk of excessive bleeding has to be considered. Whether additional high doses of aspirin offset the bleeding tendency resulting from low-dose aspirin administration is known as the Aspirin Dilemma (1). The present study investigated the effects of additional aspirin on bleeding time in patients taking ticlopidine or aspirin in comparison with placebo groups.
Materials and Methods: Subjects comprised 41 patients, with 20 patients (13 men; mean age, 67 $\pm$ 7 years) on ticlopidine 200 mg/day (Group T), and 21 patients (12 men; mean age, 70 $\pm$ 12 years) on low-dose aspirin 81 mg/day (Group A). 12 of group T and 14 of group A took aspirin 660 mg, and others took placebo immediately after measuring bleeding time, capillary fragility test and platelet count. Values were measured again 2 h later.
Results and Discussions: Bleeding time was prolonged significantly from 5.1 $\pm$ 3.1 min to 9.9 $\pm$ 4.2 min after 660 mg of aspirin in Group T ($P < 0.01$). In Group A bleeding time was shortened significantly from 7.3 $\pm$ 3.1 min to 3.4 $\pm$ 1.6 min ($P < 0.01$). However, there was no significant difference in patients administered placebo in both groups. No significant differences in capillary fragility test or platelet count were noted between groups, either before or after administration of additional aspirin or placebo.
Conclusion(s): Administration of an additional 660 mg of aspirin prolongs bleeding time in patients taking daily ticlopidine, but shortens bleeding time in patients taking daily low-dose aspirin. Additional aspirin may be useful in patients taking low-dose aspirin to help prevent hemorrhaging during emergency operation. Conversely, aspirin should be used carefully for analgesia in patients taking ticlopidine.
Reference:
1 Marcus AJ. *NEJM.* 1977; 297: 1284–1285.

A-309

Platelet function recovery after aspirin

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Background: Aspirin is widely used for prevention cardio- and cerebrovascular complications. Recommendations to stop aspirin intake before surgery are based on platelet life span and vary between 7 to 10 days. Although evidence of platelet function recovery is lacking, it has been suggested that less than 7 days are required (1). The goal of this study was to detect the time of recovery of platelet function after cessation of aspirin therapy.
Methods: After IRB approval and signed informed consent 12 healthy male volunteers were enrolled in the study. Aspirin effect on platelets was evaluated by aggregometry activated by arachidonic acid (ARA), epinephrine (EPN), and adenosine diphosphate (ADP). Aggregometry was performed before aspirin administration, on the 10th day of aspirin intake, on the 1st, 2nd, 3rd, 4th, and 7th days after aspirin cessation. The data was analyzed with ANOVA for repeated measurements and presented as mean $\pm$ SD, $p < 0.05$ is considered significant.
Results and Discussion: Platelet aggregation with ARA and EPN decreased significantly after aspirin intake. Aggregation with ADP remained unchanged during all period of the observation. Aggregation with ARA and EPN returned to normal value on the 3rd day after aspirin cessation (Table).

Table.

Agonist	Baseline	10 d on aspirin	2 d off aspirin	3 d off aspirin	4 d off aspirin
ARA	90.2 $\pm$ 3.3	13.1 $\pm$ 5.5*	28.1 $\pm$ 24.8*	82.3 $\pm$ 16.1	91.1 $\pm$ 3.8
EPN	89.8 $\pm$ 9.0	50.5 $\pm$ 13.0*	63.8 $\pm$ 19.3*	76.5 $\pm$ 16.4	88.4 $\pm$ 8.9
ADP	90.9 $\pm$ 5.9	77.9 $\pm$ 8.1	81.8 $\pm$ 5.9	85.3 $\pm$ 10.8	89.8 $\pm$ 3.0

*$p < 0.05$.

Conclusions: Aggregometry with ARA and EPN is sensitive test for evaluation of cessation of the aspirin effect on platelet function. In healthy volunteeers platelet function recovers after 3 days of aspirin cessation.
Reference:
1 Gibbs et al. *J. Cardiothorac. Vasc. Anesth.* 2001;15:55–59.

A-311

Could modified thromboelastogram assess platelet inhibition by aspirin in off pump coronary artery bypass surgical patients and healthy volunteers?

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Background and Goal of Study: Thromboelastogram (TEG) is regarded as a method by which coagulation can be measured during surgery. Off pump coronary artery bypass (OPCAB) surgical patients are routinely placed on aspirin. But conventional TEG could not detect platelet dysfunction by antiplatelet agent (1). We used modified TEG (addition of heparin and platelet agonists) to determine whether this modified TEG could assess the platelet dysfunction by aspirin in OPCAB surgical patients and healthy volunteers (2).
Materials and Methods: After institutional review board approval and consent, platelet function of 10 OPCAB patients (group 1) and 10 healthy

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subjects (group 2: before aspirin, group 3: after aspirin) were measured using modified TEG. In each group, TEG parameters (R, K time and MA) were analyzed using paired t-test and one way ANOVA was used to determine the difference between groups.

Results and Discussions: In group 1 (OPCAB patients) and group 2 (healthy subjects, before aspirin), the R and K time were increased significantly with the addition of heparin and then decreased subsequently with the platelet agonists (ADP or collagen) in the presence of anticoagulation (heparin). MA showed a decrease in both groups. This compares with no significant difference in all parameters in group 3 (healthy subjects, after aspirin) with the addition of heparin, ADP and collagen. There were no significant differences in each TEG parameter between groups.

Conclusions: This study suggested that aspirin medication obliterated the effect of anticoagulation and platelet agonists in modified TEG. However modified TEG does not provide a comprehensive and sensitive reflection of platelet inhibition by aspirin. TEG should be supplemented by other methods of platelet function assessment.

References:

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Neurosciences

A-313

Respiratory complications in patients after surgery for aneurismal subarachnoid bleeding

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Background and Goal of Study: The goal of our study is to evaluate the relationship between neurological impairment and the intensity of the respiratory complications in our patients. (1).

Materials and Methods: Study is performed in a group of 151 patients suffering from aneurismal subarachnoid bleeding. Pulmonary function was evaluated through measurement of parameters reflecting its impairment using a quantitative system of measurement (lung injury score-LIS) reflecting the intensity of the acute lung injury. Evaluation of mechanical support provided to patients under mechanical ventilation is performed using PIF index (2). To assess the neurological impairment the Hunt and Hess scale was used. The incidence of multi organ failure (MOF) and mortality rate are considered in relationship to neurological impairment and to acute lung injury developed.

Results and Discussion: In our patients is shown a strong correlation ($r = 0.88$) between the level of neurological impairment and the lung injury score (LIS) prior and after the clipping of the aneurism. Vasospasm and its neurological impact are major determinants of the incidence of the impairment of the respiratory function. Mortality rate in the group was 13.91% (21 from 151). Disorders not related to neurological impairment are responsible for 38.01% (8 from 21) of mortality. In most of the cases multi organ failure (MOF) was the cause death. Acute lung injury differs significantly among patients depending on their Hunt and Hess grade ($p < 0.05$). Hunt and Hess grade as well as the severity of the acute lung injury are a strong predictor ($r = 0.79$) of patient outcome, too.

Conclusions: Severity of the acute lung injury is in close relationship to Hunt and Hess grade of the patient and both are a major predictor of the patient outcome.

References:

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2 Doyle RL, Szaflarski N, Modin GW, et al: Identifikation of patients with acute lung injury. Predictors of mortality. Am J Respir Crit Care Med 151: 1568 1575, 1995.

A-314

Intraoperative visualization of deep seated expanding brain lesions with contrast ultrasound

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Background and Goal of Study: During neurosurgery for deep-seated brain lesions intraoperative identification sometimes entails transporting the patient to the imaging suite. An alternative technique for intraoperative visualization is direct brain ultrasound scanning. Owing to the limited difference in ultrasound lesion scattering, contrast-enhancement might improve visualization. In this study, we investigated whether SHU 508A injected intravenously during mechanical ventilation opacifies the right and left ventricular cavities after lung transit, reaches the cerebral circulation and visualizes deep-seated expanding brain lesions.

Materials and Methods: Twenty-five patients undergoing neurosurgical procedures for supratentorial expanding lesions were prospectively enrolled. All patients received intravenous SHU 508A, during spontaneous breathing (baseline), 5 min after mechanical ventilation began, and 5 min and 30 min after extubation. Of the 25 patients, 10 undergoing intraoperative open-skull brain ultrasound scanning to visualize deep-seated lesions received an additional dose of SHU 508A to investigate cerebrovascular contrast distribution within the lesion. After intravenous contrast injection, we evaluated pulmonary transit time and cardiac chamber opacification; the time for contrast to reach the cerebral circulation; the time it remained in the brain; and its distribution within the expanding brain lesions.

Results and Discussions: In all patients, SHU 508A passed through the lungs with a constant physiologic transit time; opacified both cardiac chambers; reached the cerebral circulation in a physiologic time and visualized the deep-seated expanding brain lesions.

Conclusion: Intravenous SHU 508A provides physiologic pulmonary capillary transit during mechanical ventilation, reaches the cerebral circulation and visualizes deep-seated expanding brain lesions in patients undergoing intraoperative cerebral ultrasound scanning.

A-315

Postoperative hypertension after craniotomy and catecholamine secretion

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Background and Objective: Hypertension after craniotomy is frequent. It has been assumed that the stress of recovery is at least as great as that of surgery. Hypertension after craniotomy is higher compared to other types of surgery. The goal of the study is to figure out the association between catecholamine dynamic in blood and postoperative hypertension with or without high heart rates.

Methods and Materials: Twelve patients (age 40.33 ± 22.23), without preoperative history of hypertension, after planned craniotomy and normal per-operative history, were selected. Mean arterial blood pressure (MAP), heart rate and plasma concentrations of Epinephrine (E) and Norepinephrine (NE) were measured at three moments: 20 minutes after halothane discontinuation, one and two hours after that (moments 1;2;3). Data are given as mean $\pm$ SD (range), $p \leq 0.05$ is considered as statistically significant.

Results: Seven of the patients had normal blood pressure postoperatively (group N) and five others developed postoperative hypertension (group H) defined as MAP $>$ 20% more than the baseline. The mean value of MAP measured in groups H and N, was 114.6 ± 15.5 mmHg (range: 98–134) and 103 ± 11.9 mmHg (range 73–100) ($p \leq .01$). Postoperative catecholamine plasma concentrations were much higher in group H. The mean value of Epinephrine (E) was 464.0 ± 295.4 pg/ml and of Norepinephrine (NE) was 886.7 ± 495.3 pg/ml, compared with those of group N (Epinephrine (E) = 191.8 ± 104.7 pg/ml and Norepinephrine (NE) = 574.7 ± 329.3 pg/ml). Difference in catecholamine plasma levels persists in all check moments.

Conclusion: These results suggest that an increased discharge of sympathetic system may play an important role in the development of postoperative hypertension after craniotomy. This observation may indicate a rational approach for treatment of postoperative hypertension after craniotomy.

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A-316

Postoperative hypertension (HTN) following craniotomies for tumour: incidence and predictive factors

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Background and Goals of Study: Systemic hypertension (HTN) is a risk factor for postcraniotomy intracranial hematomas[1]. Studies have quoted 20 to 80% incidence of HTN following craniotomies for tumour[2]. However these studies have not had incidence of HTN as the primary endpoint. The purpose of this study is to determine the true incidence of postoperative HTN, and identify predictive factors.
Material and Methods: After IRB approval, all consented patients undergoing craniotomy for tumor were prospectively followed. Data collected included patient demographics, surgical data, hemodynamic parameters, complications and outcome. Hypertension was defined as a value of greater than 160/90 mmHg lasting longer than 5 minutes. Statistical analyses were by Chi-Square test and t-tests.
Results: 108 patients were followed. 37(34.2%) patients were hypertensive in the postoperative period. 10 patients with treatable causes of HTN (pain, hypothermia, vomiting) were excluded. True incidence of hypertension was 25%. There were no demographic differences between the groups. Results are shown in the table:

	HTN (n = 37)	No HTN (n = 71)
Chronic HTN (n)	19*	18
Raised ICP (n)	18*	11
Site of tumor (n)		
Supratentorial	28	41
Infratentorial	10	30
Type of tumor		
Primary CNS	10	26
Meningioma	9	21
Metastases	8	24

*$p < 0.05$.

Conclusion: In our study true incidence of post craniotomy HTN is 25%. Chronic HTN and raised intracranial pressure are significant predictive factors. These results are preliminary and more numbers are needed to identify risk factors.
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A-317

Effects of fentanyl and S(+)-ketamine on gastrointestinal motility and catecholamine dosages in neurosurgical patients – a pilot study

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Background and Goals: In neurosurgical patients, narcotics are usually administered to prevent secondary cerebral damage due to elevated intracranial pressure (ICP) and to provide conditions favouring the recovery of brain tissue. Intestinal atonia and a decrease in blood pressure affording the use of vasopressors, however represent complications often related to the type of anesthesia being used. The aim of the present study was to evaluate gastrointestinal motility and catecholamine consumption in neurosurgical patients undergoing two different protocols of anesthesia using fentanyl/methohexital, and S(+)-ketamine/methohexital.
Material and Methods: Twenty-four patients (mean age 52 ± 17 years) who sustained severe traumatic brain injury or aneurysmal subarachnoid haemorrhage received either fentanyl/methohexital or S(+)-ketamine/methohexital in a prospectively controlled randomised trial. In both groups, dosage of methohexital was 3 mg/kgBW/h. Dosage of analgesia (fentanyl or S(+)-ketamine) was titrated to establish a comparable level of sedation, monitored by Bispectral-Index (BIS). ICP was treated according to the AANS guidelines. The dosage of norepinephrine was adapted to reach a cerebral perfusion pressure (CPP) of >70 mmHg. BIS, ICP, CPP and norepinephrine dosage were recorded over 5 days. Indirect calorimetry was performed to determine the energetic requirements of each patient and enteral nutrition was started via a stomach tube following an increasing nutrition scheme. Metoclopramid, neostigmin and ceruletid were applicated in a standardised fashion. In order to asses gastrointestinal motility, time intervals to full enteral nutrition and first defecation were recorded. Based on the results of the this pilot study, sample size estimation was performed to evaluate the number of patients required to reach statistically significant differences.
Results: Patients who underwent analgesia with S(+)-ketamine had a lower demand of norepinephrine compared with the fentanyl-group (3.6 ± 5.1 μg/kgBW/h vs. 12.8 ± 18.4 μg/kgBW/h). Sample size estimation revealed that 42 patients in each group would be required in order to demonstrate a significant difference regarding catecholamine consumption. In contrast, there was no difference between the two groups regarding the time period to achieve full enteral nutrition (85.3 ± 47.2 hrs vs. 94.4 ± 72.9 hrs) or time until first defecation (40.9 ± 22.9 hrs vs. 43.5 ± 46 hrs).
Conclusion: In patients receiving S(+)-ketamine, lower dosages of norepinephrine are needed to maintain an adequate CPP than in patients sedated with fentanyl. The influence of fentanyl and S(+)-ketamine on gastrointestinal motility is comparable.

A-318

Developing of reliable and safe technique for induction of mild hypothermia during cerebral aneurysm surgery

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Background and Goal of Study: Efficacy of hypothermia is heavily dependent on proper technique and timing. We performed current study for assessment of efficacy and safety of intraoperative induction and maintenance of mild hypothermia to core temperature of 32–33°C by combination of forced air, circulating water mattress, and i.v. bolus infusion of iced slushed saline.
Materials and Methods: We included in study 50 consecutive patients undergoed open cerebral aneurysm surgery. Range of the weight was 50 to 120 kg. For core temperature monitoring used nasopharyngeal probe. Core temperature immediately after induction was 35.8–37°C. After induction of anaesthesia we begun forced air cooling (set for ambient air) and cooling by circulating water mattress (set for 4°C), infused 2.5 g $MgSO_4$, and after stabilization infused iced slushed saline (4°C) through two lines (central 14–16 G and periferal 18 G) until approaching target temperature. We adjusted ventilation to keep $PaCO_2$ 32–35 mm in pH-stat mode.
Results and Discussions: All patients with weight ≤90 kg were successfully cooled to 32–33°C; expended volume of saline was 15–30 ml/kg. Low-weight patients (<55 kg) did not require iced saline for cooling. Four patients with weight near 120 kg were also successfully cooled; expanded volume of saline was 35–40 ml/kg. Time interval from beginning of the cooling to achieving target temperature was 1.5–2.5 hours. Most frequent adverse effects: bradycardia (responsive to atropine and to decreasing rate of bolus infusion); cold diuresis, that can contribute to hypovolemia; trend to low normal serum potassium (3–3.5 mmol/l) and hyperglycemia (7–11 mmol/l); retarded recovery; prolonged intubation and ventilation; shivering at emergence. None from these effects caused break of the cooling.
Conclusion: (1) Combination of forced air, circulating water mattress and i.v. bolus infusion of slushed iced saline is effective and safe technique for induction of mild hypothermia (32–33°C) during cerebral aneurysm surgery. This technique is effective in significantly overweight patients just as well. (2) Timing of this technique is fast enough for achieving of target temperature until the beginning of surgical dissection of intracranial vessels. (3) Profile of associated adverse effects is acceptable in face of brain ischemia.

A-319

Use of bispectral Index (BIS) to guide the anesthetic management for wake-up craniotomy

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Introduction: Wake-up craniotomy has been advocated as thé solution for patients undergoing epilepsy surgery or tumor surgery in eloquent areas. The anesthetic challenge is to provide as well adequate analgesia, sedation, hemodynamic stability, as a safe airway, with an awake cooperative patient for neurological testing. In the present paper, we want to illustrate how we used BIS, which is a measure of the hypnotic component of anesthesia, to guide our anesthetic management during wake-up craniotomy.
Materials and Methods: In this paper, we report on 6 adult pts scheduled for brain tumor surgery in eloquent areas of the brain. Following premedication (midazolam 7.5 mg po), induction was accomplished with propofol TCI (3 μg/ml), remifentanil TCI (8 ng/ml) and rocuronium (0.6 mg·kg). After insertion of a laryngeal mask airway (LMA), anesthesia was maintained with propofol TCI (titrated to BIS between 40 and 60) and remifentanil TCI (titrated to hemodynamic responses). Surgical field was infiltrated with up to 30 ml bupivacaine 0.5%. For neurological testing (and wake-up) TCI propofol-remifentanil was gradually (minus 10% of initial rate) reduced according to a BIS value between 60 and 80. When BIS was higher than 80, pt was

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stimulated, LMA was removed and propofol-remifentanil TCI was maintained according to a BIS value between 80 and 90.
Results: In all 6 pts, the wake-up procedure was successfully managed. In a mean of 18 min (range 14–31 min) after start of the wake-up procedure, BIS values higher than 60 were obtained. At this time, mean propofol TCI was 2.1 μg/ml and mean remifentanil TCI was 3.5 ng/ml. Infusion rates were further decreased in order to reach BIS values higher than 80 (mean propofol 1.3 μg/ml and mean remifentanil 2.1 ng/ml). All pts were arousable, LMA was removed, and neurological testing was started (for a mean of 37 min). Hemodynamic parameters remained stable, respiratory rate and arterial PCO_2 remained within normal limits. No pt experienced any anxiety or pain. In 4 pts, the end of the surgical procedure was performed under local anesthesia.
Conclusions: Anesthetic management for awake craniotomy can be strictly guided BIS monitoring, allowing smooth and safe transition from anesthesia to conscious sedation with great patient satisfaction.

A-320

Factors that may predict and influence postoperative neurological recovery in posterior fossa surgery

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Background and Goal of Study: Posterior fossa (PF) itself is a small, confined space. Any space occupying lesion can block CSF flow and cause pressure on vital brain structures resulting in increased morbidity and mortality. The goal of the study was to determine the factors affecting short term neurological outcome in patients undergoing PF surgery upon ICU discharge.
Materials and Methods: We retrospectively analyzed the clinical, radiological and operative findings of 194 patients that underwent PF surgery at our institution over the last 10 years. The patients were divided in two groups. Group A: ICU stay <2 days (n = 142), group B: ICU stay >2 days (n = 52). The following parameters were recorded: age, ASA-PS, preoperative GCS, CT-scan grade, anesthesia and surgery duration, presence of CSF drainage, APACHE II (acute and chronic health state) score upon ICU admission and GOS. Statistical analysis was performed using Mann Whitney, chi-square and multivariate stepwise regression.
Results and Discussion: Overall mortality was 3.05%. No statistically significant difference was noticed regarding age or ASA-PS. Parameters significantly associated with ICU stay are referred to in the table. CT scan grade, duration of surgery, APACHE II score and CSF drainage were factors that predicted 62% of the variance of prolonged ICU stay.

GCS*	14.8 ± 0.7	13.9 ± 2.9	0.000
CT-scan grade 5	4 (15.8%)	22 (84.8%)	0.000
APACHE II*	7.3 ± 3.5	9.6 ± 5.1	0.004
Surgery (h)*	4.5 ± 1.6	5.6 ± 2.3	0.005
Anesthesia (h)*	5.7 ± 1.7	6.9 ± 2.4	0.004
CSF-drainage	20 (14.1%)	25 (49%)	0.012
GOS 1–3	3 (2.1%)	14 (26.9%)	0.000
*mean ± SD	A (n = 142)	B (n = 52)	p-value

Conclusion: CT-scan grade, duration of surgery, APACHE II score as well as the presence of CSF drainage affected short term neurological outcome (GOS) and ICU stay in an important manner.

A-321

Mitochondrial ATP-sensitive potassium channel blocker dose not attenuate ischemic and hypoxic preconditioning on hypoxic-ischemic brain injury in the neonatal rat

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Background and Goal of Study: Involvement of mitochondrial adenosine triphosphate-sensitive potassium (K_{ATP}) channels in the development of ischemic tolerance has been suggested in the rat. In this study, we examined the effect of selective mitochondrial K_{ATP} channel blocker 5-hydroxydecanoate (5HD) on ischemic and hypoxic preconditioning in the neonatal rat brain.
Materials and Methods: Seven-day old Sprague-Dawley rat pups were divided into five groups: control (C, n = 91), ischemic preconditioning (IP, n = 51), hypoxic preconditioning (HP, n = 39), pretreatment ischemic preconditioning (PIP, n = 52), and pretreatment hypoxic preconditioning (PHP, n = 43). Thirty minutes before preconditioning, PIP and PHP received 60 mg/kg intraperitoneal 5HD. For IP and PIP, the right common carotid artery was occluded for 10 min. Rats in HP and PHP were kept under hypoxic (8% oxygen, 92% nitrogen) conditions for 4 h. Twenty-four hours after the preconditioning, rats from all groups were exposed to the right common carotid artery ligature, followed by 2.5 h of hypoxia. Triphenyl tetrazolium chloride (TTC) staining and terminal deoxynucleotidyl transferase-mediated dUTP-biotin nick end-labeling (TUNEL) were evaluated as measures of infarct and apoptosis 1 and 7 days after hypoxic-ischemic injury. In addition, all rats were sacrificed 2 weeks after hypoxic-ischemic brain injury, and the morphologies of the brains were examined.
Results: In the pretreatment and preconditioning groups, the infarct size of TTC staining, the numbers of TUNEL-positive cells, and the degree of morphologic changes were significantly lower than those in the control group ($p < 0.05$), but there were no significant differences between the four pretreatment and preconditioning groups.
Conclusion: These results suggest that mitochondrial K_{ATP} channel blocker 5HD dose not attenuate ischemic and hypoxic preconditioning on hypoxic-ischemic brain injury in the neonatal rat.

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Interleukin-18: a new marker of neurocognitive dysfunction after cardiac surgery

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Background and Goal of Study: Neurological injury following cardiopulmonary bypass (CPB) remains a potentially devastating consequence of heart surgery. Increased expression of Interleukin-18 (IL-18), a proinflammatory cytokine, is seen in the acute ischaemic stroke patient [1]. This study investigates our hypothesis that IL-18 may be used as a marker of neurological dysfunction after cardiac surgery.
Materials and Methods: With ethical approval and informed patient consent, 30 patients (24 male, 6 female, age 62 ± 10) undergoing elective cardiac surgery (CABG 27, Valve Replacement 2, ASD repair 1) using CPB were enrolled. IL-18 blood samples were taken: before induction, 10 min post CPB, 6, 24, 48, 72, 96 h post CPB, at discharge and 6 weeks. Patients were assessed using a battery of 9 neuropsychometric tests [2] preoperatively, at 5 days and 6 weeks postoperatively. A patient was considered to have a major deterioration in a test if the score deteriorated by 1 SD of the baseline score for all patients. Neurocognitive impairment was defined as a major deterioration in two or more tests and was examined at 2 time intervals from; pre-operatively (baseline) to day 5 and baseline to 6 weeks. The peak difference of IL-18 was calculated from the peak and baseline values. Logistic regression was used to investigate the effect of peak difference of IL-18 on neurological outcome.
Results and Discussions: 8 patients had neurocognitive impairment between 5 days and baseline. Neurological outcome was significantly dependent on the peak difference in IL-18; p = 0.033.

	Time intervals	
	Baseline to day 5	Baseline to 6 week
No. of patients	8	3
p values	0.033	0.29

Conclusion: IL-18 may be a useful marker of neurological dysfunction after cardiac surgery. Further investigation is required.
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A-325

Influence of sevoflurane on the neuroregenerative potency of the brain after cerebral ischemia

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Introduction: The present study investigates the effect of halothane and sevoflurane on the neuroregenerative potential of the brain after cerebral ischemia.
Methods: Following approval of the institutional animal care committee 48 male Sprague-Dawley rats were intubated, anesthetized and ventilated with

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halothane. After insertion of catheters and preparation of the carotid arteries animals were randomized to six different treatment groups (n = 8 per group). Animals of all groups received 25 μg/kg/h fentanyl i.v. and were ventilated with O_2 and air (FiO_2 = 0.33). In groups 1 and 2 animals additionally received 0.8 MAC halothane, in groups 3 and 4 animals received 0.8 MAC sevoflurane and in groups 5 and 6 animals received 1.6 MAC sevoflurane. In the sham operated groups 1, 3, and 5 no cerebral ischemia was performed. In ischemic groups 2, 4, and 6 ten minutes of forebrain ischemia was induced by bilateral carotid artery occlusion plus hemorrhagic hypotension to a mean arterial blood pressure of 40 mmHg. Pericranial temperature, arterial blood gases and pH were maintained constant. Upon recovery from anesthesia and return to their home cages bromodeoxyuridine (BrdU, 100 mg/kg) was administrated i.p. for seven postischemic days as a marker of newly generated cells. At the end of a 28 days observation period animals were killed in deep anesthesia, perfused with paraformaldehyde, and brains were removed and stored at −20°C. Histological damage of the hippocampus was evaluated in 40 μm slices stained with hematoxylin and eosin. Immunohistochemistry was used to detect cells in the dentate gyrus with a positive staining for BrdU. Eight non-ischemic animals were used as a naive control. Statistics: Two way ANOVA ($p < 0.05$; mean ± standard deviation).

Results: In animals subjected to cerebral ischemia 10% of the hippocampal CA1 region was damaged, regardless of the choice or concentration of the anesthetic agent. After cerebral ischemia an increase of newly generated cells in the dentate gyrus by 100% was observed with halothane and 1.8 MAC sevoflurane. Four hours of anesthesia with halothane or sevoflurane in the absence of cerebral ischemia did not influence neurogenesis.

Discussion: Histopathologic damage was observed after cerebral ischemia with both anesthetic agents. At the same time halothane and sevoflurane allowed an ischemia-induced increase of neurogenesis in the dentate gyrus. These data show, that halothane and sevoflurane are suitable as background anesthetics for stem cell research, as both agents lack intrinsic effects on stem cell activity, while they allow for a ischemia induced proliferation of stem cells.

A-326

Correlation between continuously monitored regional cerebral blood flow and brain tissue oxygenation

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Background and Goal of Study: Cerebral tissue oxygenation ($p_{ti}O_2$) is thought to be predominantly influenced by cerebral blood flow (CBF). Just recently, a thermodiffusion-probe has been developed for continuous monitoring of regional CBF in patients. The goal of this study was to investigate the relationship between regional $p_{ti}O_2$ and CBF.

Materials and Methods: In eight patients with either subarachnoid hemorrhage (n = 5) or severe traumatic brain injury (n = 3), both regional $p_{ti}O_2$ and CBF were simultaneously monitored for an average of 9.6 days. $P_{ti}O_2$ and CBF were assessed using a flexible polarographic Clark-type microcatheter (Licox, Integra Neurosciences) and a thermodiffusion probe (QFlow 400, Hemedex), respectively. Both probes were placed close to each other (10 mm) in tissue considered at risk of ischemia. For each subsequent 30-minutes interval, in which $p_{ti}O_2$ changed more than 5 mmHg, the correlation between $p_{ti}O_2$ and CBF was calculated.

Results and Discussions: Four hundred 30-min. intervals were analysed, of which a close correlation ($r > 0.6$) between $p_{ti}O_2$ and CBF was observed in 70%. A weak correlation ($0.3 < r < 0.6$) was found in 19%, and no correlation ($r < 0.3$) in 9% of intervals, respectively. Compared to $p_{ti}O_2$-monitoring, CBF monitoring was possible only in 64% of time. The remaining times of non-monitoring were mostly due to calibration of the CBF-device or fever of the patient.

Conclusion(s): Our preliminary data suggest that changes in CBF are associated with similar changes in $p_{ti}O_2$ most of the time. The level of $p_{ti}O_2$ seems to be predominantly determined by regional CBF rather than by arterial pO_2, at least in patients without major pulmonary disease.

A-327

Oxidative stress response of remifentanil-based anaesthesia with isoflurane or propofol in craniotomy operations

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Background and Goal of Study: Excess of free radicals, known as oxidative stress, is the major cause of neurologic injury (1). In this presenting study, our aim was to examine effects of two anaesthesia techniques on oxidative stress response via malondialdehyde (MDA), a lipid peroxidation by-product, in craniotomy procedures.

Materials and Methods: Forty patients scheduled for craniotomy were enrolled into two groups to receive either isoflurane-remifentanil (Group I) or propofol-remifentanil (Group II) anaesthesia. MDA samples were obtained at time points as preoperatively (PRE), after intubation (INT) and dura incision (DUR) and at 60th minutes (60.M), after extubation (EXT) and at postoperative 1st (P1) and 24th (P24) hour. Haemodynamic measurements were performed simultaneously and also after skull pin placement and craniotomy and at every 30 minutes during the procedure.

Results and Discussions: All patients were comparable with respect to demographic properties. Both isoflurane and propofol in conjunction with remifentanil anaesthesia provided considerable haemodynamic stability. Oxidative stress response pattern via MDA was similar in both groups intraoperatively, whereas postoperative 1st hour value was significantly higher in propofol group. Data (Mean ± SD) are shown in the table:

MDA (nmol/ml)	GROUP I	GROUP II
PRE	10.86 ± 4.03	12.72 ± 3.39
INT	15.73 ± 4.87*	16.99 ± 4.68*
DUR	12.82 ± 4.19	13.77 ± 4.63
60.M	13.02 ± 5.59	13.87 ± 3.44
EXT	13.69 ± 5.12	12.06 ± 3.92
P1	11.89 ± 5.86	16.28 ± 4.29*#
P24	12.58 ± 4.61	13.80 ± 3.17

*$p < 0.05$: comparison with preoperative value within group.
#$p < 0.05$: between groups.

Conclusion: Neither of the techniques could be respected as superior in preventing the oxidative stress response.

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A-328

Factors affecting brain tissue oxygen tension: a computational modelling study

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Background and Goal of Study: Computational modeling allows theoretical investigation of factors promoting cerebral tissue hypoxia. Previous models have focused on describing oxygen flux at just the capillary-tissue interface. (1) Using a previously described model (2) of cerebral haemodynamics and gas exchange we studied the effect of arterial hypoxia, arterial hypotension and brain tissue swelling in otherwise normal brains.

Materials and Methods: The model consists of serial vascular beds confined within a non-compliant cranium. Arteriolar resistance is responsive to changes in cerebrospinal fluid pH, arteriolar transmural pressure and cerebral blood flow. The partial pressure of oxygen in brain tissue ($PbrO_2$) is a complex function of arterial oxygen saturation/partial pressure (SaO_2/PaO_2), tissue volume, distance from capillary, capillary pH, $PaCO_2$ and oxygen solubility and diffusivity in brain tissue. The simulation was set up with normal parameters for autoregulation and intracranial CSF dynamics. $PbrO_2$ was calculated over a range of mean arterial pressure, SaO_2 and tissue volume.

Results and Discussions: Between 70 and 150 mmHg mean arterial pressure (MAP), $PbrO_2$ increased from 3.1 to 3.9 kPa. Below 70 mmHg MAP $PbrO_2$ fell by 0.05 kPa $mmHg^{-1}$. The fall in $PbrO_2$ as SaO_2 was reduced was greater between 90 and 100% SaO_2 (0.075 kPa% SaO_2^{-1}) than 85 and 90% (0.059 kPa% SaO_2^{-1}). Increasing tissue volume by 10% lowered $PbrO_2$ across the range of MAP and SaO_2. The lowest $PbrO_2$ was 0.71 kPa (MAP 60 mmHg, SaO_2 85%, 10% oedema). The model predicts that in normal brains, moderate hypotension and hypoxia even when combined are not enough to generate critical cerebral ischaemia. Modest degrees of oedema may allow critical ischaemia to occur. The results are consistent with published clinical data (1).

Conclusions: This computational model can provide useful data regarding the pathological factors which, when combined, predispose to critical cerebral ischaemia.

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A-329

Effects of the intracerebroventricular application of insulin-like growth factor (IGF) and its N-terminal tripeptid (GPE) on cerebral recovery after cardiac arrest in rats

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Background and Goal of Study: After transient global cerebral ischaemia, selectively vulnerable brain areas show delayed neuronal degeneration (1). Recent data demonstrated potent neuroprotective effects of the application of growth hormones like IGF (insulin-like growth factor) and its cleavage product GPE (glycine-proline-glutamate) after focal cerebral ischaemia (1, 2). In order to assess possible effects of the intracerebroventricular application of IGF and GPE on cerebral recovery after cardiac arrest in rats, the vulnerable hippocampal CA1 sector was investigated.

Materials and Methods: After approval was obtained from the Governmental Animal Care Committee, global cerebral ischaemia was initiated by ventricular fibrillation in rats during general anaesthesia. After 6 min, animals were resuscitated by external cardiac massage combined with defibrillation and divided into three groups (IGF vs. GPE vs. placebo). Continuous application of IGF (1.25 μg/h), GPE (5 ng/h) and placebo was performed during the complete reperfusion time using an implanted osmotic minipump. After 7d ($n = 6$ per group) coronal brain sections were analyzed by TUNEL- and Nissl-staining. Viable and TUNEL positive neurons were counted in the hippocampal CA1 sector. All experiments were performed in a randomized and blinded setting. For statistical analysis the Kruskal-Wallis, the Wilcoxon and the Chi-square test (mean ± SEM; $p < 0.05$ = significant) were used.

Results and Discussions: In all groups typical delayed neurodegeneration could be found in the hippocampal CA1 sector. Interestingly, animals treated with IGF and GPE showed a strong trend towards more viable neurons than placebo treated rats (IGF: 54 ± 21; GPE: 53 ± 24; placebo: 40 ± 21; p = ns). Results from TUNEL staining revealed no differences between the groups (IGF: 21 ± 7; GPE: 17 ± 7; placebo: 20 ± 6).

Conclusion(s): Despite the well known neuroprotective properties of IGF and GPE in ischaemic induced neuronal degeneration, this model could not reveal significant beneficial effects after cardiac arrest in rats. However, a trend towards neuroprotective effects of IGF and GPE could be seen and should be investigated in detail.

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A-330

The attenuation of vasospasm by using dexmedetomidine after experimental subarachnoidal haemorrhage model in rabbits

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Background and Goal of Study: Vasospasm that leads to brain ischemia following subarachnoidal haemorrhage (SAH) can be defined as narrowing of brain arteries focally or diffusely. Dexmetedomidine is used for sedation in intensive care units nowadays. The mechanism of neuroprotection by dexmetedomidine is stil unclear. Acute vasospasm following SAH occurs by 48 hours. In our study, we wanted to study if vasospasm following subarachnoidal haemorrhage can be alleviated by using dexmetedomidine.

Materials and Methods: Experimental subarachnoid haemorrhage, in concentrations of 0.9 ml of autologous arterial blood/1 kg of body weight was carried out on 18 New Zealand rabbits. Rabbits were infused either 0.9% sodium chloride or 5 μg/kg/h dexmetedomidine for two hours, 48 hours after subarachnoid haemorrhage was established. Third group was the sham control group. Histological specimens were obtained by fixation of brainstems of rabbits after they were sacrificed. The occlusion effect of experimentally induced subarachnoid haemorrhage was determined by computer image analysis of rabbit basilar arteries that were photographed under microscopy. Statistical analysis was by a one-way ANOVA with Tukey's test. Values are expressed as mean ± SD, and $n = 6$ for all groups.

Results and Discussions: Thickness of basilar artery was significantly thick in SAH group than the others ($p < 0.05$). Morphometric diameter was significantly narrower in SAH group than the others.

SAH-Dexmetedomidine group revealed attenuation of vasospasm, formed after 48 hours.

Conclusion(s): Our study showes that vasopasm is attenuated by dexmetedomidine when it is used after acute vasospasm is formed as our study is compared with a previous study (1) that showed clonidine, another α-2 agonist, prevented chronic vasospasm.

Reference:

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A-331

The effects of endotracheal tube lidocaine administration on endotracheal suctioning-induced increases in intracranial pressure in head-injured patients

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Background and Goal of Study: In patients with severe traumatic brain injury, endotracheal suctioning can result in a number of undesirable side effects including hypertension, tachycardia and increased intracranial pressure. To avoid these effects we evaluated the use of endotracheal tube lidocaine administration. Lidocaine inhibits neuronal transmission by its action in stabilizing the neuronal membrane (central nervous effects) thus is suitable for being used in patients in the acute phase of head injury.

Materials and Methods: Twenty-five patients mechanically ventilated after neurosurgical procedures for head trauma were prospectively enrolled. Patients that coughed and/or moved during endotracheal suctioning were enrolled and received 2 ascending doses of endotracheal lidocaine: low-dose 1 (1 mg/kg bolus) and high-dose 2 (2 mg/kg bolus). The presence of coughing during endotracheal suctioning after endotracheal lidocaine administration was recorded as failure. The endotracheal suction protocol was performed 20-min after bolus administration with increase of FiO_2 to 100% for 60 s and insertion of standardized suction catheter by the side port of the endotracheal tube for <30 s. Heart rate, ICP, mean arterial blood pressure and cerebral perfusion pressure were continuously monitored. ICP was continuously monitored with Rehau System (Switzerland). Ventilation (tidal volume or respiratory rate) was adjusted to mantain PCO_2 between 33 and 37 mmHg.

Results and Discussions: In 17 patients out of 25 (68%) low-dose lidocaine effectively prevented coughing during endotracheal suctioning, while the high-dose lidocaine was effective in 21 out of 25 (84%) in preventing cough during endotracheal suctioning. Mean arterial pressure decreased significantly after endotracheal tube lidocaine administration but ICP and cerebral perfusion pressure did not decreased significantly.

Conclusions: The present study shows that endotracheal tube lidocaine administration used in patients with severe traumatic brain injury reduces the cough reflex during endotracheal suctioning in a dose-dependent manner. Endotracheal lidocaine administration did not alter brain blood autoregulation and allows adequate cerebral perfusion.

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Correlation between cerebral pressure autoregulation and brain tissue oxygenation-pressure-reactivity

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Background and Goal of Study: The indices ORx and b_{ptiO_2} were invented recently (1) to describe how cerebral tissue oxygenation ($p_{ti}O_2$) is influenced by changes in cerebral perfusion pressure (CPP). We investigated the relation between those two indices and PRx, an established index of cerebral autoregulation (2). In addition, we examined whether ORx and b_{ptiO_2} were predictive for outcome.

Materials and Methods: Continuous neuromonitoring including arterial blood pressure (ABP), intracranial pressure (ICP), CPP and $p_{ti}O_2$ was performed in 27 patients with severe traumatic brain injury. PRx and ORx were calculated as running correlation coefficients between ICP and ABP, and between $p_{ti}O_2$ and CPP, respectively. Glasgow outcome score was assessed 6 month after trauma.

Results and Discussions: We observed a significant correlation between PRx and ORx ($r = 0.57$), as well as between PRx and b_{ptiO_2} ($r = 0.47$). Furthermore, the indices were inversely correlated with both $p_{ti}O_2$ and outcome. However, there was no correlation between arterial blood gas- and neuromonitoring-parameters.

Conclusion(s): The $p_{ti}O_2$-pressure-reactivity indices ORx and b_{ptiO_2} seems to be estimators of pressure autoregulation following traumatic brain injury.

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Our data confirm that patients with impaired pressure autoregulation are at high risk to develop secondary cerebral hypoxia and to achieve an unfavorable outcome.

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A-333

Hemodynamic changes after endotracheal intubation in patients with cerebral aneurysm (lightwand vs laryngoscope)

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Background and Goal of study: Tracheal intubation with a lightwand device will attenuate the hemodynamic stress response to tracheal intubation compares with direct laryngoscope. So we compared the effects of the lightwand (lighted intubation stylet) and the laryngoscope (Macintosh blade) for intubation in patients with cerebral aneurysm.

Material and Methods: Twenty patients undergoing cerebral aneurysm clipping surgery were randomly divided to either the lightwand (Group 1, n = 13) or the laryngoscope (Group 2, n = 13) group. All patients received fentany (2–3 $$/kg), dormicum (0.1 mg/kg) and thiopental sodium (5 mg/kg) followed by vecuronium (0.1–0.15 mg/kg). The lungs were ventilated with 3–4% isoflurane in oxygen. Patients were then intubated with either the lightwand or the laryngoscopy. Systolic and diastolic blood pressures and heart rate were recorded continuously before and after intubation. And the time to intubation was recorded.

Results: There was no difference in hemodynamic changes between the two groups. Major factors of hemodynamic changes likely associated with direct tracheal stimulation.

Conclusions: We found that there was no difference in hemodynamic changes between the two techniques in patients with cerebral aneurysm.

Reference:

1 Nishikawa K, Omote K, Kawana S, Namiki A. A comparison of hemodynamic changes after endotracheal intubation using the lightwand device and the laryngoscope in normotensive and hypertensive patients. Anesth Analg 2000; 90: 1203–7.

A-334

Antithrombin III concentrates reduce secondary brain damage in experimental model

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Background and Goal of Study: In addition to the well known role in blood coagulation cascade, thrombin contributes to generate the inflammatory response (induces chemotaxis, increases the expression of interleukins), and can be considered neurotoxic (determines the degeneration of neurones[1], enhances brain edema[2]). In ischemic stroke patients the activation of coagulation cascade reflects on the increase of thrombin activity[3] and on the consumption of the natural anticoagulant ATIII, with the consequent decrease of plasmatic levels[4].

The aim of this study was to demostrate the neuroprotective effects of AT III.

Materials and Methods: 18 mice underwent transient MCA occlusion.

Group 1(n = 6) and Group 2 (n = 6) were treated with AT III respectively 3–6 hours and 6–9 hours after the onset of ischemia, while Group 3 (n = 6) was treated with vehicle.

The mice were sacrificed 24 hours after the ischemia, the brain was removed, the slices colored with 2% TTC to discriminate the vital zones from the ischemic areas. T-test was used for statistcal analysis.

Results and Discussions:

Group	Ischemic areas Mean	T
1	21.71 ± 18 mm^3	<0.05
2	42.26 ± 47 mm^3	>0.05
3	51.81 ± 20 mm^3	

AT III significantly reduces the infarct size area ($p < 0.05$) when injected 3–6 hrs after the onset of ischemia

Conclusion: AT III may attuenuate the secondary brain damage.

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A-335

Determination of critical cerebral perfusion pressure in cranial hypertension

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Background and Goal of study: A consensus has been reached that a cerebral perfusion pressure (CPP) of around 70 mmHg may provide an optimal blood supply to the brain (1). The aim of the present study was to measure the changes of energy-related metabolites in the porcine cortex during a defined increase of intracranial pressure (ICP), compare them with perfusion parameters and to determine the level at which damage occurs.

Material and Methods: Male domestic pigs (32–40 kg) were anesthetised, mechanically ventilated, and randomly assigned to either the experimental (n = 6) or control groups (n = 5). A microdialysis probe (CMA 70) was inserted into the cortex and continuously perfused at a flow rate of 2 μl/min. Extracellular dialysate concentrations of lactate, pyruvate, glucose, glutamate and glycerol were measured from samples collected over 20 minute intervals during the whole experiment. Every hour a stepwise increase of 10 mmHg in ICP was produced by infusion of artificial cerebrospinal fluid into the ventricular system of the brain until maximum ICP of 50 mmHg was reached. In the control group no changes in ICP were made.

Results and Discussion: The present study demonstrated a significant increase of lactate and glycerol compared to control at ICP values ⩾30 mmHg and CPP below 50 mmHg (2.33 ± 0.33 mmol/l (mean ± sem) vs. 1.21 ± 0.18 mmol/l and 124.64 ± 13.51 mmol/l vs. 73.19 ± 6.58 mmol/l, respectively). The elevation of ICP to 40 mmHg or more in conjunction with a reduction in CPP below 40 mmHg led to a significant increase in the lactate/pyruvate ratio and glutamate, as well as a decrease of glucose in relation to control (74.16 ± 16.53 mmol/l vs. 23.78 ± 2.08 mmol/l, 20.40 ± 6.14 μmol/l vs. 6.54 ± 3.28 μmol/l and 0.29 ± 0.11 mmol/l vs. 0.89 ± 0.19 mmol/l, respectively). There were no differences in blood glucose and lactate levels, in pH, pO_2 and pCO_2 detectable between the groups. It seems that the point of irreversible damage could be found where L/P ratio, glutamate and glycerol are significantly increased.

Conclusion: Our data strongly suggest that during a quick ICP increase, lower CPP values may be tolerable until severe damage occurs. In this model critical CPP values of 40–50 mmHg could be postulated.

Reference:

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A-336

Hemodynamic responses to noxious stimulation during brain tumor surgery comparing remifentanil to sufentanil

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Introduction: During craniotomy, it is desirable to have stable, easily controllable hemodynamics. Remifentanil is a rapid, ultra-short-acting opioid that has been successfully used to control acute autonomic responses. In the present study, we compared the hemodynamic reactions to noxious stimulation in a remifentanil-based anesthesia to a sufentanil-based anesthesia.

Materials and Methods: With IRB approval, 30 patients (pts) scheduled for brain tumor surgery were randomized to sufentanil or remifentanil. Anesthesia was induced with propofol TCI (3 μg/ml), rocuronium (0.6 mg/kg), sufentanil TCI (0.4 ng/ml) or remifentanil TCI (10 ng/ml). Propofol was titrated to BIS 40 to 60, while analgesia was titrated to hemodynamic responses (20% of baseline). Mean arterial pressure (MAP), heartrate (HR) and BIS were analysed at intubation, pin holder placement, skin incision and at time of craniectomy. Statistical analysis was performed with Anova.

Results: At intubation, no patient experienced a significant increase in MAP. 4 pts in the remifentanil group (Rg) showed a significant decrease in MAP. BIS values in the sufentanil (Sg) group were lower at intubation than in the Rg. In both groups, 2 pts had a significant increase in HR at intubation. At pin holder placement, 2 Sg pts and 3 Rg pts experienced a significant increase in MAP and HR. We found no correlation between change in hemodynamics and BIS. Significantly more patients in the Rg necessitated titration of the analgetic component during or after intubation and pin holder placement. At skin incision and at time of craniectomy, we did not observe a significant increase in MAP or in HR, nor in the Sg, nor in the Rg. Overall, there was no difference between both groups for the propofol requirements, although patients in the Rg required significantly more adjustments of the propofol TCI administration.

Conclusion: Sufentanil offers similar hemodynamic conditions, with less need for titration compared to remifentanil, for neurosurgical procedures.

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Validation of an integrated model of cerebral haemodynamics and metabolism

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Background and Goal of Study: Computational modelling may be used to investigate and demonstrate complex, non-linear processes of cerebral haemodynamics and metabolism, but most models have concentrated on single aspects of physiology in isolation. (1) We have created and validated an integrated model describing intracranial haemodynamics and metabolism from large vessel to capillary and tissue level.

Materials and Methods: The model consists of sequential beds of parallel vessels contained within a non-compliant space containing brain, blood and cerebrospinal fluid (CSF). Individual vessels have defined volume, radius and compliance relationship, and flow is modelled as laminar throughout. Arteriolar wall tension is responsive to changes in CSF pH, transmural pressure and cerebral blood flow. Oxygen and carbon dioxide flux occur at the capillary level, taking into account the effect of tissue volume, pH and metabolic rate. The results of the computational simulation have been compared to published human data. Dynamic testing was performed by assessing steady-state change cerebral blood flow at various levels of mean arterial pressure and arterial carbon dioxide partial pressure ($PaCO_2$). To test dynamic autoregulation, a transient hyperaemic response to carotid occlusion was simulated and the strength of autoregulation (SA) calculated. (2)

Results and Discussions: Vessel radii and compartment volumes are within published ranges. The upper and lower limits of autoregulation are mean arterial pressures of 60 and 150 mmHg. The calculated SA was 1.05 between the limits of autoregulation (normal range 0.88–1.13). Carbon dioxide reactivity is 40% kPa^{-1} when $PaCO_2$ is 2–10 kPa. Brain tissue PO_2 varies between 3.5–4 kPa depending on distance from the capillary. Jugular venous haemoglobin oxygen saturation is 60–70% for arterial saturations 90–100%. The model appears to simulate normal physiology acceptably well under static and dynamic conditions.

Conclusions: This model provides a credible simulation of healthy, intracranial physiology. Further work will involve validation of the model under pathological conditions.

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A-338

Behaviour of IL18 in subarachnoid haemorrhage

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Background: Secondary brain injury due to systemic inflammatory response syndrome is a major factor contributing to morbidity and mortality. Subarachnoid haemorrhage is associated with elevated pro-inflammatory cytokines (1). IL18 has been is shown to play an important role in many human diseases and it may be a marker of cerebral injury (2). The behaviour of IL18 in patients with subarachnoid haemorrhage is not known.

Method: With Local Research Ethics Committee Review and written informed consent, we recruited 10 patients with post-aneurysm subarachnoid haemorrhage, having embolisation of their aneurysm to a pilot study. We measured IL 18 in blood samples taken pre and immediately postoperatively and at 24 and 48 h postoperatively. Clinical progress was noted using World Federation Neurological Scoring (WFNS). Statistical analysis used paired t-test with Bonferroni correction for multiple testing. Normal serum IL18 levels are mean(SD) 126(44.5)$pgml^{-1}$.

Results: Perioperative IL 18 level. Data are mean (SD) [range]

Pre-op	Post-op	24 hr	48 hr
209 (99)	174 (78)	227 (97)	191 (91)
[100–365]	[85–330]	[100–312]	[95–352]

$P < 0.0166$ compared to preoperative level. The correlation between IL18 and WFNS was poor.

Conclusion: Immediate post-op IL18 levels were significantly raised as compared to pre-op. Greater numbers of patients are needed to investigate the behaviour of this cytokines and it's association with cerebral dysfunction.

References:

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A-339

Propofol effect on H-reflex recovery in humans

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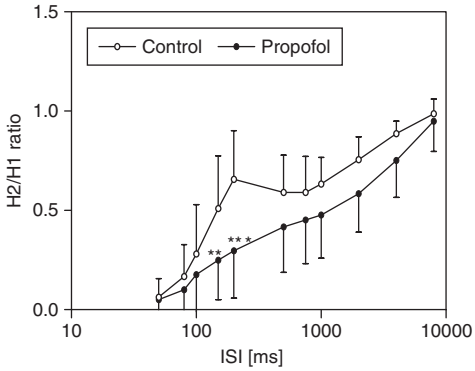
Background and Goal of Study: The spinal H-reflex has been proposed for investigating immobilizing effects of anesthetics. Its amplitude is suppressed in a dose dependent manner by propofol in humans and rats. A paired pulse stimulation was used to examine whether use-dependent block might play a role in H-reflex suppression during propofol anesthesia in the intact human spinal cord. Use dependent block, an increasing reduction of currents elicited by subsequent pulses applied at high frequency, can be explained by binding of propofol to ion channels such as Na^+(1) and Ca^+ channels.

Materials and Methods: Following IRB approval and written informed consent, the study was perfomed in 16 patients prior to elective surgery. After recording baseline values, patients received propofol via a TCI-system with plasma concentrations corresponding to the C_{50} (electrical tetanus), approx. 4.5 mg/l. The H-reflex was recorded over the M. soleus after double-pulse stimulation (H1,H2) of the tibial nerve with increasing inter stimulus intervals (ISI) (50–10000 ms). Statistics: Amplitude ratios (H2/H1) compared by two way ANOVA; Bonferoni post test.

Results and Discussions: The presented time course of the H-reflex of all 16 patients shows a slower recovery under propofol in comparison to the control values. Significant differences occur only at an ISI of 150 and 200 ms. ISI dependent excitation of different sizes of Ia afferent fibres is discussed as an underlying mechanism for the intercurrent facilitation showing a maximum at 200 ms which is suppressed by propofol.



(**$p < 0.01$; ***$p < 0.001$)

Conclusion(s): Paired pulse depression is not altered by propofol at a concentration suppressing movement to painful electrical stimuli. However, the results indicate an interference of propofol with size-dependent activation of Ia afferent fibers, possibly contributing to surgical immobility caused by propofol.

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A-340

Nefopam or clonidine in the pharmacologic prevention of shivering in patients undergoing conscious sedation for interventional neuroradiology

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Background and Goal of Study: The aim of this randomized, double-blind study was to investigate the usefulness and possible advantages of i.v. nefopam, clonidine or placebo in the prevention of shivering in patients undergoing sedation or anesthesia for interventional neuroradiologic procedures. In this setting shivering may arise from various causes: hypothermia, central thermoregulatory downregulation, pyrogens, and injected iodated contrast media. The consequences of shivering include increased cardiac and

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systemic energy demands, increased oxygen consumption and carbon dioxide production, and increased cardiac workload.
Materials and Methods: A total of 128 patients were prospectively enrolled and assigned by a computer-derived sequence to one of 3 groups: 42 patients received 0.15 mg kg^{-1} of i.v. nefopam, in 10 ml of saline solution, 46 patients received 3 mcg kg^{-1} of i.v. clonidine in 10 ml of saline solution, and a control group of 40 patients received 10 ml of i.v saline solution. Mean arterial pressure was kept at 100 mmHg or higher, the need for vasoactive drugs in the 3 groups of study patients was recorded.
Results and Discussions: The overall incidence of intraoperative shivering was significantly lower in patients treated with nefopam than in those treated with clonidine or placebo (5% vs 26%; $P < 0.05$ and 5% vs 62%; $P < 0.01$); and in patients treated with clonidine than in those treated with placebo (26% vs 62%; $P < 0.05$). In the group of patients enrolled to receive clonidine as antishivering drug a larger number of patients required ephedrine infusion, to ensure a MAP of 100 mmHg or higher, in comparison to patients who received nefopam or placebo (45% vs 14%; $P < 0.05$, 45% vs 10%; $P < 0.05$). We found that both nefopam and clonidine significantly lowered the rate and severity of shivering during interventional neuroradiologic procedures.
Conclusions: Our findings in this double-blind prospective study suggest that nefopam is effective and has few disadvantages for the prevention of shivering during anesthesia or sedation in patients undergoing interventional neuroradiology. Unlike clonidine, nefopam has the distinct advantage of reducing the need for vasoactive drugs.

A-341

The effect of thalidomide on spinal cord ischemia/reperfusion injury in rabbits

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Background and Goal of Study: Thalidomide has anti-inflammatory and immunomodulatory effects through reduced the production of TNF-α [1]. The purpose of our study was to evaluate the effects of thalidomide on the spinal ischemia/reperfusion injury through reduced production of TNF-α.
Material and Methods: A rabbit spinal cord ischemia was induced by occluding infrarenal aorta for 15 minutes. The rabbits in group N (n = 6) did not undergo ischemic insult. The rabbits in group I (n = 18), group TI (n = 18), and group TIT (n = 12) underwent ischemic insult for 15 minutes. The rabbits in the group TI and TIT received thalidomide (20 mg/kg) intraperitonealy before the ischemic insult and the rabbits in the group TIT received intraperitoneal thalidomide (20 mg/kg) 24 and 48 hours after reperfusion. After evaluating neurologic function at 1.5 hours, 3 days, and 5 days after reperfusion, the rabbits were killed for histopathologic evaluation and Western analysis for TNF-α.
Results and Discussion: The rabbits in the group TI and TIT had significantly less neurologic dysfunction compared to those in the group I ($P < 0.05$). The number of normal spinal motor neurons in ventral gray matter was higher in the group TI and TIT than in the group I ($P < 0.05$). The Western analysis showed significantly increased level of TNF-α in the group I compared to the group TI and TIT at 1.5 hours after reperfusion ($P < 0.05$).
Conclusion: The results indicate that treatment of thalidomide before the ischemic insult reduces the early phase ischemia/reperfusion injury of the spinal cord in the rabbits.
Reference:
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A-342

Intraoperative motor evoked potential monitoring in scoliosis surgery – a randomised study comparing desflurane and total intravenous anaesthesia (propofol)

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Background and Goal of Study: During scoliosis surgery, monitoring motor evoked potentials (MEP) is used to assess intraoperative integrity of the motor evoked pathways. However MEPs are sensitive to the effects of inhalational anaesthetic agents. This prospective randomized observational study compares the use of desflurane and total intravenous agents (TIVA) when monitoring MEPs using multipulse cortical stimulation.
Materials and Methods: 20 consecutive patients undergoing scoliosis surgery (10 in each group) were randomly assigned to receiving desflurane or TIVA. Inhalational anaesthesia was maintained using 66%N_2O in oxygen and mean end tidal desflurane concentration of 3.4%. For TIVA, continuous intravenous infusion of propofol was used. Fentanyl and morphine were used as required for analgesia for both groups. Cortical stimulation was achieved with the use of 2 bipolar direct current stimulators connected in parallel by jumper cables. 5 equivalent pulses 0.5 mm duration at 4 msec intervals were delivered at C1C2 positions MEP recordings were made at the abductor hallucis(AH) and tibialis anterior (TA) muscles with needle electrodes.
Results and Discussions: Reproducible MEPs were obtained throughout the operation in all 20 cases, with up to 80 mA per stimulator. Mean (SD) MEP amplitudes obtained were 85(19) mV and 21(10.8) mV for AH and TA respectively using desflurane. With TIVA AH and TA amplitudes were 56.7(28.4) and 59.1(24.5) mV respectively. Both muscle MEP amplitudes were significantly different using different anaesthetic regimes ($p < 0.05$ for all four). AH MEP amplitudes obtained with desflurane were significantly ($p < 0.0001$) larger than TA amplitudes. No intra and post operative complications were reported.
Conclusion(s): This study compares the use of desflurane and TIVA showing that both anaesthetic regimes are satisfactory for intraoperative monitoring of the scoliosis patient.

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Evaluation of desflurane and sevoflurane based anesthesia for supratentorial craniotomy procedures

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Background and Goal of the Study: Brain surgery necessitates stable and easily controllable haemodynamics, during intense surgical stimulation. Aim of the present study was to ascertain whether there is any difference between desflurane (desf) or sevoflurane (sevo) based anesthesia, employing remifentanil (R) as an opioid analgesic, with regard to haemodynamic performance during intracranial surgery.
Materials and Methods: We studied prospectively 56 adult patients (32 male/24 female, ASA I–II) scheduled for supratentorial craniotomy. After a standardized induction sequence consisting of propofol 2 mg/kg, lidocaine 1 mg/kg, cis-atracurium 0.2 mg/kg and remifentanil 0.5 μg/kg/min, followed by a constant-dose infusion of 0.125 μg/kg/min. When the MAP or heart rate (HR) increased >20% from basal values, 1 μg/kg bolus dose of R was administered. However, if the MAP or HR decreased >20% from basal values, the R infusion was transiently discontinued. Patients were allocated randomly to two groups of 28 each according to the inhalational agent used for maintainance of anesthesia: desflurane or sevoflurane (0.6–0.8 MAC) in an air/oxygen mixture. BIS value <50 was used to assess depth of anesthesia and to guide inhalational anesthetic requirements. Total use of R was also recorded. For statistical purposes Mann-Whitney test and chi-square analysis were used as appropriate.
Results: Demographic characteristics, type of surgery and its duration and total dosages of R, were comparable in two groups. Data is given on the table.

Parameters	Desf	Sevo	p-value
High BP (min)*	4 ± 6.2	2.7 ± 3.1	0.897
Low BP (min)*	5.2 ± 9	6.7 ± 12	0.633
High HR (min)*	3.2 ± 6.1	1.1 ± 1.7	0.613
Low HR (min)*	0.9 ± 2.4	3.2 ± 10	0.965
Bolus doses	50%	50%	0.681
Discontinuation	25%	40%	0.437
Discontinuation (min)*	5.2 ± 9.9	11 ± 21.2	0.633

*mean ± SD.

Conclusion: Our results indicate that both desflurane/remifentanil and sevoflurane/remifentanil anesthetic techniques, appear to confer equal characteristics in maintaining "targeted" haemodynamic performance during intracranial surgery.

A-345

ATP-sensitive and voltage-dependent potassium channel involved in the antinociceptive effects produced by an adenosine A_1 agonist into the brainstem medial pontine reticular formation in rats

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Background and Goal of Study: The brainstem medial pontine reticular formation (mPRF) is a brain stem region contributing to the regulation of

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sleep-wake cycles, anesthesia, and antinociception (1). Adenosine is thought to be an endogenous sleep promoting molecule and adenosinergic compounds play a key role in pain modulation (2). In the present study, we investigated the antinociceptive and behavioral effects of the direct application of an adenosine A_1 receptor agonist R(-)-N6-(2-phenylisopropyl)-adenosine (R-PIA) into the mPRF and examined the effects of potassium channel activation on antinociception of mPRF R-PIA in rats.

Materials and Methods: Sprague-Dawley rats were implanted with 24-gauge stainless steel guide cannulas in the mPRF. Animals were randomly assigned to one of the following protocols: antinociception was tested using tail flick latency, overt sedation was assessed using a behavioral checklist. All measurements were performed after R-PIA microinjection into the mPRF with or without pretreatment of theophylline, DPCPX, glibenclamide, 4-AP.

Results: Data are presented as mean ± SD, statistical differences were analyzed using ANOVA followed by Bonferroni's correction for post hoc comparisons. Microinjection of R-PIA (0.5–2.0 μg) into mPRF produced transient sedative effect and a significant dose- and time-dependent antinociception. The antinociception of R-PIA were completely antagonized by pretreatment with adenosine receptor antagonist theophylline or adenosine A_1 receptor antagonist DPCPX, and partially antagonized by pretreatment with ATP-sensitive potassium channel blocker glibenclamide or voltage-dependent potassium channel blocker 4-AP.

Conclusions: The present results suggest that the R-PIA administered into the mPRF produced antinociception through pontine adenosine A_1 receptor is mediated, at least partly, via the activation of both ATP-sensitive and voltage-dependent potassium channel in mPRF in rats.

References:

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2 Poon A, Sawynok J. Pain 1998; 74: 235–245.

A-346

Modulation of H-current by calcium currents in rat sensory neurons: influence of spinal nerve ligation

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Background: Hyperpolarization-induced inward rectification and calcium currents both are major factors influencing excitability in primary sensory neurons [1]. Spinal nerve ligation (SNL) decreases both rectifying currents and membrane Ca^{2+} currents in rat dorsal root ganglion cells [1,2]. The direct relationship between Ca^{2+} currents and inwardly rectifying currents in DRG neurons has, however, never been investigated.

Materials and Methods: SNL or control operations were performed similarly to the previously described method of Kim and Chung (1992). DRG neurons were investigated using sharp microelectrodes. Time-dependent inward rectification ("sag") in response to hyperpolarization was quantified during injection of a 1.2 nA hyperpolarization current for 100 ms.

Results: In our study, withdrawing external Ca^{2+} decreased the sag ratio in control Aα/β neurons (from 18.99 ± 11.2% to 13.94 ± 10.6, n = 44, $P < 0.01$) and Aδ neurons (from 14.06 ± 15.1 to 4.2 ± 10.9 %, n = 12, $P < 0.05$). Blocking Ca^{2+} currents using Cd^{2+} significantly decreased sag ratio in control δ cells (from 40.8 ± 11.4% to 30.1 ± 9.2%; $P < 0.01$, n = 5). The same effect was observed following intracellular EDTA iontophoresis (from 19.23 ± 17.2 to 14.9 ± 16.8%; $P < 0.05$, n = 5). SNL injury substantially precluded the effect of calcium withdrawal upon precentile change in sag ratio in both Aα/β (7% vs. 27%) and A(neurons (13% vs. 70%).

Conclusion(s): Our findings suggest that intracellular Ca^{2+} levels modulate hyperpolarization-induced rectifying current.

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A-347

Protecting effect of adrenaline and noradrenaline infusion during cerebral ischemia in rats

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Introduction: Katekolamin infusions are often used to protect hemodynamia in intracranial operations. The aim of this study is to observe the effects of adrenaline and noradrenaline in ischemia, provided by occlusion of middle cerebral artery (MCA).

Material and Methods: After approval of the animal ethic committee, 36 female Wistar rats separated into three groups randomly. After left arterial canulation under anesthesia invasive hemodynamics followed up. Femoral venous canulation was performed and 0.9% NaCl infusion was applied. All rats were ventilated during a tracheal canulla. After dissection of bilateral common carotid artery (CCA) 3 mg kg^{-1} thiopental were applied intravenously. Hemodynamic parameters were recorded in every minute for 5 minute period. When SAP decreased by 20%, adrenaline or noradrenaline were given in a rate of 1–5 μg kg^{-1} min^{-1}. When the rats that has no change in SAP values separated to control group. In control group 5 minute after thiopental application, in adrenaline and noradrenaline groups when SAP ⩾ 140 mmHg; left and right CCA and right external carotis artery (ECA) were ligated with a 3-0 silk suture. The MCA were occlused with internal occlusion catheter during internal carotis artery (ICA). For 60 minutes hemodynamic followed and at the end the rats were decapitated and their brains removed for pathological examination. The brains were sectioned and were examined. As parameter of the hypoxemia and ischemia, occurance of red neurons, microglial proliferation, vascular congesion, perineural vacuolisation were assessed. For statistical analyses ANOVA and chi-square tests were used. $P < 0.05$ considered significant.

Results: Hemodynamic values were decreased in control group, but in all groups the SAP levels were over 120 mmHg.

Table. Pathological examination results of groups (%)

	Red neuron				Microglial proliferation			
	None	Mild	Mod.	Severe	None	Mild	Mod.	Severe
C	0%	25%	75%	0%	71%	0%	14%	14%
A	28%	57%	14%	0%	50%	25%	25%	0%
NA	0%	20%	80%	0%	100%	0%	0%	0%

	Vascular congesion				Perineural vacuolisation			
	None	Mild	Mod.	Severe	None	Mild	Mod.	Severe
C	0%	25%	50%	25%	0%	0%	25%	75%
A	0%	57%	28%	14%	0%	14%	43%	43%
Na	0%	33%	50%	17%	0%	20%	20%	60%

$P < 0.05$.

Conclusion: We conclude that ischemia can be prevented by adrenaline infusion in rats with MCA occlusion. This may be occured due to the increased effects of adrenaline on cerebral blood flow.

Reference:

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A-348

Cellular mechanisms of inflammatory pain induced by low-frequency stimulation in the rat spinal cord in vivo

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Background and Goal of Study: Injection of formalin or capsaicin in the rat hind paw lead to low-frequency C-fibre activation are often used models for inflammatory pain. Here we have investigated whether low frequency discharges in C-fibres can induce synaptic long-term potentiation (LTP) of synaptic strength in primary afferent C-fibres in the rat lumbar spinal dorsal horn, a potential cellular mechanism of abnormal pain sensitivity.

Materials and Methods: C-fibre-evoked field potentials were recorded in laminae I/II of the lumbar spinal cord with glass microelectrodes. For conditioning stimulation either capsaicin (100 μl, 1%, n = 5) or formalin (100 μl, 5%, n = 6) was injected into the plantar side of the ipsilateral hind-paw, or low frequency stimulation (LFS; 60 V, 0.5 ms, 2 Hz for 2 min) was delivered to the sciatic nerve. To test if NK1-receptors are required for LTP-induction, the NK1-receptor antagonist RP67580 (10 mg/kg) was injected as a bolus intravenously 15 min prior to the induction of LFS. In other experiments, the NMDA-receptor antagonist MK 801 (3 mg/kg) was injected 15 min prior to the induction of LFS. The NO-synthase inhibitor L-NMMA (100 mg/kg/h) was given as a continuous infusion for 25 min starting 20 min prior to LFS.

Results and Discussions: Formalin or capsaicin induced LTP of C-fiber-evoked field potentials to 172 ± 9% (mean ± SEM) % or 174 ± 16%, respectively. LFS of the sciatic nerve induced LTP to 330% ± 42% of control (n = 14). The NK1-receptor-antagonist RP67580 diminished LFS induced LTP (LTP was to 248% ± 34%, n = 6). LFS-induced LTP is NMDA-receptor-dependent. When NMDA-receptor antagonist MK-801 was given 10 min prior to LFS, a short-term potentiation but no LTP was induced (n = 5). LFS-induced LTP is NO-sensitive. The NO-synthase-inhibitor L-NMMA given prior to the conditioning stimulus induced a short-term potentiation lasting for 60 min, but no LTP could be induced (n = 5).

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Conclusions: Peripheral inflammation induces long-term potentiation of synaptic strength in superficial spinal dorsal horn. Low-frequency afferent stimulation in C-fibres is sufficient to induce LTP. This new form of synaptic plasticity is NMDA-and NK1-receptor-dependent and requires activation of NO-synthase.

A-349

A comparison of recovery following desflurane and sevoflurane anaesthesia in patients undergoing craniotomy for tumour

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Background and Goal of Study: Craniotomy for tumour carries the risk of postoperative complications such as bleeding, cerebral oedema and cerebral ischaemia. If not diagnosed early and treated promptly these can lead to neurological deficit. Therefore, rapid recovery and early neurological assessment are useful goals in the anaesthetic management of patients undergoing craniotomy for tumour.

The anaesthetic technique should enable a rapid and predictable recovery. The pharmacology of remifentanil and desflurane suggests that recovery will be faster if used in combination compared to remifentanil/sevoflurane anaesthesia. We compared emergence from remifentanil/desflurane vs remifentanil/sevoflurane anaesthesia in patients undergoing craniotomy for tumour.

Materials and Methods: 40 patients undergoing anaesthesia for elective craniotomy for tumour were randomly assigned to receive remifentanil/desflurane or remifentanil/sevoflurane anaesthesia. Following induction with remifentanil, propofol and rocuronium, anaesthesia was maintained with study vapour and remifentanil in oxygen and air. All treatment was standardised. Recovery staff blinded to the study recorded early recovery parameters.

Results and Discussions: The time required for spontaneous ventilation, eye opening, extubation, stating name, stating date of birth and acheiving post anaethesia recovery score (Aldrete) >9 were 50% shorter after remifentanil/desflurane compared to remifentanil/sevoflurane anaesthesia.

Conclusion(s): In patients undergoing craniotomy for tumour surgery, recovery is significantly faster and more predictable after remifentanil/desflurane compared to remifentanil/sevoflurane anaesthesia allowing a earlier neurological examination.

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Endocrine stress response of remifentanil-based anaesthesia with isoflurane or propofol in craniotomy operations

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Background and Goal of Study: Surgical stress response and its prevention has been a currently popular research field (1). We aimed to examine effects of two anaesthesia techniques on stress response via plasma glucose (GLU), insulin (NS) and cortisol (COR) in craniotomy operations.

Materials and Methods: Forty patients scheduled for craniotomy were enrolled into two groups to receive remifentanil-based anaesthesia either with isoflurane (Group I) or propofol (Group II). GLU, INS, COR samples were obtained at time points as preoperatively (PRE), after intubation (INT) and dura incision (DUR), at 60th minutes (60.M), after extubation (EXT) and at postoperative 1st (P1) and 24th (P24) hour. Glucose measurements were also performed after induction, skull pin placement and craniotomy and at every 30 minutes during the procedure.

Results: All patients were comparable with respect to demographic properties. Glucose values measured after craniotomy, at 90th and 180th minutes were also statistically higher in the isoflurane group. Data (Mean $\pm$ SD) are shown in the table:

	GROUP I			GROUP II		
	GLU (mg/dl)	INS (μU/mL)	COR (μgr/dL)	GLU (mg/dl)	INS (μU/mL)	COR (μgr/dL)
PRE	96.2 $\pm$ 16.5	11.1 $\pm$ 8.5	8.5 $\pm$ 2.4	94.4 $\pm$ 20.1	13.4 $\pm$ 9.0	7.3 $\pm$ 1.5
INT	86.3 $\pm$ 10.6	5.9 $\pm$ 4.0	8.0 $\pm$ 2.6	82.3 $\pm$ 18.7	7.4 $\pm$ 6.4	6.4 $\pm$ 3.3
DUR	104.8 $\pm$ 13.5	7.6 $\pm$ 4.4	8.0 $\pm$ 2.9	93.2 $\pm$ 19.5$^{\#}$	12.1 $\pm$ 10.8	6.9 $\pm$ 2.2
60.M	110.6 $\pm$ 17.0*	6.2 $\pm$ 4.5	9.5 $\pm$ 3.2	96.3 $\pm$ 27.0	12.1 $\pm$ 9.3$^{\#}$	7.3 $\pm$ 3.8
EXT	122.7 $\pm$ 21.8*	7.4 $\pm$ 5.5	10.2 $\pm$ 3.2	99.2 $\pm$ 17.7$^{\#}$	13.2 $\pm$ 10.5$^{\#}$	8.5 $\pm$ 2.4
P1	134.9 $\pm$ 35.5*	11.9 $\pm$ 6.2	9.6 $\pm$ 2.7	96.1 $\pm$ 18.1$^{\#}$	15.2 $\pm$ 10.6	8.1 $\pm$ 2.4
P24	117.6 $\pm$ 26.5*	24.3 $\pm$ 16.9*	7.2 $\pm$ 2.8	103.8 $\pm$ 18.4	19.7 $\pm$ 11.9	8.6 $\pm$ 2.8

*$p < 0.05$: comparison with preoperative value within group; $^{\#}p < 0.05$: between groups.

Conclusion: Despite both anaesthesia techniques inhibited the rise in cortisol concentration during the procedure by a comparable degree, propofol anaesthesia was considered to be superior to isoflurane which was insufficent to prevent the increase in plasma glucose and the decrease in insulin level.

Reference:

1 Adams HA, Hempelmann G. *Anasthesiol Intensivmed Notfallmed Schmerztther* 1991; 26: 294–305.

A-351

Emergence after sufentanil-propofol TCI anesthesia compared to remifentanil-propofol TCI for elective craniotomy

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Introduction: Early assessment of neurological function is essential after craniotomy. Remifentanil offers pharmacokinetic properties that might allow faster recovery after neurosurgery. Recently, it was reported that sufentanil TCI (with 0.25 ng/ml effect-site concentration at extubation) resulted in better recovery conditions that remifentanil TCI, at least for major abdominal surgery (1). In the present study, we compared the characteristics of recovery after sufentanil TCI and remifentanil TCI – ccombined with propofol TCI- for elective craniotomy.

Materials and Methods: With IRB approval, 20 pts scheduled for brain tumor surgery were randomized to sufentanil or remifentanil. Anesthesia was induced with propofol TCI (3 μg/ml), rocuronium (0.6 mg/kg) and either sufentanil TCI (0.4 ng/ml) or remifentanil TCI (10 ng/ml). Propofol was titrated to maintain BIS values between 40 and 60, while the analgetic component (remifentanil or sufentanil) was titrated to autonomic responses. Recovery times were taken from cessation of propofol infusion. In the remifentanil group, 1 hour before the anticipated end of surgery, piritramide 0.15 mg/kg was administered i.v. In the sufentanil group, an effect-site concentration of 0.25 ng/ml was targeted at extubation. Statistical analysis was performed with ANOVA.

Results: Although non significantly different, the mean time to eye opening tended to be shorter in the remifentanil group (m11 min vs m17 min for sufentanil). Mean arterial blood pressure during the first postoperative hour was significantly increased in the remifentanil group compared to the sufentanil group. Therefore, significantly more patients required antihypertensive treatment in the remifentanil group. Patients in the remifentanil group required significantly more analgesics during the first postoperative hour. We did not observe a difference in respiratory rate or in arterial CO_2-tension in the early post-extubation period between both groups.

Conclusions: Remifentanil TCI resulted in a nonsignificant shorter recovery time, but was associated a higher incidence of arterial hypertension and with less early postoperative pain relief. Sufentanil TCI offered superior and safe recovery conditions.

Reference:

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A-352

Neuroprotective effects of etomidate on H_2O_2 induced injury in neuronal PC12 cells

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Background and Goals: To investigate the effect of etomidate to intracellular free calcium ($[Ca^{2+}]_i$) concentration change in response the H_2O_2-induced injury on the neuronal PC12 cells.

Material and Methods: PC12 pheochromocytoma cell line were plated in 20 mm diameter cell culture dishes with density of 2×10^2 cell/each and randomly divided into the injury group (I) three etomidate groups (E_1, E_2 and E_3) with different concentrations 3 μM L^{-1} and μ6 and μM L^{-1} and 15 μM L^{-1}. The intracellular calcium concentration $[Ca^{2+}]_i$ changes were continuously measured by the confocal laser scanning microscope after using the calcium day $Fluo_3$ 30 min in 37°C incubation and induced by the H_2O_2 in each group from the third scanning.

Results: The fluorescence of 90% PC12 cells increased immediately after H_2O_2- induced injury ($p < 0.05$) and reached significantly changes at 10 min and gone to the top at 80 min in group I. Only the fluorescence of 10% PC12 cells of each group E were fluctuated and decreased lightly in group E_1 and E_3 ($p < 0.05$) after 50 min.

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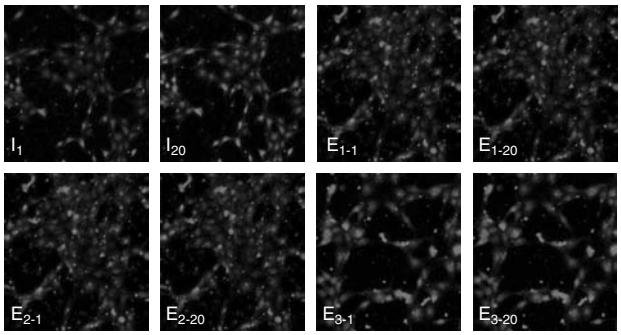

Conclusion: Etomidat can protect the neuronal PC12 cells by inhabiting $[Ca^{2+}]_i$ increase on H_2O_2- induced injury.

References:

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2 Chen PH *J Cereb Blood Flow metab,* 2001, 21: 2–14.

A-354

Dose-dependent effects of ketamine and propofol on the electrical activity of primary murine frontal cortex networks in vitro

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Background and Goal of Study: Ketamine is a commonly known antagonist at the NMDA receptor. Propofol acts at the $GABA_A$ receptor. Other receptors are controversially discussed in the mechanism of action of both hypnotics. We used primary murine frontal cortex networks on microelectrode arrays (MEAs) to study the electrophysiological and receptorspecific effects of Ketamine and Propofol.

Materials and Methods: Cells on coated MEAs were incubated at 37°C with constant pH at 7.4 in a 10% CO_2 atmosphere. Neuronal activity was recorded with a 64 channel amplifier system. Units were discriminated with a template matching algorithm, spike and burst data were analyzed offline. Effects of Ketamine ($n = 6$) and Propofol ($n = 10$) application to native activity and Ketamine application to $NMDA_{only}$ (after blockage of all receptors except that of NMDA; $n = 9$) and BCC activity (after blockage of the $GABA_A$ receptor with bicuculline; $n = 4$) were recorded.

Results: Ketamine caused initial increase at 1 nM up to 117 ± 10% and 128 ± 24% for spike (SR; $n = 2$) and burst rates (BR; $n = 2$), followed by a significant decrease to 9 ± 6% (SR; $p = 0.0006$) and 14 ± 10% (BR, $p = 0.003$), respectively. Under $NMDA_{only}$ conditions initial increase was less pronounced (SR 109 ± 4%, $p = 0.04$; BR 111 ± 6%, $p = 0.08$) followed by a more distinct drop at higher concentrations (SR 2.8 ± 1.5%, $p = 3.8E-17$; BR 0.5 ± 0.2%, $p = 5.0E-11$). Under BCC conditions first significant activity reduction showed at 1 μM (SR: 79.8 ± 3.5%, $p = 0.01$; BR: 74.2 ± 7.7%, $p = 0.04$) without complete loss of activity at 100 μM (SR: 10.0 ± 5.8%, $p = 0.0006$; BR: 11 ± 6%, $p = 0.0007$). Propofol decreased frontal cortex activity significantly at $$ 22.4 μM (SR: 10.0 ± 5.8%, $p = 0.0006$; BR: 11 ± 6%, $p = 0.0007$). At 2.25 mM activity dramatically droped (SR: 10.7 ± 5.0%, $p = 9.7E-8$; BR: 12.5 ± 6.2%, $p = 6.0E-7$). With increasing propofol concentration synchronicity and regularity of network activity decreased.

Conclusion: Ketamine and Propofol show significant dose-dependent reduction of murine frontal cortex activity. Ketamine acts not only at the NMDA receptor, since dose response curve was shifted and maximum effect was pronounced under $NMDA_{only}$ conditions. The results under $GABA_A$ blocking conditions suggest that Ketamine effects are partly mediated through the $GABA_A$ receptor.

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Dose-dependent effects of fentanyl and remifentanil on the electrical activity of primary murine frontal cortex networks in vitro

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Background and Goal of Study: Fentanyl and Remifentanil are agonists at the μ-opioid receptor. Lately activation of the NMDA-receptor by opioids was reported *1. We used primary murine frontal cortex networks on microelectrode arrays (MEAs) to study the electrophysiological effects of fentanyl and remifentanil.

Materials and Methods: Cells on coated MEAs (CNNS, Denton, Texas) were incubated at 37°C with constant pH at 7.4 in a 10% CO_2 atmosphere until ready for use. Neuronal activity was recorded with a 64 channel amplifier system (Plexon Inc., Dallas). Units were discriminated with a template matching algorithm, spike (SR) and burst rates (BR) data were analyzed offline with NeuroEXplorer (NEX, Plexon, Inc.). Activity effects of Fentanyl ($n = 6$) and Remifentanil ($n = 6$) application to native activity were recorded. Dose-response-curves were calculated.

Results: Fentanyl and Remifentanil caused a significant reduction of network activity at $$ 10 ng/ml (SR: 84.1 ± 6.5%, $p = 0.04$; BR: 90.0 ± 6.0%, $p = 0.04$) and $$ 0.01 pM (SR: 98.3 ± 0.7%, $p = 0.04$), respectively. Further application of Fentanyl up to 4 μg/ml caused no complete loss of activity. In higher concentrations Remifentanil showed a biphasic behavior with a significant increase in activity at 20 μM (SR: 165.8 ± 7.3%, $p = 0.003$; BR: 151 ± 6%, $p = 0.003$) followed by a complete loss of activity at 100 μM.

Conclusion: Fentanyl and Remifentanil caused a significant reduction of primary murine frontal cortex activity. In higher doses Remifentanil, but not Fentanyl, caused an increased network activity followed by a total loss of activity, possibly caused by NMDA-activation followed by excitotoxicity. For receptor correlations of the effects further experiments are necessary.

Reference:

*1 Hahnenkamp K, Nollet J, van Aken HK *et al*. Remifentanil directly activates human NMDA receptors expressed in Xenopus laevis oocytes. Anesth 2004;100(6): 1531–1537.

Local and Regional Anaesthesia

A-356

Comparison of hyperbaric solutions of levobupivacaine and ropivacaine for spinal anesthesia

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Background and Goal of Study: According to our previous observation hyperbaric levobupivacaine (in glucose 8%) provides more reliable spinal anesthesia, with faster onset than the same dose of glucose free local anesthetic solution (1). The aim of this study was to compare the clinical efficacy of hyperbaric solutions of levobupivacaine and ropivacaine, when administered intrathecally.

Materials and Methods: Following institutional approval, we conducted a prospective randomized double blind study, including 60 men ASA status I–II, scheduled for transurethral procedures under spinal anaesthesia. They received levobupivacaine (group L) or ropivacaine (group R) 5 mg ml^{-1} (with glucose 80 mg ml^{-1}), 3 ml from each anesthetic solution, injected into the L3–4 interspace. Sensory (pinprick) and motor block (Bromage scale 0–3) characteristics were recorded. Data were analyzed by median, χ^2 and Mann-Whitney U tests, $p < 0.05$.

Results and Discussions: Intergroup demographics were similar. All spinals were sufficient for the planned surgery.

Table. Results of spinal block characteristics.

	L (n = 30)	R (n = 30)	p
† max. height (dermatome)	T7 (T5–T11)	T8 (T6–T11)	NS
≠min to onset at T10	7.54 (2.52)	9.13 (3.34)	NS
≠min to onset at max. height	12.47 (3.45)	14.22 (4.03)	NS
≠duration at T10 (min)	115.46 (22.32)	73.42 (15.47)	0.001
Patients with grade 3 motor block (%)	80	73	NS
≠total duration of motor block (min)	189.47 (37.52)	108.21 (21.38)	0.001

NSnon significant, †median (range), ≠mean (SD).

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Hemodynamics were comparable among the study groups.
Conclusion(s): Equal doses of hyperbaric levobupivacaine or ropivacaine provide similarly effective spinal blocks. Faster recovery of sensory and motor functions for ropivacaine might offer an advantage over levobupivacaine for its use in the outpatient setting.
Reference:
1 Gorgias N et al. Eur J Anaesth 2003; 20: A-424.

A-357

Combined spinal and epidural anesthesia for lower extremity surgery: minimum dose of hyperbaric bupivacaine solution during spinal anesthesia for geriatric patients

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Background and Goals: The dose of bupivacaine to produce a T10 level is reported to be 10–14 mg, a T12 level is 8–12 mg (1). Previous work at XXIII Annual ESRA Congress has shown that when hypobaric bupivacaine is given in incremental doses, a total of 4 mg or less is sufficient to produce satisfactory spinal anesthesia for lower extremity surgery in 88% of geriatric patients. In this study, the minimum effective dose of hyperbaric bupivacaine for lower extremity surgery was determined in geriatric patients by using different doses of the drug.
Materials and Methods: Twenty-eight patients, aged 65–88 (mean 75.1 ± 7.0) years were studied. Surgical sites were knee in 25 cases, leg in 1 case, ankle in 1 case, foot in 1 case. Surgical procedures performed were knee arthroscopy in 18 cases, total knee arthroplasty in 7 cases, osteosynthesis in 1 case, removal of hardware in 1 case and tendon suture in 1 case. Four ml of 0.5% hyperbaric bupivacaine solution (20 mg) were diluted with 6 ml of 10% dextrose to produce a 0.2% hyperbaric local anesthetic solution (20 mg/10 ml = 2 mg/ml). A combined spinal/epidural needle was inserted at the L2–L3 interspace or distally with the patient lying on the affected side. Incremental amounts of bupivacaine, 2 mg by 2 mg, were injected until the T12-T10 level of spinal anesthesia was obtained. An epidural catheter was then placed and 1–2 ml of 2% lidocaine were injected as a test dose, followed by continuous infusion of 2% lidocaine at a rate of 0–10 ml/h.
Results: The required doses of bupivacaine were 4 mg in 24 cases, 6 mg in 4 cases, with the mean of (4.29 ± 0.71) mg.
Conclusion: This study shows that when hyperbaric bupivacaine is given in incremental doses of 2 mg, a total of 4 mg is usually sufficient to produce satisfactory anesthesia in again over 80% of geriatric patients (23/27 = 0.85) for lower extremity surgery. This lower dose minimizes the risk of spinal anesthesia. Prolonged surgery and postoperative pain can be controlled by the combined spinal/epidural approach.
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A-359

Treatment with ACE inhibition or ARA until the morning of surgery does not increase the rate of hypotensive events during the early phase of spinal anaesthesia

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Background and Goal of the Study: Previous data report no difference in blood pressure response after spinal anesthesia between patients under treatment with angiotensin converting enzyme inhibitors (ACEI) and controls (1). This observational study measures prospectively blood pressure decrease after spinal anesthesia in patients chronically treated with ACEI or angiotensin II-receptor-antagonists (ARA). We evaluated the effect of either maintaining these drugs until the morning of surgery or discontinuing them the day before.
Materials and Methods: Twenty-five patients (ASA II/III) with arterial hypertension under long-term treatment with ACEI or ARA were assigned, depending on the previous treatment, to the *D*ay *B*efore surgery group (DB, N = 11) or the *M*orning of *S*urgery group (MS, N = 14). They underwent orthopaedic (16), urological (6) and inguinal hernia repair (3) procedures. Hyperbaric bupivacaine 0.5% (12.4 ± 1.5 mg) was injected intrathecally at a low lumbar interspace. Systolic blood pressure (SBP) was measured during the first twenty minutes after the neuroaxial block. The main clinical variables examined were the presence of hypotension (SBP < 90 mmHg) and the amount of vasoactive drugs used.
Results and Discussion: Hypotensive values were not found neither in the DB nor in the MS group during the first twenty minutes. Only one patient in the MS group needed ephedrine (p = 0.57). SBP decrease seems to be faster (p = 0.02) in the MS group. Data of SBP in mmHg (Mean ± SD) are shown in the Table:

	Minutes after neuroaxial block				
Group	0	5	10	15	20
DB	164 ± 17	148 ± 10	138 ± 17	138 ± 17	132 ± 12
MS	160 ± 21	143 ± 19	129 ± 16*	129 ± 17	131 ± 20

*p < 0.05 vs DB group.

Conclusion: Treatment with ACEI or ARA until the morning of surgery does not further magnify the blood pressure decrease during the early phase of spinal anesthesia and does not increase the rate of hypotensive events. These results do not support to maintain or to discontinue ACEI or ARA before spinal anesthesia. Patient status and the surgical procedures have to be evaluated before withdrawing these drugs.
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A-360

High incidence of post-dural puncture headache after spinal catheters in young adults

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Background and Goal of Study: In single-shot spinal anaesthesia (SPA) with small atraumatic needles (Whitacre 27G) the risk of post-dural puncture headache (PDPH) was calculated to be 1.7% in a metaanalysis with parturients as being at the highest risk.[1] On the other hand, in continuous spinal anaesthesia (CSA) the data on PDPH is controversial, ranging from very low[2] to over 30%.[3] Since no prospective studies for the population of the young adults have been reported, we examined the development of PDPH in 3 small-gauge spinal catheter systems.
Materials and Methods: After ethic-committee approval 28 healthy volunteers (18–30 years old) received a spinal catheter (MicroCatheter, Portex, UK, n = 9; 22-G Spinocath®, n = 9 or 24-G Spinocath®, B.Braun, Germany, n = 10) at the lumbar level 3/4 or 4/5. The persons were enrolled in a neuroendocrine investigation with intermittent sampling of serum and cerebrospinal fluid (17 × 0.5 ml) for analysis of neuropeptides. After 4 h the spinal catheter was removed and the test persons immediately mobilized. The development of PDPH and the intensity of headache were documented prospectively by using a standardized headache assessment method with a numeric rating scale (NRS 0–10). Nonparametric tests were applied for statistical analysis.
Results and Discussions: The study revealed a high overall incidence of 68% PDPH. (MicroCatheter: 89% PDPH, 22G-Spinocath: 67% PDPH, 24G-Spinocath: 50% PDPH, p = 0.19). The average onset of PDPH was on the second day (range: day 1–day 5). The mean of the maximal headache intensity documented on the NRS by the persons affected was M = 6.3 ± 2.5 and the mean duration of PDPH was M = 4.5 ± 2.3 days. Intensity and duration of headache increased significantly with the MicroCatheter, Portex (p ⩽ 0.05 resp.).
Conclusion: Because of the strikingly high incidence of PDPH after small-gauge spinal catheters, this anaesthesiologic technique at its present level of development has to be avoided in the young adult population.
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A-361

Prospective randomized trial of incidence and severity of headache following lumbar puncture with an a-traumatic 22 G needle compared with traumatic 22 G needle

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Background and Goal of Study: Lumbar puncture (LP) allows the collection of cerebrospinal fluid (CSF) for diagnostic procedures and the injection of chemotherapeutic agents directly into the nervous system. Post-lumbar puncture headache (PLPH) is the most prevalent reported complication post LP, occurring in 40–70% patients. Therefore, we prospectively analyzed the

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ability of an a-traumatic needle, usually used for spinal anesthesia to reduce the incidence of PLPH compared with a traumatic, conventionally used needle.
Material and Methods: 79 patients aged ⩾18 years, who were planned either for diagnostic or therapeutic LP as part of their clinical management, were prospectively randomized to undergo LP with traumatic Quincke, 22 Gauge, 90 mm; TSK, JAPAN (n = 35) versus a-tramatic Whitacre, 22 Gauge, 0.70 mm, 103 mm, Polymedic, E.C (n = 44) needle. Patients with thrombocyte count lower than 50,000 $\times$ 10^9/L and those with abnormal fundoscopy/head CT scan were excluded. The same experienced anesthesiologist, using the identical technique, performed all LPs. Patients were immobilized for one-hour bed rest after LP.

The indication for LP and procedure-related parameters (e.g.: CSF volume, number of attempts, interspaces level) were recorded. Patient's demographic data, medical history, medications, a history of chronic pain syndrome and daily consumption of caffeine containing drinks, were evaluated. A questionnaire, provided on days 2 and 7 following LP assessed the appearance of neurologic complications, local pain, PLPH and therapy required for these complications.
Results and Discussion: There were no statistically significant differences in demographic data, background illnesses, a history of previous pain syndrome and indication for LP between the two groups. The incidence of local pain at site of needle insertion and neurological complications post LP was slightly lower in the a-traumatic group (16% vs. 29%, p = 0.16). However, the incidence of PLPH was significantly higher in the traumatic needle group compared with the a-traumatic group (34% vs. 2.3%, p = 0.003).
Conclusions: Using a-traumatic 22 G needle for diagnostic and therapeutic LP is feasible, safe and significantly reduces the incidence of PLPH. Therefore, an extensive application of a-traumatic Whitacre needle for both diagnostic and therapeutic applications is recommended.

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Minimal effective dose of spinal hyperbaric bupivacaine for adult anorectal surgery: a prospective, double-blinded, randomized study

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Background and Goals: To find minimal effective dose of spinal hyperbaric bupivacaine for anorectal surgery.
Materials and Methods: The study included 93 adult consecutive ASA 1–3 patients. Spinal anaesthesia (SA) was performed in the sitting position at L3-4 or L4-5 with hyperbaric bupivacaine (Marcaine Spinal Heavy 0.5%) injected over 2 minutes: group 1 (n = 17) 1.5 ml, group 2 (n = 38) 1.0 ml, group 3 (n = 38) 0.8 ml. After sitting for 10 minutes surgery was started. Following variables were assessed: rate of success, level and duration of sensory and motor block, time to voiding and ambulation, complications, consumption of analgesics, quality of anaesthesia according to the patient and medical staff. ANOVA, post hoc Bonferroni, χ^2 and Kruskall-Wallis tests were used where appropriate.
Results: Groups were comparable in demographics. No case of failure was registered but 4 patients (10.5%) in the 3rd group received supplemental i/v fentanyl. Characteristics of SA are presented in the table, mean ± SD, no of cases (%), median (range), p < 0,05 significant:

		Group 1	Group 2	Group 3
Sens. block, dermatomes		10.4 ±1.7*	7.013 ±2.2*	6.7 ±1.9
Duration (min) of sensory block		254.1 ±42.6*	201.8 ±41.2*	181.6 ±40.0+
Motor block	0	1 (5.9)*	26 (68.4)*	32 (84.2)
	1	4 (23.5)	11 (28.9)	3 (7.9)
	2–3	12 (70.5)	1 (2.6)	3 (7.9)
Duration of motor block, min		90 (0–120)*	0 (0–90)*	0 (0–60)+
Time to ambulate, min		181.5 ±41.5*	136.6 ±32.2*	123.0 ±45.9

*p < 0.000 group 1 vs 2 and 1 vs 3.
+0.1 group 2 vs 3 (β = 0.3).

Quality of anaesthesia was rated as excellent by patient in group 1 in 58.8% (76.5% day 1 postop.) versus 94.7 (92.1) and 86.8 (97.4)% of cases in groups 2 and 3; by the ward nurse 82.4, 100 and 97.4%, respectively (p < 0.05).
Conclusions: 1) minimal dose of spinal hyperbaric bupivacaine for anorectal surgery is 4 or 5 mg; 2) 7.5 mg produce excessive sensory and motor block with lower rates of quality.

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A prospective, randomized, double blind comparison between hyperbaric levobupivacaine and ropivacaine for outpatient knee arthroscopy

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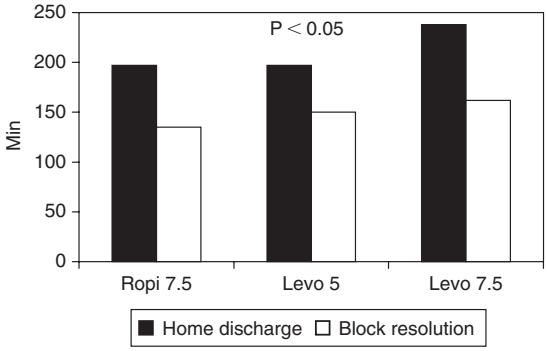
Background: The purpose of this prospective, randomized, double-blind study was to compare equivalent and equipotent doses of hyperbaric ropivacaine and levobupivacaine for spinal anesthesia in outpatient knee arthroscopy.
Methods: With Ethical committee approval and written informed consent, 91 ASA physical status I–II, 18–65 yr-old patients undergoing day-case knee arthroscopy were randomly allocated to receive unilateral spinal anesthesia with 7.5 mg of hyperbaric ropivacaine 0.5% (group Ropi-7.5, n = 31), or either 7.5 mg (group Levo-7.5, n = 30) or 5 mg (group Levo-5, n = 30) of hyperbaric levobupivacaine 0.5%. Hyperbaric solutions were prepared by one investigator not involved in further patient management by diluting 20 mg of 0.75% plain ropivacaine or levobupivacaine with glucose and sterile water to obtain 4 ml of the 0.5% concentration of the local anesthetic solution with 8% glucose. Times for readiness to surgery, recovery of sensory and motor functions, ambulation, first micturition, and home discharge were recorded as well as the need for postoperative analgesic medication.
Results and Discussion: No differences in anthropometrics parameters and time for readiness to surgery were found between the two groups. Thirty min after injection strictly unilateral sensory block was present in 73%, 50%, and 61% of cases in groups Ropi-7.5, Levo-7.5, and Levo-5, respectively (P = 0.40); while unilateral motor block was observed in 94%, 93%, and 83% in groups Ropi-7.5, Levo-7.5, and Levo-5, respectively (P = 0.31). The median (range) time for spinal block resolution was shorter in group Ropi-7.5 [135 (126–154) min] respect group Levo-7.5 [162 (148–201) min] (P < 0.05); while home discharge was shorter both in groups Ropi-7.5 [197 (177–218) min] and Levo-5 [197 (187–251) min] as compared to group Levo-7.5 [238 (219–277) min] (P = <0.05).



Conclusion: We concluded that 7.5 mg of 0.5% hyperbaric ropivacaine and 5 mg of 0.5% hyperbaric levobupivacaine provide adequate spinal block for outpatient knee arthroscopy, with a faster home discharge as compared to 7.5 mg of 0.5% hyperbaric levobupivacaine.

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Gender differences in the development of pruritus after intrathecal sufentanil

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Background and Goal of Study: Intra-thecal sufentanil has gained increased popularity for the last years as it allows the reduction of the doses of local anaesthetics and latency time necessary to achieve subarachnoid block (SAB). Furthermore it provides additional analgesia long past the reversal of block. Like other opioids intra-thecal sufentanil has secondary effects like nausea, vomiting, respiratory depression and pruritus. The incidence of pruritus is dependent on the dose (1) and individual susceptibility. Although the precise mechanism of opioid-associated pruritus is not known, it has been associated (2) with opioid receptors that are influenced by sexual steroids. We hypothesize that gender is a factor of susceptibility to the development of pruritus after SAB with sufentanil.

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Materials and Methods: This is a prospective cohort study (n = 130). Patients 18 or older, ASA I or II were randomly selected for the study. Patients were submitted to SAB using 0,04–0,06 mg bupivacaine/cm of height and 2,5 microgram Sufentanil. We evaluated and recorded the development of pruritus every 20 min after the block until 120 min, as well as nausea, vomiting, deep sedation and hypoxia. Pruritus was classified into 4 categories: none, light, moderate, severe. Data was analysed using ANOVA.
Results and Discussions: Women have an increased susceptibility to the development of pruritus, which appeared earlier and more frequently than in men. Pregnant and pre-menopausal women have increased susceptibility although it did not reach statistical significance.
Conclusion(s): Our data shows that women are more prone to the development of pruritus after SAB with sufentanil. We propose that the mechanism underpinning this fact might be the hormonal milieu of sexual steroids in particular progesterone.
References:
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The influence of the temperature of bupivacaine 0.5% used for lumbosacral spinal anaesthesia (Taylor's approach) on onset and extent of block

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Background and Goal of Study: Within a few minutes local anaesthetics for spinal anesthesia equilibrate to cerebrospinal fluid temperature resulting in decreased baricity and, depending on the agent used, in hypobaric behaviour. This may result in unintended peak block height, unintended cephaled spread and hypotension or bradycardia especially following unplanned posture change. For the lumbosacral approach according to Taylor more stable hemodynamics and lower peak block height have been reported compared to traditional lumbar puncture. The purpose of this study was to compare onset of block, maximum level of sensory block (MLSB) and hemodynamics during spinal anaesthesia using Taylor's approach with plain bupivacaine at different temperatures.
Materials and Methods: After institutional approval and written informed consent 49 men undergoing transurethral prostate resection in spinal anaesthesia were randomly assigned to 2 groups. Twenty mg of plain bupivacaine were injected within 30 sec at 24°C (group 24°C) or 37°C (group 37°C), respectively. MLSB (pin-prick), loss of temperature discrimination to cold saline (LOTD), and motor block (Bromage scale), as well as heart rate and blood pressure was assessed every 2 min during onset of block by an examiner blinded to bupivacaine temperature. Decrease in blood pressure >20% to baseline was treated with theodreanaline.
Results and Discussions: Patient charcteristics and duration of surgery did not differ between groups. Onset of block was faster in group 37°C as was peak block height (see Table). There was a moderate decrease in heart rate and blood pressure within 60 min in both groups, not necessitating interventions.

	Group 24°C	Group 37°C	p-value
Bromage 1 [min]	6.5 ± 4.3	3.3 ± 2.9	0.004
Bromage 2 [min]	10.5 ± 6.6	6.1 ± 4.9	0.011
Bromage 3 [min]	18.1 ± 11.3	10.3 ± 5.6	0.006
MLSB [segments]	11.6 ± 2.1	13.3 ± 2.2	0.007
MLSB [min]	19.1 ± 11.3	13.0 ± 8.7	0.038
LOTD [segments]	12.5 ± 2.1	14.5 ± 2.1	0.006
LOTD [min]	16.8 ± 10.0	11.0 ± 6.7	0.019

Conclusion(s): Plain bupivacaine injected at body temperature resulted in a more rapid onset and a higher MLSB without increasing the risk of hypotension or bradycardia. This may decrease the risk of secondary cranial block extension during posture change.

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Total intravenus anesthesia (T.I.V.A.) versus spinal block in minor urological operations

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Background and Goal of Study: Traditionally, general or regional anesthesia has been employed during minor urological operations, whereas a variety of drugs and techniques have been introduced into ambulatory anesthesia. We compared the advantage of early home readiness and the side effects of these anesthesia techniques.
Materials and Methods: 60 unpremedicated patients, ASA I–II (18–60 av. age), who underwent hydrocele and varicocele repair were randomly divided into two groups. Group A (30 patients) received TIVA with propofol, fentanyl 3 γ/kgr and atracurio 0.2 mg/kgr and placement of a laryngeal mask. Patients in Group B (30 patients) had spinal anaesthesia administrated using a midline approach with a 26-G atraumatic needle at the level of the L2–3 or L3–4 intervertebral space with the patient in the sitting position. The subarachnoidal injection contained hyperbaric bupivocaine 0.5%, 1 ml and xylocaine 2%, 1 ml. The extent of the block was assessed by using pinprick and a modified Bromage scale.
Results and Discussion: On questioning 18% of patients who underwent spinal anesthesia reported a headache and 50% of these headaches were described as moderate or severe and lasted between 12 and 24 hours. The average anesthesia and recovery room times were significantly shorter for patients given TIVA (25 vs 40 min) and (80 vs 180 min) for the spinal group. The characteristics and duration of surgery were recorded. Patients in TIVA group had a greater need for postoperative analgesia. The times for home readiness were longer in spinal group.
Conclusions: In urological diagnostics and therapy the spinal anesthesia has still its full right, is less toxic for the patient and has less severe complications. However, prerequisite the full assent and psychic guidance of the patient during the whole duration of the intervention, it provides as effective as the general anesthesia which has the advantage of earlier home readiness.

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Ketamine sedation during spinal anesthesia for arthroscopic knee surgery reduced the ischemia-reperfusion injury markers

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Background and Goals: We studied the effect of ketamine sedation on oxidative stress during arthroscopic knee surgery with tourniquet application by determining blood and tissue malonyldialdehyde and hypoxhantine levels.
Material and Methods: Thirty ASA I–II patients, undergoing arthroscopic knee surgery with tourniquet were randomly divided into two groups. After standard monitorization, spinal anaesthesia was induced with 12,5 mg bupivacaine in all patients. In ketamine group after midazolam 0.01 mg kg^{-1} IV, ketamine was infused at a dose of 0.5 mg $kg^{-1} h^{-1}$ until the end of the surgery. In control group the same amount of placebo infusion was started after midazolam administration. Ramsey Sedation Scale (RSS) was used for determining the sedation level. Venous blood and synovial membrane tissue samples were obtained before ketamine infusion, at the 30th min. of ischemia, and at 5 min. after tourniquet deflation for malonyldialdehyde (MDA) and Hypoxhantine (HPX) measurements.
Results: There were not any differece among to Demographical data (Table 1) Tissue MDA and HPX levels were significantly lower in the ketamine group than the control group following reperfusion. RSS scores were higher in ketamine group without any adverse effect.
Conclusion: As a conclusion, ketamine sedation attenuated lipid peroxidation markers in arthroscopic knee surgery with tourniquet application.

Table 1. Demographical data.

	Control Group	Ketamine Group
n	15	15
Age (yr)	30 (±7)	31(±8)
Weight (kg)	71(±11)	69(±14)
Sex (M/F)	10/5	9/6
Tourniquet t (min)	72.3(±22.3)	74.3(±21.4)
Reperfusion t (min)	5.7(±4.3)	5.9(±4.1)

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A-368

Intravenous administration of NMDA receptor antagonists to the patient under spinal anesthesia: ketamine or magnesium

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Background and Objective: NMDA receptor antagonists; ketamine and magnesium have decresed postoperative pain scores and analgesic requirements

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in patients underwent general anesthesia (1,2). But they have not been used as an adjunct to spinal anesthesia.
Materials and Methods: Fourty five patients, aged 18–45 years, ASA I–II were randomly assigned to three groups. Patients received either ketamine 25 mg or magnesium sulphate 1.5 g or placebo intravenously 5 min prior to the i.v addition were prepared by an anesthesiologist who was not responsible to collct the intraoperative and postoperative data spinal injection. All patients were administrated standardized spinal anesthesia. Heamodynamic fidings, onset time of motor and sensorial blockade, duration of motor and sensorial blockade, duration of analgesia, postoperative haemodynamic findings, pain scores (VAS), adverse reactions were recorded.
Results: The onset time of sensorial blockade was significantly longer in Group ketamine. The duration of motor blockade and analgesia were significantly longer in study groups when compared to the Group placebo. The other data were not significantly different in all groups.
Conclusion: We concluded that the addition of the single dose of ketamine or magnesium via intravenously provided longer duration of motor blockade in patients with spinal anesthesia. Moreover, ketamine provided faster onset of sensory blockade. As a result, addition of i.v. ketamine or magnesium can be recommended for patients undergoing spinal anesthesia.

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Music decreases propofol requirement of the target-controlled infusion during spinal anaesthesia

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Background and Goal of Study: Perioperative music has been shown to decrease patient's sedative requirement. However, most results were obtained in conscious or lightly sedated patients and few objective measures were used. This study was designed to confirm such efficacy of music in patients being sedated adequately during spinal anaesthesia by using bispectral index (BIS) monitoring and the target-controlled infusion of propofol.
Materials and Methods: In this prospective, randomized, controlled study, 100 patients, mean age 42.3 ± 8.6 year and mean weight 61.6 ± 8.6 kg, undergoing hysterectomy were perioperatively exposed to music or no music. None of them had hearing impairment, drug abuse or psychiatric disorder. Intraoperatively, sedation was maintained at an OAA/S score of 3 (Responsiveness and Sedation Rating Scale). Patient's satisfaction was assessed by a 5-grade scale. Differences in propofol amount and patient's satisfaction between the groups were analyzed using an unpaired t-test. All values are expressed as mean ± SD and statistical significance was accepted at $P < 0.05$. The suggested sample size is 42 in each group.
Results and Discussions: Compared to the controls, the music group had smaller propofol consumption (119.7 ± 110.1 vs 256.6 ± 109.8 mg, $P < 0.001$) and higher satisfaction ($\chi^2 = 4.05$, $P < 0.05$).

Consistent with previous reports, our results demonstrate that music decreased intraoperative propofol requirement and improved patient's satisfaction, meanwhile the adequate sedation was assured. Previous studies have demonstrated that the concept of sound as modulators of human response to surgical stress are also valid in unconscious patients, even as BIS is between 40~60[1].
Conclusion(s): This study shows that perioperative music may benefit adequately sedated patients undergoing hysterectomy with spinal anaesthesia according to less propofol requirements and higher satisfaction.
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A-370

A sedative effect induced by spinal anaesthesia: a comparison between young and elderly patients

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Background and Goal of Study: Spinal anaesthesia has been reported to have a sedative effect, i.e, decreasing the need for intravenous anaesthetics 1)2)3). This study was designed to estimate a comparative efficacy of spinal sedation in young and elderly patients using Bispectral Index (BIS) monitor and Observer's Assessment of Alertness/Sedation (OAA/S) Scale.
Materials and Methods: We studied 11 young patients (mean age 16.5 ± 0.8 (range 16–18) years old) and 13 elderly patients (mean age 75.5 ± 4.7 (range 70–84) years old) who received lower limb surgery under spinal anaesthesia. Patients received 13–16 mg of isobaric 0.5% bupivacaine intrathecally according to the surgical procedure requirements. A depth of sedation was evaluated using BIS monitoring and OAA/S scale before and 5–10-minutes interval after starting spinal anaesthesia. Statistical significance (*P* less than 0.05) was determined using paired t-test, unpaired t-test and repeated measure ANOVA.
Results and Discussions: In the young patients, BIS showed a significant decrease at 10 minutes ($P = 0.02$) and OAA/S score showed a significant decrease at 70 and 80 minutes after starting spinal anaesthesia ($P = 0.003$ and 0.02). In the elderly patients, BIS and OAA/S score showed no significant change throughout the time course ($P = 0.9$ and 0.9). There was no significant change in BIS and OAA/S between the groups ($P = 0.07$ and 0.8). The results show that early and late sedative effects are observed in the young patients during spinal anaesthesia, whereas they are not observed in elderly patients.
Conclusion(s): We conclude that young patients but not old patients show early and late sedation during spinal anaesthesia.
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Effects of chronic alcohol consumption on propofol-induced sedation in spinal anesthesia

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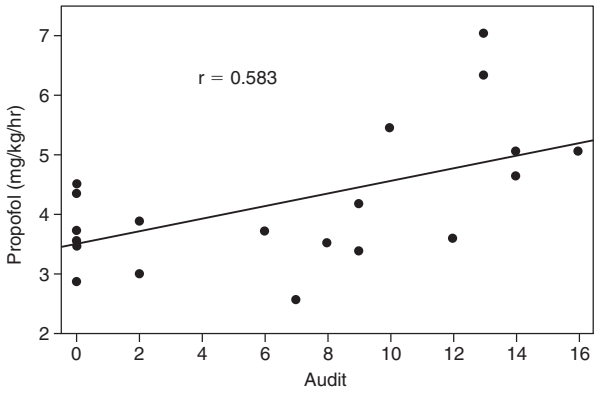
Background and Goal of Study: It has been known that anesthetic induction dose of propofol is increased in patient with chronic alcoholism (1). We evaluated the effects of chronic alcohol intake on propofol-induced sedation in spinal anesthesia.
Materials and Methods: Twenty-one adult patients with 20–50 years of age, scheduled for knee joint surgery, were enrolled. Alcohol Use Disorder Identification Test (AUDIT) questionnaire was used as a marker of alcohol consumption (2). Propofol infusion was titrated to maintain Bispectral index (BIS) in the range of 70–80 in a blinded manner.
Results and Discussions:



The infusion rates of propofol were between 2.56 and 7.02 mg/kg/hr and were correlated with AUDIT score significantly (Spearman, $r = 0.583$, $P < 0.001$).
Conclusion(s): A careful and judicious use of propofol is recommended in sedation for chronic alcoholic patients during regional anesthesia.
References:
1 Conigrave KM, Saunders JB, Reznik RB. Addiction 1995; 90: 1479–1485.
2 Fassoulaki A, Farinotti R, Servin F, et al. Anesth Analg 1993; 77: 553–556.

A-372

Spinal vs. general anesthesia for orthopedic surgery – a comparison of costs

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Background and Goal of study: Hip and knee replacement are common orthopedic surgeries and can be performed either under spinal (SA) or general anesthesia (GA). So far, little is known concerning the cost-effectiveness of SA compared to GA (1). We compared the economic aspects and anesthesia relevant times of SA vs. GA in elective orthopedic surgery.

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Materials and Methods: Thirty patients undergoing elective hip or knee replacement were randomized to receive either GA or SA. We assessed the costs of all used resources (drugs, gas, fluids, medical items) and the clinical relevant times. Personnel costs were neglected. *GA* was induced by fentanyl and propofol. Intubation was facilitated by rocuronium. Anesthesia was provided by 1 MAC Sevoflurane in 1.5 liter fresh gas flow and by repeated dosages of fentanyl IV. *SA* was performed after skin infiltration with lidocaine 2% (2–3 ml) by single shot technique at the L 2–3 or L 3–4 interspace with a 26-Gauge needle. For sedation repeated doses of midazolam IV were given. Postoperative analgesia was standardized with paracetamol 1000 mg IV and additional piritramid 3 mg IV boluses. Discharge criteria from PACU were defined as Aldrete Score $>$ 8. Statistical Analysis was done by t-test for independent samples.
Results and Discussion: Patients' demography (age, sex, height, weight, ASA) and anesthesia relevant durations were similar in both groups. Costs per case were lower in the SA group (€ 43.06) compared to the GA group (€ 104.90; $P < 0.01$).
Conclusions: Whereas, for minor surgery the costs of SA and GA are similar (2, 3) we showed that SA is more cost-effective than GA in longer cases. We conclude, that SA is more cost-effective than GA in patients undergoing elective knee or hip replacement.
References:
1 Ben-David B, Levin H, Solomon E, et al *Anesth Analg* 1996; 83:716–20.
2 Martikainen M, Kangas-Saarela T, Löppönen A, et al *Ambul Surg* 2001; 9:77–81.
3 Chilvers CR, Goodwin A, Vaghadia H, et al *Can J Anaesth* 2001; 48:279–83.

A-373

The pharmacokinetic profile of a sustained-release formulation of bupivacaine (SKY0402) administered as a partial nerve block

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Background and Goal of Study: SKY0402 is a sustained-release formulation of bupivacaine intended for the treatment of post-operative pain following perineural, epidural, subcutaneous, or intra-articular injection. In the current study, the pharmacokinetics of SKY0402 were compared with unencapsulated bupivacaine (UB) administered via a partial ankle nerve block.
Materials and Methods: This was a Phase 1, randomized, double-blind, dose-escalation study in which four cohorts of healthy male subjects received doses of 75, 125, 150, and 175 mg of SKY0402 and 75 mg of UB administered via partial ankle nerve block.
Results and Discussions: Maximum plasma concentrations of bupivacaine were attained at 0.5 hours post-dose, irrespective of the formulation. As expected for a sustained-release formulation, the mean C_{max} following the administration of all doses of SKY0402 was less than that observed after the administration of 75 mg UB, and importantly, was significantly lower (at all doses) that the toxic concentration of bupivacaine reported in the literature (approximately 2000 ng/mL). Specifically, compared to 75 mg of UB, the C_{max} was 5-fold lower following the administration of 75 mg of SKY0402 and was $>$ 2-fold less following the administration of 175 mg of SKY0402. Following the administration of all doses of SKY0402, both C_{max} and the systemic exposure ($AUC_{0\text{-tlast}}$) to bupivacaine increased in an approximately dose-proportional manner.
Conclusion(s): SKY0402 demonstrated a plasma pharmacokinetic profile consistent with a sustained-release formulation.

A-374

Brachial plexus blockade impairs sympathetic activity and endothelial function in human skin microcirculation, evaluated by wavelet transform

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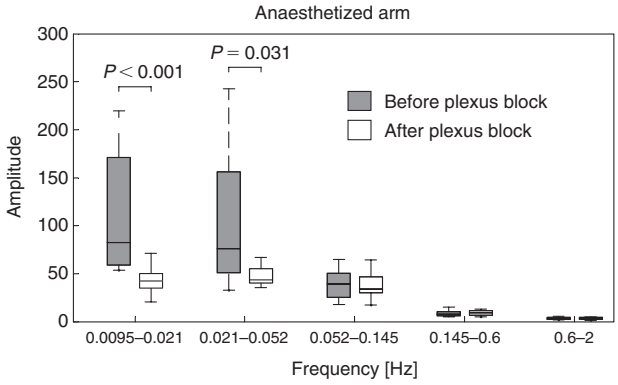
Background and Goal of Study: Wavelet transform of Laser Doppler flowmetry (LDF) signals in human skin microcirculation have shown periodic oscillations of five characteristic frequencies around 1.0, 0.3, 0.1, 0.04 and 0.01 Hz. These oscillations are related to heart rate, respiration rate, myogenic activity of vascular smooth muscle cells, neurogenic activity in the vessel wall and vascular endothelial activity, respectively (1). The aim of the present study was to investigate alterations of these oscillations during brachial plexus blockade.
Materials and Methods: 13 patients undergoing hand surgery were included. All were healthy, non-smokers without medication. Brachial plexus blockade using Bupivacain, Lidocain and Epinephrine was performed. Skin microcirculation was measured on the forearm using LDF before and after nerve blockade and wavelet transform was performed.
Results and Discussions: The five horizontal lines in the box plots show the median, quartiles and the10th and 90th percentiles.



Conclusions: Brachial plexus blockade reduces the forth and fifth oscillation of the perfusion signal. These alterations in skin microcirculation induced by brachial plexus blockade are related to inhibition of sympathetic activity in the vessel wall and a possible effect on endothelial function.
Reference:
1 Soderstrom T. et al. *Am J Physiol Heart Circ Physiol* 2003; 284:H1638–H1646.

A-375

The distribution of injected solution in simulated paravertebral nerve block. An anatomical study

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Background and Goal of Study: The paravertebral nerve block is used for various procedures. The aim of our study was to assess if there is a relationship between injected volume and intercostal nerve distribution.
Materials and Methods: After ethic committee approval a study was performed on 16 human cadavers. Ten, resp. 20 ml of methylene blue colored water were randomly administered on each side at T 4 level before section. A standard technique of paravertebral block was used. After removal of thoracic and abdominal organs the extent of color below pleura could be observed and the number of intercostal spaces was noticed.
Results and Discussions: The paravertebral space could not be detected from anatomical or technical reasons on the one or the other side in 4 cadavers. Results obtained in the other 12 cases are presented in Table 1. There was a clear relationship between the number of colored intercostal spaces and injected volume at the same individual ($p < 0.05$), but there was not found any relationship between the number of colored intercostal spaces and injected volume across the whole sample studied. It means that at the same body doubling the dose means roughly doubling the number of nerves influenced, but we were not able to predict how many intercostal nerves will be affected by a given volume.

Table 1. Number of colored intercostal spaces and injected volume in 12 cadavers.

No	1	2	3	4	5	6	7	8	9	10	11	12
10 ml	2	2	3	5	5	1	1	1	3	1	2	2
20 ml	4	4	6	6	6	4	1	3	2	4	4	2

Conclusion(s): We were not able to predict an extent of spread of colored dye to the intercostal nerves in relationship to the administered volume in post mortem study. The impact for clinical praxis needs further examination.

A-377

Lipophilicity of local anaesthetics determines their effects on intracellular calcium regulation in skeletal muscle fibres

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Background and Goal of Study: A massive increase in intracellular Ca^{2+} is considered to be major patho-mechanism in local anesthetic myotoxicity.[1]

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Recently, we have shown that bupivacaine and ropivacaine enantiomers stereoselectively alter Ca^{2+} homeostasis in striated myocytes.[2] Examining the racemates of pipecoloxylidide local anaesthetics, it was the aim of this study to investigate the impact of lipophilicity on Ca^{2+} regulation in muscle fibres.

Materials and Methods: Bupivacaine, ropivacaine and mepivacaine racemates were tested in concentrations of 5, 10 and 15 mM. Saponin skinned murine skeletal muscle fibers were loaded at 0.41 μM Ca^{2+} according to a standardised protocol.[1,2] To assess the effects on Ca^{2+} uptake, agents were added to the 'loading solution', and caffeine induced force transients were measured. Further-more, agents were added to the release solution to investigate the effects on Ca^{2+} release from the sarcoplasmic reticulum. Force transients were normalised to maximum force at 24.9 μM Ca^{2+}, and mathematically transferred into Ca^{2+} transients (5 fibres per agent and concentration; statistics: One-way analysis of variance/t-test).

Results: Data (mean ± SD; in μM) are shown in the Table.

	5 mM	10 mM	15 mM	Control
Ca^{2+} reuptake				
Mepivacaine	1.36 ± 0.12	1.11 ± 0.07*	1.01 ± 0.10*	1.51 ± 0.13
Ropivacaine	0.99 ± 0.09*§	0.85 ± 0.09*§	0.67 ± 0.03*§	1.57 ± 0.08
Bupivacaine	0.91 ± 0.09*§	0.79 ± 0.03*§	0.61 ± 0.09*§	1.56 ± 0.12
Ca^{2+} release				
Mepivacaine	0.31 ± 0.07	0.45 ± 0.08	0.53 ± 0.10	
Ropivacaine	0.34 ± 0,04	0.57 ± 0.06§	0.76 ± 0.03§	
Bupivacaine	0.64 ± 0.03§#	0.77 ± 0.07§#	0.86 ± 0.04§#	

*$p < 0.05$ vs control; §$p < 0.05$ vs mepivacine; #$p < 0.05$ vs ropivacine.

Conclusions: These results show that the specific lipophilicity of local anaesthetics (bupivacaine > ropivacaine > mepivacaine) has a significant impact on their effects on Ca^{2+} release and Ca^{2+} reuptake in mammalian skeletal muscle fibres.

References:

1 Zink W. *Anesthesiology* 2005 (in press).
2 Zink W. *Anesthesiology* 2002; 97: 710–716.

A-379

Effect of carbamate local anesthetics on NMDA receptors signaling: role of side chain position in lipophilic part

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Background and Goal of Study: Clinically used local anesthetics, both amides and esters, inhibit NMDA receptor signaling in *Xenopus* oocytes[1]. This effect seems to be independent on the linking bond in local anesthetics molecule. To further evaluate the molecular structural features needed for this inhibition, we study the effect of experimental local anesthetics with carbamate linking bond on recombinatly expressed NMDA receptor (NR 1/2A) in *Xenopus* oocytes. We investigated the effect of heptacaine and its 2 geometric isomers (XX and XXI), which differ in the position of the side carbon chain on the aromatic ring. Lipid solubility and pKa of these compounds are almost same.

Materials and Methods: Human NR1/NR2A receptors were expressed in *Xenopus laevis* ocytes by microinjection of mRNA. Receptors were studied under voltage clamp, using Ba as charge carrier, and responses to the physiological co-agonists glutamate and glycine (G/G, both at 10^{-5} M) were determined in the absence and presence of heptacaine, XX and XXI (all at 10^{-4} M, incubation 10 min). Results are reported as % of control ± SEM, and were analyzed by t-test.

Results and Discussions: We observed no inhibition of NMDA receptor with heptacaine, in concentration 10^{-4} M (95,3% control response, $p = 0{,}781$); while its geometric isomers significantly inhibited signaling through NMDA receptor in this concentration (XX 64,6% control response, $p < 0{,}05$; XXI 68,7% control response, $p < 0{,}05$).

Conclusion(s): We observed inhibition of NMDA signaling in *Xenopus* oocyte model also by local anesthetic with carbamate linking bond; however this effect was strongly determined by the position of the substitution on aromatic ring. Significant inhibitory effect was observed only by the compounds with the alkyl chain in positions 3- and 4- on the aromatic ring; while heptacaine, with the bulky substitution in position 2- on the aromatic ring, was found to cause no significant inhibitory effect on NMDA signaling.

Reference:

1 Hahnenkamp K et al: Anesthesiology 2004; 101: A897

A-380

Epidural clonidine causes an increase in T-helper1 lymphocytes and a decrease in T-helper2 lymphocytes in patients undergoing lung surgery

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Background and Goal of Study: Surgical trauma initiates stress response in human body with consecutive immune suppression. Previous study established that clonidine modulates immune stress response at the end of operation (1). The goal of this study was to make clear the effects of clonidine on lymphocyte subsets in postoperative period.

Materials and Methods: In a prospective, double-blinded study 16 patients with lung carcinoma were randomly divided to two groups, clonidine (CLO; n = 8) and control (CON; n = 8). All patients received a bolus of 40 μg/kg of morphine by epidural catheter at Th_{6-7}. The CLO also received 4 μg/kg of clonidine epidurally, before the induction to general anesthesia (GA). We used continuous epidural infusion of 4 μg/kg/h of morphine and 10 μg/kg/h of bupivacain in saline for postoperative analgesia in both groups. In CLO we added 0.2 μg/kg/h of clonidine. We took four blood samples (before induction to GA – T_1, at the end of operation – T_2, the next morning – T_3 and the second morning – T_4) and measured lymphocyte subsets (CD3, CD4, CD8, CD19, CD16/56, IFNγ/CD4 (T-helper1), IL-4/CD4 (T-helper2)), using flow cytometry. We compared the significance of ratios of absolute counts of lymphocytes in certain subsets between two samplings using T-test.

Results and Discussions: Clonidine causes an increase in T-helper1 and a decrease in T-helper2 (Table 1, Table 2).

Table 1. Ratio of absolute count between T_2 and T_1.

	T-helper 1	
CLO	1.35* ± 0.7	*$p < 0.05$
CON	0.73 ± 0.37	

Table 2. Ratios of absolute count between T_3 and T_1

	T-helper 1	T-helper 2	
CLO	4.79* ± 4.65	1.02* ± 0.6	* $p < 0.05$
CON	0.43 ± 0.26	1.42 ± 1.15	

There were no significant differences in other lymphocyte subsets. An increase in T-helper1 and a decrease in T-helper2 are beneficial for cancer patients since this favors cellular immune response.

Conclusion(s): Changes in immune response caused by clonidine after lung surgery may be advantageous for cancer patients.

Reference:

1 Novak-Jankovic V et al. Eur J Anaesthesiol 2000; 17: 50–56.

A-381

Ropivacaine sparing effect of intrathecal fentanyl in spinal anaesthesia for day-surgery

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Background and Goals: Qualities of the spinal block suitable for day-case surgery can be achieved by adding fentanyl to a low-dose hyperbaric bupivacaine solution (1,2). We investigated whether the same principle may also apply for intrathecal (i.t.) ropivacaine which, in addition has the advantage over bupivacaine in blocking motor fibres less potently.

Methods: In this double-blind study, 60 patients were randomised into 2 groups. They received i.t. 1.5 ml of ropivacaine 10 mg ml^{-1} (15 mg) (group R_{15}) or 1 ml (10 mg) combined with fentanyl 0.02 mg (group $R_{10}F$) both in glucose 75 mg ml^{-1}. Pinprick-needle was used for testing sensory block and a modified Bromage scale for motor block. Data is expressed in means [SDs] and tested using Mann-Whitney *U*-test.

Results: The groups did not differ regarding demographic data or haemodynamic changes. Sensory block spread reached T10 dermatome equally in both groups (R_{15}, $R_{10}F$) (9 [4], 11 [6] min, $P = 0.555$) and duration of analgesia at T10 was 80 [35] in group R_{15} and 63 [30] min in group $R_{10}F$, $P = 0.066$. Relevant recovery data are presented in the table. Recovery of both of the sensory and motor block was significantly faster in group $R_{10}F$. Itching bothered 18 (60%) group $R_{10}F$ patients but none of group R_{15} patients, $P < 0.001$.

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Mean [SD], hours	Group R_{15}	Group $R_{10}F$	P
Sens. recovery (Pinprick = S2)	3.2 [0.6]	2.8 [0.6]	0.026
Motor recovery (Bromage = 0)	1.7 [0.6]	1.1 [0.6]	<0.001
Walking around the bed	3.1 [0.7]	2.8 [0.7]	0.017
First voluntary voiding	5.3 [1.4]	5.3 [1.6]	0.902

Conclusions: Earlier recovery (by means of pinprick sensory block, Bromage motor block, and ability to walk) was noticed with i.t. fentanyl 0.02 mg combined with hyperbaric ropivacaine 10 mg compared to i.t. hyperbaric ropivacaine 15 mg for day-case surgery. As the latency to micturition was relatively long (5 h) and itching was bothersome, further focus on individualised adjustment of doses and their proportions is needed.

References:

1 Choi DH, et al. Reg Anesth Pain Med 2000; 25: 240–245.
2 Ben-David B, et al. Reg Anesth Pain Med 2000; 25: 235–239.

A-382

The improvement in analgesic parametres of spinal anesthesia by the addition of intrathecal midazolam to bupivocaine in benign prostate hyperplasia surgery repair

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Background and Goal of Study: Antinociceptive effect of midazolam is well established by now and its safety is documented. This study compared the efficacy (perioperative and postoperative pain relief), safety and side effects with respect to recovery time, pain scores, patient satisfaction, duration and quality of regional anesthesia, by the administration of hyperbaric bupivocaine intrathecally either alone or with midazolam using spinal blockade for transvesical (TVPE) or transurethral (TURP) prostatectomy.
Materials and Methods: 60 patients, ASA I–III, with an average age of 70.7 years, scheduled to undergo TURP or TVPE for benign prostate hyperplasia **(**BPH) under spinal anesthesia, were enrolled in this prospective and randomized trial. The patients were randomly allocated in two groups; Group A/ control group-30 patients and Group B/experimental group-30 patients. By using an 25G spinal needle at the L3–L4 level, group A received 2.5 ml of 0.5% hyperbaric bupivacaine and group B received the same drug and dose but supplemented with intrathecal midazolam, 1 mg. The duration and quality of the blockade, even the effective analgesic times, were recorded. Intensity of pain was detected on a simple verbal scale, observer's assessment of alertness/sedation, (OAA/S). Hemodynamic parameters and side effects were also recorded. The incidence of occult cancer and bladder stones, even the average weight of the resected prostate tissue, the average surgery times and the average demand on blood transfusion were recorded in the procedures.
Results and Discussion: The duration and quality of motor and sensory block were prolonged in the experimental group (210 min vs 150 min) and the effective analgesia was also longer (190 min vs 110 min). The level of comfort was higher in the experimental group. Adverse effects were minor; their incidence was similar in both groups and was not related to the anesthesia techniques.
Conclusions: The analgesic effect was significantly potentiaded and the peri/postoperative analgesia time was prolonged by the addition of intrathecal midazolam to bupivocaine. Side effects were minor and related to the procedure (TURP-TVPE) and to the advanced age of urological patients.

A-383

Comparing intrathecal alfentanil and fentanyl in improving bupivacaine anesthesia quality

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Background and Goal of the Study: It is a fact that intrathecal opioids improve the quality of anesthesia. In this study, we compared the effect of fentanyl or alfentanil added to intrathecal bupivacaine on anesthesia quality.
Materials and Method: After ethics committee approval 55 parturient women (ASA I–II, 19–42 yr) scheduled for elective caesarean section under combined spinal-epidural anesthesia (CSEA) were randomly allocated into one of the three groups: Group BF (bupivacaine + fentanyl), group BA (buivacaine + alfentanil) and group BS (bupivacaine + saline). CSEA was accomplished using needle through needle technique with 18-G Tuohy epidural needle and 27-G Whitacre spinal needle. In addition to 10 mg 0.5% hyperbaric bupivacaine, patients in group BF received fentanyl 20 μgr (n = 20), in group BA received alfentanil 0.2 mg (n = 20) and in group BS received 0.4 ml 0.9%saline (n = 15). Total volumes of the solutions were 2.4 ml in each group.

Data were analyzed by Mann-Whitney, Kruskal-Wallis, ANOVA tests.
Results: Results are summarized in the Table below.

	†TT4 (min)	†DA (min)	†QA (%)	†PS (%)	†FART (min)
BA	10.00	146	100	100	104.1
BF	10.48	146	100	100	109.4
BS	13.20*	120*	60	66.7	89.47*

(†TT4: time to reach T4 dermatome, DA: duration of anesthesia, PS: patient satisfaction, FART: first analgesic request time).
*$p < 0.05$.

Conclusion: Intrathecal alfentanil is as potent as fentanyl in improving anesthesia quality when added to bupivacaine.

References:

1 Cooper D.W. BJA 1997; 78:311–313.
2 Morgan G.E. Clinical Anesthesiology (Edition 3); 309–358.

A-384

The effect of intrathecal fentanyl added to lidocaine for open prostatectomy surgery

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Background and Goal: Subarachnoid block is a widely used technique for open prostatectomy surgery. We assessed the effect of intrathecal fentanyl on the characteristics of the spinal block and its effect on postoperative analgesia.
Material and Methods: We studied 45 adult male patients ASA I–II, scheduled for urological procedures under intrathecal anaesthesia. Patients were randomly assigned in a double-blind fashion into two groups to receive intrathecally either fentanyl 10 μg in Group F (n = 23) or normal saline 0.5 ml in Group P (n = 22) added to 3.5 ml of 2% lidocaine in a total volume of 4 ml. Characteristics of spinal block, time to first required analgesics, intraoperative cardiovascular parameters and side effects were recorded. For statistical analysis ANOVA and t-test were used.
Results and Discussion: The demographic data and duration of surgery were comparable in both groups. The maximum level of sensory blockade was significantly higher in group F as compared to group P (T4 vs T7). The time to reach the peak level of sensory blockade in group F was shorter than in group P (12.5 ± 2.6 vs 16.3 ± 2.6 min) ($P < 0.05$). The time to two-segment regression in fentanyl group was longer than in placebo group (111.4 ± 17.3 min vs 92.6 ± 21.7) ($P < 0.05$). Time to maximum motor block (Bromage 3) did not differ between the groups. Recovery of complete motor block (Bromage 0) was significantly longer in group F. Time to first required analgesics was significantly longer in group F compared to group P (352.7 ± 38.7 min vs 119 ± 31) ($P < 0.05$). Intraoperative blood pressure and heart rate did not differ between the two groups. No remarkable side effects were observed.
Conclusions: Addition of intrathecal fentanyl 10 μg to 3.5 ml of 2% lidocaine improves the quality of anaesthesia and delays the analgesics requirements during the early postoperative period in patients undergoing open prostatectomy surgery.

A-385

Spinal diamorphine: a comparison of two doses for knee arthroplasty

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Background and Goal of Study: Intra-thecal diamorphine (ITD) may delay the need for intravenous post-operative analgesia and reduce the total dose required. The optimum dose is unknown. The efficacy and side-effects of two doses of ITD were compared in this prospective trial.
Materials and Methods: We randomized 41 patients for unilateral primary knee arthroplasty to receive 0.5 mg or 1.0 mg ITD with 12.5 mg hyperbaric bupivacaine as spinal anaesthesia. Post-op analgesia was provided by morphine in a patient-controlled analgesia (PCA) device. Time to first morphine dose (M_0) and total morphine in 24 hours (M_t) were recorded. Nausea and sedation scores (verbal rating scores 0–3), lowest respiratory rate and pruritis needing treatment were also examined.

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Results and Discussions:

Dose of IT diamorphine	0.5 mg	1 mg
Number of patients	19	22
Age (y) *	61 (7)	63 (9)
Weight (kg) * p0.08	85 (15)	94 (18)
M_0 (mins) * ($p < 0.001$)	231 (87)	472 (171)
M_t (mg) * ($p < 0.001$)	58 (26)	29 (18)
Nausea score > 2 (No pts)	4 (21%)	3 (14%)
Sedation score > 2 (No pts)	0 (0%)	1 (5%)
Lowest resp rate < 11 (No pts)	1 (5%)	3 (14%)
Significant pruritis (No pts)	1 (5%)	2 (9%)

*mean(sd).

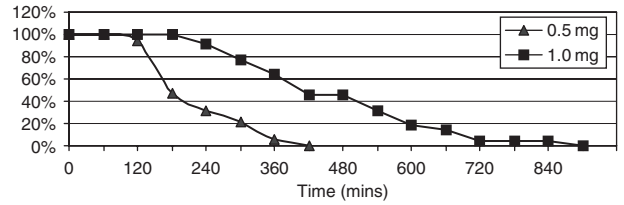

Figure 1. "Survival curve" of time of first PCA request.

Conclusion: 1 mg ITD prolongs post-operative M_0 and reduces M_t in knee arthroplasty compared to 0.5 mg.

Reference:

1 Rathmell et al. Intrathecal Morphine for Postoperative Analgesia: A Randomized, Controlled, Dose-Ranging Study After Hip and Knee Arthroplasty. *Anesthesia & Analgesia.* 97:1452–1457, November 2003.

A-386

The effect of adding intrathecal magnesium sulphate to bupivacaine-fentanyl spinal anaesthesia

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Background: In this prospective, randomized, double-blind, controlled study, we investigated the effect of adding intrathecal magnesium sulphate to bupivacaine-fentanyl spinal anaesthesia.

Methods: 102 ASA I or II adult patients undergoing lower extremity surgery were recruited. They were randomly allocated to receive 1.0 mL of preservative-free 0.9% sodium chloride (group S) or 50 mg of magnesium sulfate 5% (1.0 ml) (group M) following 10 mg of bupivacaine 0.5% plus 25 mcg of fentanyl intrathecally. We recorded the following: onset and duration of sensory block, the highest level of sensory block, the time to reach the highest dermatomal level of sensory block and to complete motor block recovery and the duration of spinal analgesia.

Results: Magnesium caused a delay in the onset of both sensory and motor blockade. The highest level of sensory block was significantly lower in group M than in group S at 5, 10 and 15 minutes ($p < 0.001$). The median time to reach the highest dermatomal level of sensory block was 17 min in group M and 13 min in group S ($p < 0.05$). The mean degree of motor block was also lower in group M at 5, 10 and 15 minutes ($p < 0.001$). The median duration of spinal analgesia was greater in group M ($p < 0.001$).

Conclusion: In patients undergoing lower extremity surgery, the addition of intrathecal magnesium sulphate (50 mg) to spinal anaesthesia induced by bupivacaine and fentanyl significantly delayed the onset of both sensory and motor blockade, but also prolonged the period of analgesia without additional side-effects.

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Intrathecal magnesium, fentanyl, or placebo combined with bupivacaine 0,5% for parturient undergoing elective cesarean delivery

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Background and Goal of Study: The safety profile of intrathecal magnesium administration has been evaluated in animal and human studies (1). In this prospective, randomized, double-blind, controlled study, we investigated the sensory, motor, and analgesic block characteristics of intrathecal magnesium 50 mg compared with fentanyl 25 microgram and saline when added to 0.5% bupivacaine (10 mg).

Material and Methods: 90 ASA I or II adult patients undergoing cesarean section were recruited. They were randomly allocated to receive 50 mg of magnesium sulfate 5% (1.0 ml) in group M, 1.0 mL of 0.9% sodium chloride in group S or 25 microgram (1.0 ml) of fentanyl in group F following 10 mg of bupivacaine 0.5% intrathecally. We recorded the followings: onset and duration of sensory block, the highest level of sensory block, the time to reach the highest dermatomal level of sensory block, onset and duration of motor block, the quality and the duration of spinal analgesia.

Results and Discussion: Magnesium caused a delay in the onset of both sensory and motor blockade ($p < 0.007$). Duration of sensory and motor blockade was significantly longer in M group than in S group ($p < 0.004$). Time to reach the highest dermatomal level of sensory block was significantly shorter in group F than in S and M groups ($p < 0.004$). The quality of spinal analgesia was significantly better in group F compared with group M and S ($p < 0.004$).The duration of spinal analgesia was significantly greater in group F than in group S and M ($p < 0.001$), but there were no significant differences in mean pain and sedation scores at any time.

Conclusion: In patients undergoing cesarean sectio, the addition of intrathecal magnesium (50 mg) significantly delayed the onset of both sensory and motor blockade without causing any side-effect. However, the addition of intrathecal fentanyl (25 μg) to spinal bupivacaine (10 mg) provided shorter onset and longest duration of effective analgesia.

Reference:

1 Buvanendran A, McCarthy RJ, Kroin JS, Leong W, Perry P, Tuman KJ. Intrathecal magnesium prolongs fentanyl analgesia: a prospective, randomized, controlled trial. *Anesth Analg* 2002;95:661–666.

A-388

Intrathecal S(+) ketamine, fentanyl, or placebo combined with bupivacaine 0.5% for parturient undergoing elective cesarean delivery

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Background: In this prospective, randomized, double-blind, controlled study, we investigated the sensory, motor, and analgesic block characteristics of intrathecal S(+) ketamine (0.05 mg kg^{-1}) compared with fentanyl 25 microgram and saline when added to 0.5% bupivacaine (10 mg).

Methods: 90 ASA I or II adult patients undergoing cesarean sectio were recruited. They were randomly allocated to receive 0.05 mg kg^{-1} of S(+) ketamine (1.0 ml) in group K ($n = 30$), 1.0 mL of 0.9% saline in group S ($n = 30$) or 25 microgram (1.0 ml) of fentanyl in group F ($n = 30$) following 10 mg of bupivacaine 0.5% intrathecally. We recorded the followings: onset and duration of sensory block, the highest level of sensory block, the time to reach the highest dermatomal level of sensory block, onset and duration of motor block, the quality and the duration of spinal analgesia.

Results: Onset times of motor and sensory block were similar between S(+) ketamine and fentanyl groups. Duration of sensory and motor block and spinal analgesia was shorter in K group than in F group ($p < 0.05$). Time to reach the highest dermatomal level of sensory block was significantly shorter in group K and F than in group S ($p < 0.05$).The quality of spinal analgesia was significantly better in group K and F than in group S ($p < 0.05$). No major complication was reported and mostly (hypotension, urinary retention, sedation) were minor.

Conclusion: Spinal anaesthesia provided by intrathecal S(+) ketamine (0.05 mg kg^{-1}) plus spinal bupivacaine (10 mg) is as effective and safe as that provided by intrathecal fentanyl (25 μg) plus bupivacaine (10 mg), with a faster recovery of sensory and motor block.

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Comparison of the effects of the intrathecal levobupivacaine and levobupivacaine + fentanyl in patients undergoing TUR procedure

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Background and Goal of Study: Intrathecal fentanyl increases the intensity of motor and sensorial block and prolongs the duration of block without

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prolonging recovery time when added to bupivacaine (1,2). Intrathecal levobupivacaine has also similar properties with less toxic effects. The aim of this study is to compare the effects of intrathecal levobupivacaine combined with different doses of fentanyl.

Materials and Methods: 60 ASA I–II patients who were scheduled for TUR procedure were included in this double-blind, randomised study after the approval of ethics committee. Patients were allocated into 3 groups and levobupivacaine 10 mg, levobupivacaine 10 mg + fentanyl 12.5 mg, levobupivacaine 10 mg + fentanyl 25 mg were administered in groups I (n = 20), II (n = 20) and III (n = 20) respectively. SAP, DAP, MAP, HR, SPO_2, level of sensorial and motor block were recorded at 0, 3, 5, 7, 10, 15, 20, 25, 30, 45, 60, 75, 90, 105, 120th minutes. Level of motor block was recorded in 30 minutes intervals until it resolves completely. 2 segment regression time, time to reach the T10 sensorial level and resolving time of motor block were also recorded. Besides adverse affects were assessed.

Results: Demographic data, SAP, DAP, MAP, HR, SPO_2 were similar in all groups. Sensorial block reached to T10 faster in group I than in group III ($p < 0,05$). 2 segment regression time was significantly shorter in group I than in group III ($p < 0,05$). Complete resolving time of motor block was longer in groups II and III than in group I ($p < 0,05$). Adverse effects were also similar in both groups.

Conclusion(s): Intrathecal 25 mg fentanyl when added to levobupivacaine produces early sensorial block, and prolongs the duration of sensorial and motor block. Therefore we think further studies should be performed with low doses of levobupivacaine in patients undergoing TUR procedure under spinal anaesthesia.

References:

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2 Ben-David B. Anesth Analg 1997;85:560–5.
3 Glaser C. Anesth Analg 2002;94:194–8.

A-390

The effect of glossopharyngeal nerve block with ropivacaine on immediate postoperative pain relief after tonsillectomy in adult patients

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Background and Goal of Study: Post-operative pain is the common problem following tonsillectomy. This prospective randomized study was designed to assess the effect of the glossopharyngeal nerve block (GNB) with ropivacaine on throat pain after tonsillectomy in adult patients.

Materials and Methods: 45 patients were allocated randomly to one of three groups. Group C had no further intervention until recovery. Group R and group B received bilateral GNB using 0.75% ropivacaine and 0.5% bupivacaine with adrenaline 1:200 000 at the end of operation respectively. For evaluation of effect of GNB, throat pain with 100 mm visual analogue scale (VAS), the response for provoking gag reflex and swallowing ability were assessed in recovery room (RR), at 8 h and 24 h after surgery (8 h, 24 h).

Results and Discussions: The Table shows demographic and postoperative throat pain data (mean ± SD).

	Group C	Group R	Group B
Age (y)	32 ± 9	36 ± 14	36 ± 9
Sex (M/F)	10/5	9/6	10/5
Height (cm)	168 ± 7	166 ± 11	167 ± 6
Weight (kg)	70 ± 18	69 ± 14	68 ± 13
RR-RVAS	41 ± 16	20 ± 16*	20 ± 13*
RR-SVAS	62 ± 16	27 ± 21*	28 ± 18*
8 h-RVAS	27 ± 11‡	22 ± 18	21 ± 18
8 h-SVAS	62 ± 17	53 ± 23†	50 ± 15†
24 h-RVAS	18 ± 8‡	21 ± 21	19 ± 14
24 h-SVAS	54 ± 20	52 ± 19†	51 ± 17†

RVAS: resting VAS scores, SVAS: swallowing VAS scores, *$P < 0.05$ vs. group C. †$P < 0.05$ vs. RR-SVAS within same groups. ‡$P < 0.05$ vs. RR-RVAS in group C.

Gag reflex and swallowing ability were obtunded more severely both group R and group B than in group C ($p < 0.01$). RR-SVAS both group R and group B were strongly correlated with the extent of gag reflex and swallowing difficulty ($p < 0.01$). There was no significant difference in foreign body sense in posterior pharynx, postoperative nausea and vomiting and dyspnea within inter-groups.

Conclusion(s): GNB with local anesthetics can decrease immediate postoperative pain after tonsillectomy in adult patients.

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Low-dose spinal ropivacaine for lower-limb surgery in an ambulatory setting

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Background and Goal of Study: Ropivacaine, a relatively new amino-amide local anaesthetic, has recently been licensed for intrathecal application for various indications. There is however no official recommendation of any dosage regimen to be used in women undergoing caesarean section. We reviewed all caesarean sections done in our department using ropivacaine in different dosages.

Materials and Methods: 40 women undergoing elective caesarean section received the following doses of spinal ropivacaine: 10 mg + 0,1 mg morphine, 12,5 + 0,1 mg morphine, 12,5 mg or 15 mg of spinal ropivacaine.

Patients did not receive any fluid preload. The level and duration of sensory block, intensity and duration of motor block using a modified Bromage score, time to mobilize and changes in mean arterial pressure were recorded at timed intervals.

Results and Discussions: 10 mg + 0,1 mg morphine was only used in two patients since it provided insufficient sensory and motor block.

15 mg of spinal ropivacaine produced sensory block at T3/4 level; 12,5 mg produced sufficient sensory block at T6/7 level but with a short duration of 72 ± 7 min until complete void of the block.

12,5 mg + 0,1 mg morphine provided sufficient sensory block at T6/7 level with a duration of 91 ± 17 min.

Conclusion(s): Low-dose ropivacaine is safe and easy to use in women undergoing caesarean section since it provides sufficient analgesia and motor block and haemodynamic depression is rare. Some dose-finding studies could not see any advantages of ropivacaine over other local anaesthetics but doses of ropivacaine used in those studies were much higher. Comparative studies between low-dose ropivacaine and other local anaesthetics used in women undergoing caesarean section are necessary.

Reference:

1 Khaw KS, Ngan Kee WD, Wong ELY, Liu JYW, Chung R Spinal Ropivacaine for Ceasarean Section – A Dose-finding Study. Anesthesiology 2001; **95**:1346–50.

A-392

The effectiveness of local intravesical anesthesia with ropivocaine in minimal handling endoscopic procedures. Our experience

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Background and Goal of Study: To assess the suitability, patients' tolerability and side effects of intravesical use of ropivocaine in minimal endoscopic procedures.

Materials and Methods: The patient's age was within 40 and 90 years and the procedures were performed in a single endoscopic theatre annexed to the urology ward. Group A – 16 patients underwent a follow up cystoscopy with taking biopsies after a transurethral resection (TUR-BT) of a superficial transitional cell tumor (TCC) and group B – 15 patients underwent electro cauterization of small papillary tumors (relapse of a low grade superficial tumor). 100 ml of solution with a concentration of 2 mg/ml ropivocaine HCL was intravesicaly administrated 10 min prior to the procedure through a 12 Fr Tiemann catheter. All patients were fully conscious and for the subjectively tolerance in handlings a simple 4-grade pain scale was used during the procedure; (0 = absent discomfort, 1 = minimal discomfort, 2 = painful but tolerable sensation, 3 = intolerable pain). All patients were observed 3 hours postoperatively.

Results and Discussion: Most of the patients were able to walk back to their rooms or were discharged home on the day of operation. Side effects were minimal and not related to local anesthesia, such as mild hematuria. The procedure was well tolerated in all patients of group A, especially in the first 10 minutes. In 3 patients of group B a light sedation was necessary because of a little prolongation of the procedure. In one patient, because of a moderate hematuria and the analogous prolongation of the procedure, a spinal block was intentional.

Conclusions: Local intravesical anesthesia with ropivocaine proved to be effective for short time minimal endoscopic procedures, with the respective reductions in cost and the avoiding of general or spinal anesthesia. Patients could be treated in an out-patient basis with minimal complications and good level of patient acceptance.

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Inferonasal vs inferotemporal approach for sub-Tenon's block

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Background and Goal of Study: An inferonasal (IN) sub-Tenon's block may be performed for ophthalmic surgery. In circumstances where the IN approach is contra-indicated, the infero-temporal (IT) can be used. There are no data on the relative efficacy of the IN compared with the IT route.
Materials and Methods: 100 patients undergoing cataract extraction were randomised to receive an IN or IT sub-Tenon's injection of 3–4 mls of lidocaine 2%. Akinesia was assessed using the Brahma scale at 0, 2, 4, 6 & 8 minutes by a blinded observer. Injection, pre-op and postoperative pain scores (VAS 0–10) were noted, along with the incidence of subconjunctival haemorrhage (SCH) and chemosis.
Results and Discussions: There were no differences in demographic data, or mean volume of administered local anaesthetic solution (3.3 (SD 0.4) mls). The Table shows mean (SD) akinesia, pain scores and number of patients with minor complications in each group.

	IN (n = 48)	IT (n = 52)	P value
2 min akinesia	2.7 (2.18)	2.2 (2.23)	0.26
4 min akinesia	1.1 (1.66)	0.9 (1.52)	0.54
6 min akinesia	0.4 (1.35)	0.8 (1.68)	0.19
8 min akinesia	0.2 (1.03)	0.3 (1.10)	0.65
Injection pain	0.9 (1.39)	1.1 (1.48)	0.49
Pre-op pain	0 (0.2)	0 (0.50)	0.2
Postop pain	0 (0)	0 (0.65)	NS
Chemosis	14	22	0.21
SCH	14	19	0.52

Conclusions: The IT provides an equally rapid and dense block to the IN approach, without a significant increase in minor complications.
Reference:
1 Bramha AK. Anaesthesia 1994:49;1003–5.

A-394

A comparison of three intravenous sedation techniques in phacoemulsification under topical anesthesia

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Background and Goals: There has been a significant shift toward the use of topical anesthesia with light sedation for routine cataract surgery (1,2). This study evaluated the sedation status following use of three intravenous sedation techniques for cataract surgery under topical anesthesia.
Material and Methods: After ethics committee approval and informed consent, this controlled clinical trial study was performed on 150 patients who were candidates for phacoemulsification surgery. Patients randomly divided equally in three groups. Following oral explanation of procedure to patients, and administration of topical anesthesia with tetracaine 0.5%, group 1 received fentanyl 1–1.5 μg/kg and ketamie 0.2 mg/kg intravenously. In addition to these drugs, propofol 10–20 μg/kg/min and lidocaine 0.7 mg/kg i.v. were administered in groups 2 and 3 respectively. Blood pressure, heart rate, sedation; cooperation and pain score, patient and surgeon satisfaction, PONV and delirium were assessed. Statistical analysis was performed by χ^2 and ANOVA.
Results: Data are shown in the Table.

	Group1	Group2	Group3	P value
Cooperation score (Mean ± SD)*	4.00 ± 1.01	4.12 ± 1.06	4.06 ± 0.92	0.836
Frequency of appropriate cooperation (N, %)?	35 (70)	38 (76)	38 (76)	0.660
Frequency of appropriate sedation (N, %)?	40 (80)	43 (86)	39 (78)	0.565
Patient satisfaction (Mean ± SD)*	3.64 ± 0.89	3.74 ± 0.52	3.62 ± 0.69	0. 674
Surgeon satisfaction (Mean ± SD)*	2.94 ± 1.09	3.10 ± 1.03	3.02 ± 1.05	0.754

*Oneway ANOVA Test; ?Chi-square Test

Conclusions: In previous studies, the preference of some sedation methods to other protocols was proved but in present study this subject was not significant. This issue may be due to patient selection, preoperative psychological preparation; optimum drugs dose selection, compatible drugs combination and surgeon skill. Effect of these parameters on sedation quality needs more evaluation.
References:
1 Harman DM, Pettit ME, Green K. J Cataract Refract Surg 2000; 26:109–113.
2 Dinsmore SC. Ophtalmic Surg lasers 1996; 27:935–938.

A-395

The efficiency of the administration site, volume and concentration of infiltrative bupivacaine, on postoperative analgesia

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Background and Goal of Study: It is generally agreed that the tissue plane may modulate the efficiency of infiltrative block. We aimed to investigate the importance of the volume and the concentration of bupivacaine in the analgesic efficacy in addition to tissue plane in this study.
Materials and Methods: 80 patients with ASA II–III who underwent suprapubic transvesical prostatectomy were included in the study after approval of ethical committee. The patients were randomly assigned to four groups of equal numbers and the technique of general anaesthesia was standardized across the groups. Before closure of the skin, the wound site was infiltrated either with 0.25% bupivacaine 40 cc suprafascially (Group SF-1, n = 20) or with 0.5% bupivacaine 20 cc suprafascially (Group SF-2, n = 20). The remaining 40 patients were infiltrated either with 0.25% Bupivakaine 40 cc infrafascially (Group IF-1, n = 20) or with 0.5% bupivacaine 20 cc infrafascially (Group IF-2, n = 20). The patients were evaluated postoperatively with VAS, and I.M. meperidine 1 mg kg^{-1} was administered to patients with VAS score over 4. The postoperative SpO_2 values, hemodynamic status, VAS scores and the need of additional analgesics of the patients were recorded. Mann-Whitney U and Friedman tests were used for statistical analysis and P values under 0.05 were considered as statistically significant.
Results and Discussions: Within the group comparisons showed that VAS scores were significantly higher in group SF-2 than SF-1 (P = 0.039), and significantly higher in group IF-2 than IF-1 (P = 0.009). When all groups were compared, the VAS scores were as follows: Group SF-2 > Group IF-2 > Group SF-1 > Group IF-1 (P < 0.001). When all the groups were compared according to the need of additional analgesics, the need of additional analgesics in group SF-2 was the highest among the groups (90% in group IF-1, 70% in group IF-2, 55% in group SF-1 and 30% in group SF-2, p = 0.01).
Conclusion(s): In infiltrative bupivacaine applications, the tissue plain and the volume of bupivacaine was important in determining the analgesic efficiency, rather than the concentration of bupivacaine. The reason may be the removal of more pain mediators from the environment with higher volumes of bupivacaine.

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Complications of intercostal catheter analgesia vs. intercostal nerve blockade for posthoracotomy pain relief

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Background: Posthoracotomy pain relief can be achieved by several analgesic regimens. An aim of this prospective randomised study was to compare analgesic effects and postoperative/postanaesthetic complications of two regional anaesthetic techniques.
Materials: After informed consent was obtained 80 patients 40–70 years were scheduled for elective operations were divided in two groups: A (n = 40) intercostal (IC) analgesia, and B (n = 40) IC catheter analgesia. All patients were given perioperative antibiotic prophylaxis (Cefazolin 1 g) and dose adjusted thromboprophylaxis.
Methods: The intercostal nerve blockade was performed using 5 ml of 0,5% bupivacaine for blockade of intercostal nerve in thoracotomy wound, nerve below and above thoracotomy. IC catheter analgesia was achieved through catheter placed at the end of an operation into intercostal space by surgeon. 20 ml of 0.5% bupivacaine was injected Additional increments of local anaesthetics were repeated every 12 hours. Chest drainage was removed at day 1st to 3rd and chest X-rays were done at 3rd day.

Visual analogous pain score (VAS) was obtained preoperatively, 24, 48 and 72 hours after operation. Differences between groups were calculated using t-test (p < 0,05).

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Results: VAS scores ± SD are shown in Table 1.

VAS	Preop.	1 PO	2 PO	3 PO
IC catheter	0	2,2 ± 0,52	1,9 ± 0,7	1,2 ± 0,47
IC nerve block	0	3,0 ± 0,81	3,6 ± 0,84*	2,3 ± 0,82*

*Statistically significant differences.

Table 2. Postoperative complications recorded at discharge.

Postoperative complications	IC block	IC catheter
Infected haematoma of the wound	2	3 (p = 0,33)
Pneumothorax	0	0
Pleural infections	2	1 (p = 0,29)
Pneumonia	4	3 (p = 0,36)
Atelectasis	2	2

Conclusions: According to the VAS the pain control was thoroughly controlled by intercostal catheter analgesia. No statistically significant differences between postoperative complications were observed in two groups

Reference:

1 Downs CS, Cooper MG. *Anaesth Intensive Care*. 1997;25:390–7.

A-398

Efficacy of low-volume episcleral single injection anesthesia in anterior chamber surgery

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Background and Goal of Study: The purpose of this study was to evaluate the efficacy of low-dose episcleral single injection anesthesia[1,2] in anterior chamber surgery.

Materials and Methods: We included prospectively 232 patients scheduled for anterior chamber surgery over a period of 6 months (March–August). All patients received a medial canthus episcleral single injection of less than 5 ml of local anesthetics.The succes rate of the block was measured according akinesia, pain and surgeons and patients satisfaction scales. All patients were followed until postoperative day 8 and complications were recorded.

Results and Discussions: A total of 232 patients were included.All blocks were performed by experienced anesthesiologists,skilled in ophtalmic anesthesia.The most frequent surgical procedure were phacoemulsification and intraocular lens implantation (93%). Succesful block was obtained in 99,2% with mean volume of 4,8 ml of local anesthetic with a latence period of 4,06 min. No major complication (retrobulbar hemorragy, optic nerve lesion or eye perforation) was observed. The most frequent minor incidence were subconjuntival hemorrage (7,3%), caruncular hematoma (3%) and transient ocular hypertonia (2%). No single procedure was cancelled or delayed due to any complication. No different anesthetic technique was required to perform any procedure.

Conclusion(s): Single episcleral injection with low volume of local anesthesthetics is a safe, simple, time sparing and efficacious method. Requires a relative short training period and represents an alternative to classical thecniques in anterior chamber surgery.

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A-400

Does catheter tip stiffness affect the incidence of complications during the lower thoracic epidural catheterization?

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Background and Goal of Study: We reported that the incidence of paresthesia associated with epidural catheterization was not affected by the catheter stiffness. However, we hypothesized that the stiffness of catheter tip might affect the incidence of complications during the procedure. We compared the incidence of complications between polyamide catheter (PLA) and polyamide soft tip catheter (PLA Soft Tip) during epidural catheter placement in the lower thoracic region.

Materials and Methods: After obtaining IRB approval and informed consent, adult patients were randomly divided into two groups according to the type of catheter used; i.e. Group A: 20G, PLA (n = 168) and Group B: 20G, PLA Soft Tip (n = 167). The patient was positioned in a moderate chest-knee position. Epidural puncture was performed via paramedian approach at T11–12 interspace. The epidural space was identified by the loss-of-resistance technique to saline. The catheter was inserted 5 cm in the epidural space. Occurrence of complications was recorded. Data were analyzed with unpaired t-test or Chi-square analysis with Yate's correction as appropriate. $P < 0.05$ was considered significant.

Results and Discussions: Patients characteristics and number of attempts at needle insertion (Group A: 1.2 (0.5) and Group B: 1.2 (0.5) mean (SD) ($P = 0.8949$)) were comparable between the groups. No signs suggesting major complications were recognized in all patients. Insufficient block was not recorded in each patient. Statistically significant differences were demonstrated between the groups for the following factors: (1) transient paresthesia (7.7% vs. 1.2%, $P = 0.0085$); (2) resistance to introduction of the catheter (8.9% vs. 0.6%, $P = 0.0009$). Occurrence ratio of blood aspiration was comparable among the groups (1.8% vs. 2.4%, $P = 0.9927$). In the lower thoracic region, the shape of the epidural sac forms an oval or a hexagon. This might influence the position of the catheter and the incidence of resistance during the catheter placement.

Conclusions: We conclude that the reduced incidence of paresthesia and resistance to placement of the catheter observed in our study with the PLA Soft Tip is presumably because of the straight and or midline course taken by the catheter.

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A new method to confirm epidural puncture

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Background and Goal of Study: The loss-of-resistance method sometimes results in difficulty identifying the epidural space, particularly in obese or elderly patients. We developed a new method to confirm epidural puncture by changing epidural pressure (EP) using the Queckenstedt-Stookey test procedure (QST), which increases subarachnoid pressure by pressing the internal jugular vein. The present study evaluated the reliability of this new method.

Materials and Methods: The new method was examined in 30 patients who underwent cervical decompression surgery for cervical myelopathy or ossification of the posterior longitudinal ligament. All patients displayed spinal canal stenosis and received EP monitoring with the QST through a Touhy needle for electrode catheterization at T10–L2 for orthopedic diagnosis. Epidural catheterization was confirmed by electric stimulation (5 mA, 2 Hz) and postoperative radiography. In addition, 50 patients who underwent celiotomy or thoracotomy also received EP monitoring with the QST to confirm epidural puncture for catheterization at T5–L5. Changes in EP were recorded during the QST, and epidural catheterization was confirmed by perioperative analgesic effects and postoperative radiography.

Results and Discussions: Increased EP during the QST was clearly observed in 30 orthopedic patients (mean ΔEP: 5 ± 3 mmHg; range 2–10 mmHg), and the electrode in the epidural space was detected by electrical stimulation and radiography. In the 50 cases of celiotomy or thoracotomy, increased EP and epidural catheterization were observed in 49 patients (mean ΔEP: 4 ± 2 mmHg; range 2–11 mmHg), although no change in EP was observed in 1 case with the catheter tip in the thoracic cavity.

Conclusion(s): EP monitoring combined with the QST could offer a good method for confirming epidural puncture when results from the loss-of-resistance method are unclear.

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Epidural ropivacaine with sufentanil in lower abdominal surgery: a randomized double-blind study

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Background and Goal of Study: Ropivacaine is a long acting amide local anesthetic agent, administered epidurally to patients undergoing various surgical procedures[(1)]. The aim of this study was to assess the efficacy and clinical outcome of epidural ropivacaine combined with sufentanil in a randomized, double-blind, controlled trial.

Materials and Methods: After approval of the local ethics committee and informed consent, forty male patients (ASA I–II, aged between 30–65) undergoing inguinal hernia repairment under epidural anesthesia were assigned into two groups receiving 0.75%, 15 mL ropivacaine (Group I) or 0.75%, 15 mL ropivacaine combined with 10 mcg sufentanil (Group II). The spread and duration of sensory anesthesia was assessed by pinprick, and that motor block was assessed using a Modified Bromage Scale. A blinded observer evaluated onset time and regression of motor and sensory block, quality of analgesia, hemodynamic parameters, time to first analgesic requirements and all side

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effects. Pain was measured on a visual analog scale (VAS: 0: no pain; 10 cm: unbearable pain). SPSS for Windows 10.0 were used in statistical analysis and p values <0.05 was considered statistically significant.

Results: There were no differences in respect of patient characteristics, initial onset and degree of motor block, quality of analgesia, peak sensory block level and all side effects. VAS scores and haemodynamic parameters were similar. The onset time of sensory block was 4.93 ± 0.69 min and 3.72 ± 1.37 min in Group I and II respectively ($p < 0.001$). The time to first analgesic requirement was longer, although the two-segment regression time was shorter in Group II ($p < 0.001$).

Conclusion(s): Epidural anesthesia with ropivacaine plus sufentanil provided efficient pain relief, haemodynamic stability and minor side effects. A clinical concern regarding patient satisfaction, the rapid regression of sensory and motor block and longer duration of analgesia might be advantageous.

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A-403

Low back pain after epidural anaesthesia: two different approaches

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Background and Goal: Low back pain (LBP) is a common minor yet unpleasant complication after epidural anaesthesia. Different mechanisms are suggested such as needle trauma and myotoxicity of local anaesthetic. The aim of our study was to determine the incidence of low back pain depending on two different approaches of the epidural space: median and paramedian approach.

Material and Methods: 273 ambulatory patients ASA I–II, aged 20–73 years old undergoing lumbar epidural anaesthesia (levobupivacaine 0.5%) were assigned randomly to one of the two groups of the study. Group M ($n = 142$) in which epidural puncture was performed by median approach and group P ($n = 131$) in which epidural puncture was performed by paramedian approach (lateral position, L4/5 or L3/4 interspace). In both groups needle Tuohy 18 G was used. All patients were mobilised 6–7 hrs after operation. We recorded the number of epidural puncture attempts and the occurrence and duration of backache in the patients. All patients were followed up for 20 days. In the case of backache mild analgesics and NSAIDs were prescribed together with rest. Statistical analysis was achieved by using chi-square test and ANOVA-one way.

Results and Discussion: Both groups were comparable. The results are shown in the next table:

	Group M	Group P
Number of patients with LBP (%)	6 (4.5%)	2 (1.5%)*
Number of epidural attempts in patients with LBP	1.7 ± 0.8	1.4 ± 0.7
Number of epidural attempts in all patients	1.7 ± 0.7	1.4 ± 0.6
Duration of LBP (days)	8 ± 2	5 ± 2*

*$P < 0.05$

Conclusions: Taking into consideration the above results the paramedian approach of the epidural space seems to be associated with a lower incidence of low back pain.

A-404

The effect of epidural anaesthesia on the course of isolated continuous hyperthermic perfusion chemotherapy (CHPCH)

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Background and Goal of Study: Concomitant application of chemotherapy and hyperthermia significantly improves the results of cancer treatment. Real hyperthermia above 40 degree C is most effective. Extracorporeal circulation is used for heating and perfusion of the extremity with the chemotherapeutic agents.

Materials and Methods: 21 patients, aged from 26 to 72 years, ASA II, were treated with CHPCH for recurrent melanoma. The patients were divided into two groups. Group A consisted of 10 patients treated under general anaesthesia and group B included 11 patients operated under general anaesthesia combined with continuous epidural analgesia.

The time of heating of the extremity and the highest temperature achieved during the procedure were assessed. The results were verified statistically with the Student's t-test, with the significance level at $p < 0.05$.

Results and Discussions: In group A, mean time of heating was 92,7 min $\pm$ 41,3 min and the mean temperature achieved was 39,7 degree C $\pm$ 1,07. In group B, heating lasted 59 min $\pm$ 27 min on the average, and the mean temperature achieved was 40,5 degree C $\pm$ 0,97.

Conclusion(s):

1. The time of heating of the extremity and the extracorporeal perfusion phase were shorter in the patients under combined epidural and general anaesthesia.
2. In both groups mean temperature was almost the same.
3. Despite full dose of heparin was administered no local complications were noted.

References:

1 J. van der Zee, et al., Eur J Cancer, 1997, 10, 1546–50
2 F. Di Filippo, et al., World J Surg, 1995, 18, 359–62

A-405

Effect of thoracic epidural anaesthesia on desflurane and sevoflurane requirement during major abdominal surgery

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Background and Goal of Study: The combination of epidural and general anaesthesia during major abdominal surgery decreases the dose requirement of volatile anaesthetics. However, "light" anaesthesia may result in inadequate depth of hypnosis and intraoperative awareness. The aim of the present study was to determine the endtidal concentration of desflurane and sevoflurane during combined anaesthesia under neuromonitoring by BIS® and Narcotrend™.

Materials and Methods: After institutional approval and written informed consent, forty patients (ASA II–III), undergoing major abdominal surgery under combination of general and epidural anaesthesia, were randomly assigned to two groups, receiving either desflurane or sevoflurane for maintenance of general anaesthesia. Intraoperative analgesia was provided by epidural application of 10 ml ropivacaine 0.3% and 10 μg sufentanil every 60 min. Following incision, endtidal concentration was then reduced stepwise under monitoring of anaesthetic depth to a maximum Narcotrend stage of D1 (55) or BIS level of 55. Increases in the mean arterial pressure for more than 20% to baseline values were treated by increasing the volatile anaesthetic to 1 MAC and additional rescue analgesia with remifentanil infusion, respectively. Patients were interviewed following surgery and two days later for intraoperative awareness and recall.

Results and Discussions: Performance of combined anaesthesia was possible in all patients. There were no differences were in patients' characteristics, type and duration of surgery. Endtidal concentration of desflurane and sevoflurane could be reduced from 1 MAC ($2,9 \pm 0,1$ to $0,9 \pm 0,2$ and $1,0 \pm 0,05$ to $0,4 \pm 0,1$ Vol%) to 0,5 MAC and 0,4 MAC respectively. Intraoperative epidural analgesia was sufficient and rescue analgesia with remifentanil was not applied. None of the patients reported intraoperative awareness or recall. Extubation times were 90 ± 12 and 87 ± 9 sec respectively following discontinuation of volatile anaesthetics.

Conclusion: Monitoring of anaesthetic depth during combined anaesthesia allows an individual adjustment of the endtidal concentration of desflurane and sevoflurane, providing stable haemodynamics, short recovery with no signs of intraoperative awareness or recall.

A-406

The benefits of intra- and postoperative use of epidural analgesia in patients undergoing liver surgery

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Background and Goal of Study: Prolonged gastrointestinal dysfunction is a common early complication in patients receiving major abdominal surgery, resulting in delayed rehabilitation and prolonged hospital stay. Multimodal collaborate clinical pathways can implement sympathicolytic methods for pain relief like epidural analgesia, providing much more than pure analgesia as

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opposed to intravenous opioid analgesia. However, concerns have been voiced in regards to epidural analgesia during types of surgery with an increased risk of intraoperative bleeding. The purpose of the present study was to evaluate the effects of intra and postoperative epidural analgesia on blood loss, transfusion requirement and postoperative restoration of gastrointestinal function.
Materials and Methods: The records of 269 patients receiving liver resection between 1994 and 2003 were analysed regarding the intra and postoperative use of epidural analgesia. Blood loss, transfusion requirements as well as gastrointestinal dysfunction and time to first oral intake were recorded. Absence of bowel sounds and defaecation for more than 4 postoperative days were regarded as gastrointestinal dysfunction.
Results and Discussions: Complete records could be analysed in 238 patients. 27 patients were treated by thoracic epidural analgesia (group TEA) and 111 patients received patient controlled intravenous analgesia with piritramide (group PCIA) due to contraindications against central neuraxial blocks or refusal. Groups did not differ regarding patient characteristics, type and duration of surgery as well as intraoperative blood loss and transfusion requirements. Duration of gastrointestinal dysfunction was significantly reduced in group TEA (2.7 $\pm$ 1.6d vs 4.1 $\pm$ 1.6d; $p < 0.0005$), as was first oral intake of solid food (3.4 $\pm$ 1.1d vs 4.3 $\pm$ 1.6d; $p < 0.01$). Need for ICU admission and mechanical ventilation was likewise reduced in TEA.
Conclusion(s): There was no evidence of increased blood loss or need for transfusion by the intraoperative use of TEA. TEA rather than PCIA offered striking benefits regarding restoration of regular gastrointestinal function. Therefore, implementing TEA within a collaborate pathway may result in a favourable outcome in patients undergoing liver resection.

A-407

Effect of epidural ropivacaine concentration on desflurane requirement during major abdominal surgery under monitoring the anaesthetic depth – a randomized, controlled, double blind investigation

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Background and Goal of Study: The intraoperative use of epidural analgesia in combination with general anaesthesia provides stable intraoperative haemodynamics and reduces requirement of volatile anaesthetics. The aim of the present study was to investigate the effects of different doses of epidural applicated ropivacaine on dose requirement of desflurane during combined anaesthesia under monitoring of anaesthetic depth by BIS® and Narcotrend™.
Materials and Methods: After institutional approval and written informed consent, 60 patients (ASA II–III), undergoing major abdominal surgery under combined anaesthesia, were randomly assigned to 3 groups receiving 10 ml ropivacaine 0.5% and 5 μg sufentanil, 10 ml ropivacaine 0.2% and 5 μg sufentanil and placebo 10 ml NaCl 0.9% (groups 1–3, respectively) every 60 minutes for intraoperative analgesia. Following incision, endtidal concentration of desflurane was then reduced under monitoring of anaesthetic depth to a maximum Narcotrend stage D1 (55) or BIS level of 55. Increases in mean arterial pressure for more than 20% to baseline values were treated by increasing desflurane concentration to 1 MAC and additional rescue analgesia with remifentanil.
Results and Discussion: Endtidal concentration of desflurane could be significantly reduced from 2.8 $\pm$ 0.2 Vol% to 1.2 $\pm$ 0.3 Vol% (0.5 MAC) and to 1.5 $\pm$ 0.5 Vol% (0.6 MAC) in groups 1 and 2, respectively ($p < 0.005$). In group 3, reduction of desflurane requirement could not be achieved; additional remifentanil infusion was required for rescue analgesia (1.4 $\pm$ 0.7 mg remifentanil/h). Patients in group 1 received significantly more norepinephrine (60 $\pm$ 38 μg/h) for patients in group 2 (40 $\pm$ 18 μg/h) and group 3 (28 $\pm$ 19 μg/h) for restoring mean arterial pressure ($p < 0.005$).
Conclusion: Epidural application of ropivacaine during combined anaesthesia reduces dose depended requirement of desflurane. Under comparable anaesthetic depth, a concentration of 0.2% of ropivacaine provided adequate intraoperative analgesia resulting in less haemodynamic side effects compared to a 0.5% concentration.

A-408

The effects of combined epidural anaesthesia on recovery in kidney donation patients

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Background and Goal of Study: In this preliminary study we evaluated the hypothesis that combined epidural with general anaesthesia insures convenient and shorter postoperative recovery compared with general anaesthesia alone in patients undergoing traditional open donor nephrectomy.
Materials and Methods: 17 patients, who were randomised to either just general anaesthesia (group A, 7 patients) or a combined general with epidural anaesthesia (group B, 10 patients). Analgesia in group A was maintained with sufentanil, and in group B with bupivacain 0.25% with 2 μg sufentanil/cc. After the operation group B received morphine epidural, group A received morphine i.v. After that all patients were given a PCA pump with morphine.

Those patients were interviewed preoperatively, and 15 and 40 minutes after detubation. A Mini Mental State Examination (MMS) and VAS-scores concerning pain, fatigue, nausea and discomfort were used.
Results and Discussions: Data are shown in the tables:

	Pain	Fatigue	Nausea	Discomfort
Group A	6.3 (2.7)	4.7 (3.4)	1.4 (2.1)	5.6 (2.9)
Group B	1.8 (2.9)	2.4 (3.3)	1.1 (2.7)	2.6 (2.9)
t-test	0.005	0.18	0.78	0.06

Mean VAS-scores ($\pm$sdv) 40 min. after detubation

	Detubation	MMS 15	MMS 40
Group A	28.6 (26.9)	25.9 (2.1)	27.1 (3.1)
Group B	11.1 (7.2)	26.3 (4.2)	27.3 (3.2)
t-test	0.07	0.81	0.92

Mean detubation time in min. ($\pm$sdv) after end of operation, and MMS-Score ($\pm$sdv), 15 and 40 min. after detubation.

Conclusion(s): These preliminary data suggests that the chosen anaesthesia technique (general combined with epidural anaesthesia) has no significant effect on the postoperative mental score. However VAS-scores for pain, fatigue and discomfort, and moment of detubation, show a preference for the combination technique.

A-409

The effect of postoperative epidural analgesia vs NCA morphine on pain and rehabilitation after surgery for hip fracture: A randomized, doubleblinded, placebo-controlled study

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Background and Goal of Study: Hip fracture surgery is characterized by a high demand for rehabilitation and a significant risk of perioperative morbidity and mortality (1). Postoperative epidural analgesia may reduce postoperative morbidity, and has been shown to facilitate rehabilitation in elective orthopedic procedures. No studies exist on the effect of postoperative epidural analgesia on pain and rehabilitation after hip fracture surgery.
Materials and Methods: Sixty patients were included in a randomized, double-blind study comparing 4 days of continuous postoperative epidural infusion of 4 ml h^{-1} of bupivacaine 0,125% and morphine 50 mcg ml^{-1} versus placebo (saline). Both patient groups received balanced analgesia and intravenous nurse-controlled analgesia with morphine. All patients followed a well-defined multimodal rehabilitation program (2). Assessment of pain and the ability to participate in four basic physical exercise functions, were done on each of the first four postoperative days.
Results and Discussions: Epidural analgesia provided superior dynamic analgesia during all basic physical functions on the 1st and 2nd postoperative day, and patients were significantly less restricted by pain on these days, where pain was the dominating restricting factor in the placebo group. Motor blockade was not a restricting factor during epidural analgesia. Despite improved pain relief, scores for recovery of physical independence were not different between groups on any days. Further optimization of perioperative care could potentially translate this superior analgesia into increased rehabilitation.
Conclusions: Postoperative epidural analgesia after hip fracture surgery provides superior analgesia and attenuates pain as a restricting factor during rehabilitation without clinically relevant motor dysfunction.
References:

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2 Kehlet H, Dahl JB. Anaesthesia, surgery, and challenges in postoperative recovery. Lancet 2003; 362 (9399): 1921–8.

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A-410

Comparison of epidural ropivacaine, epidural bupivacaine and conventional opioid analgesia for pectus excavatum repair

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Background and Goal of Study: Thoracic epidural analgesia (TEA) is increasingly used for pectus excavatum repair (PER) [1, 2]. The aim of this study was to compare continuous thoracic epidural infusion of ropivacaine (R), bupivacaine (B) and conventional opioid analgesia (O) for perioperative analgesia in children undergoing PER.
Materials and Methods: 60 children (11–18 years) were randomized to receive either 0,5% R with 7,5 μg/ml fentanyl (n = 20) or 0,375% B with 7,5 μg/ml fentanyl (n = 20) by epidural infusion. Children were recruited to O (n = 20) when the epidural catheter was not inserted due to the lack of parent's consent or technical difficulties. Standard general anaesthesia, supplemented by epidural infusion was performed. In the postoperative period epidural infusion of 0,1% Ropivacaine with 6 μg/ml fentanyl, 0,075% Bupivacaine with 6 μg/ml fentanyl or repeated s.c. injections of morphine (0,1 mg/kg every 5 hours) were administered. Standard haemodynamic parameters and the level of pain (Prince Henry Hospital Pain Score – PHHPS, Numerical Rating Scale – NRS) were recorded. Sedation score (Ramsay Score – RS) and side-effects were also noted. Data were compared with the use of ANOVA and Kruskal-Wallis test. $p < 0,05$ was considered significant.
Results and Discussions: Extubation time was shorter in both epidural analgesia groups , when compared to O group (8 ± 5 for R, 10 ± 4 for B and 30 ± 15 for O, $p < 0.01$). Haemodynamic stability was comparable in R and B group with the mean heart rate being significantly lower in both epidural groups in comparison to O group. Level of pain and the requirement of "rescue" analgesia was higher in O group and comparable in both epidural groups.
Conclusions: TEA combined with general anasthesia is superior to general anesthesia alone for PER in children. Epidural analgesia with R is comparable to B in this group of patients.

References:

1 Barros F. et al. *Paediatr Anaesth* 2004; 14: 192.
2 Nuss D. et al. *J Pediatr Surg* 1998; 33: 545.

A-411

Pain management in uterine fibroid embolization

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Background and Goals: The embolization of intramural uterine myomas is an alternative to hysterectomy. It is an interventionist radiological technique, through the femoral artery, in which one or several myomas are located and embolized with acrylic microspheres. Acute ischemia provokes intense pain that needs to be properly relieved, during the first 24 hours at hospital and later at home, so we need to seek to best form of pain relief for our patients (1).
Material and Methods: Prospective observational study, women scheduled for myomas embolization are involved. Lumbar Epidural catheter is placed, and a first dose of 10 ml Bupivacaine 0,25% with epinephrine + 50 μg of fentanyl is administered before the procedure begins. During the technique we provide a conscious sedation to the patients with midazolam (1–3 mg) or remifentanil perfusion 0,025–0,05 μg/kg/min. Once the technique ends, an epidural catheter in modality of patient controlled analgesia (PCA), is started with bupivacaine 0,1% with epinephrine + 2 μg fentanyl/ml, 5 ml bolus, 20 minutes lockout and no background infusion. This analgesic guideline is maintained for 18–24 hours. Once discharged, an oral analgesia is provided during one week.
Results: 25 patients were included: unique myoma (17) and polimyomatose uterus (8). The size of myomas was between 49–109 mm. 9 patients required the administration of epidural bolus during the procedure. The average of hospitalization was 34,78 hours (24–96). 19 patients declared to have controlled pain, visual analogue scale (VAS) 4–5 and 6 cases presented VAS > 5. We have not found correlation between the size of myoma and the pain score.
Conclusions: Myoma embolization technique produces a painful acute ischemia. Epidural infusion via PCA with bupivacaine and fentanyl seems to provide a good pain relief.

Reference:

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A-412

72 h epidural infusion of 0.125% levobupivacaine reduces patient-controlled morphine consumption and improves pain relief after major knee surgery

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Background and Goal of Study: This prospective, randomised, open-label, multicenter investigation tested the hypothesis that epidural infusion of 0.125% levobupivacaine from 24 to 72 h after major knee surgery still reduces morphine consumption.
Materials and Methods: The study was conducted in 13 hospitals in Italy, Hungary and Spain. With ethic committee approval and written informed consent 186 patients, who had received epidural analgesia with 0.125% levobupivacaine for first 24 hours after knee replacement surgery were randomly allocated to receive either epidural infusion of 0.125% levobupivacaine with IV PCA morphine for rescue analgesia (group Levo, n = 90) or IV PCA morphine alone (group Control, n = 96) for the following 48 hours (up to 72 hours). Patients were observed at 6 hour intervals. The degree of pain (100 mm VAS), time to first PCA request, hourly morphine consumption, and safety parameters were recorded.
Results and Discussions: No differences in anthropometric variables were observed between the two groups. The degree of pain was less from 6 to 48 h hour after randomisation in group Levo than in group Control ($P < 0.05$). Mean (SD) morphine PCA consumption per hour was 0.52 ± 0.9 mg in the Levo group and 0.83 ± 0.9 mg in the Control group ($P = 0.008$), while first PCA morphine request occurred after 2.9 ± 6 (range: 0.0–36) h in the Levo group and 0.8 ± 0.8 (range: 0.0–3.7) h in the Control group ($P = 0.0001$). In the Levo group a Bromage's score >1 was reported in 3 cases (3.3%) at the 48 h and 1 case (1.1%) at the 72 h, while no patients in the Control group showed a Bromage score >1 ($P = 0.11$ and $P = 0.48$, respectively). No severe adverse events related to study drug were reported in either group.
Conclusion(s): Prolonging epidural infusion of 0.125% levobupivacaine for up to 72 h after major knee surgery reduces hourly PCA morphine consumption and improves the quality of pain relief without affecting recovery of motor function as compared to intravenous PCA morphine.

A-413

Throracic epidural analgesia reduces incidence and duration of prolonged mechanical ventilation in patients undergoing transsternal thymectomy for myasthenia gravis

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Background and Goal of the Study: Patients suffering from myasthenia gravis (MG) have an increased risk for prolonged mechanical ventilation and pulmonary complications following transsternal thymectomy. In 1998 thoracic epidural analgesia (TEA) was implemented as a method of intra and postoperative analgesia within a clinical pathway in such patients in our institution. The purpose of the present study was to examine the incidence and duration of ventilatory support as well as pulmonary complications in myasthenia patients undergoing thymectomy.
Material and Methods: After institutional approval the records of 40 consecutive MG-patients undergoing transsternal thymectomy between 1/1998 and 9/2004 were examined. All patients received general anaesthesia (GA) with desflurane up to 1 MAC in 50% N_2O/O_2 for maintenance, propofol or thiopentone for induction, and reduced doses of muscle relaxants to facilitate tracheal intubation. All patients were offered thoracic epidural analgesia for intra and postoperative analgesia, however, only 20 patients received TEA (group TEA) due to contraindications or refusal. Patients without TEA (group GA; n = 20) received fentanyl to maintain MAC values for desflurane below 1 MAC (age-adjusted) and piritramide for postoperative analgesia (group GA).
Results and Discussions: Groups did not differ regarding patients characteristics, stage of MG (Ossermann's score) and daily doses of cholinesterase inhibitors. No patient required prolonged mechanical ventilation in group TEA, however, 38% of patients could not be extubated immediately in group GA ($p = 0.01$). Mean duration of postoperative ventilatory support was 36 ± 53 min (range 20–130 min). The need for ventilatory support did not correlate with cholinesterase demand or muscle relaxant used for intubation. Re-intubation was never necessary. No pulmonary complications occured in either group. All patients with TEA could be transferred to a

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normal ward after a short PACU stay, therefore bypassing intensive care or intermediate care units.
Conclusion(s): The use of TEA for analgesia during anaesthesia reduces the need for prolonged postoperative mechanical ventilation in myasthenia gravis patients, doesn't increase the risk of pulmonary complications and may lessen costs by reducing the need for postoperative intensive or intermediate care therapy.

A-414

Patient controlled epidural analgesia for major urologic surgery. Influence of different dosage regimen on quality of analgesia, side effects and economics

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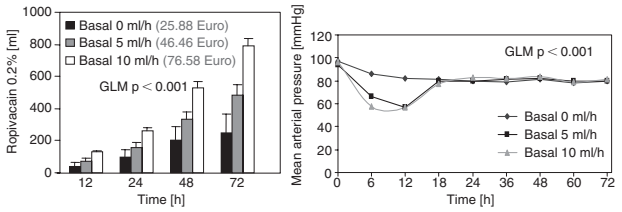
Background and Goal of Study: The efficiency of patient controlled epidural analgesia (PCEA) following major surgery has been demonstrated. Additional beneficial effects like abdominal or thoracic sympathicolysis which play a major role within multimodal clinical pathways have not been considered in previous studies. The purpose of the present study was therefore to evaluate differences in quality of analgesia, unintended as well as beneficial side effects, and economics using different dosage regimes for PCEA.
Materials and Methods: After institutional approval and written informed consent 120 patients undergoing major urological surgery in combined general and epidural anaesthesia were randomly assigned to 3 groups: group 1 basal infusion rate (BR) 0 ml/h, group 2 BR 5 ml/h und group 3 BR 10 ml/h. In all groups patient-controlled bolus application of 5 ml was possible. Ropivacaine 0.2% and sufentanil 0.5 μg/ml were used. For a minimum of 72 hours quality of analgesia was assessed by visual analog scale (VAS), blood pressure and heart rate, onset of bowel sounds and defecation, as well as unintended side effects (drowsiness, nausea, pruritus) were recorded.
Results and Discussions: 114 patients underwent complete observation. Groups did not differ regarding patients characteristics and duration of surgery. Hypotension was more common during the first 12 hours in group 1 and 2 [right figure]. There were no differences regarding quality of pain relief and onset of bowel sounds and first defecation. The amount of analgesic drugs required and therefore costs of pain relief differed significantly [left figure]. Patients in group 1 suffered more drowsiness and fatique.



Conclusion(s): In patients undergoing major urological surgery the use of different basal infusion rates for PCEA provide a similar quality of pain relief and return of gastrointestinal function. However, using no or low BR reduces the incidence of undesired side effects as well as hospital costs.

A-415

Bacterial contamination of epidural catheters used for combined spinal-epidural analgesia

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Background: The aim of this study was to explore the bacteria presents on epidural catheters (EC) during combined spinal epidural analgesia (CSE) after three days stay.
Methods: Prospective, randomized study was designed to compare two different approaches for CSE: thoracic EC (TEC) (T6-7) for patients undergoing upper abdominal surgery and spinal (L2-3) and CSE "needle through needle technique" which was performed in patients (pts) undergoing colorectal surgery in L2-3 interspinous space (LEC). The skin preparation was performed by alchocol and povidone ioidine applied with an abrasive sponge and in widening circle manner outward from point to the periphery. Epidural bupivacaine 0.25% was started preoperatively (10 ml) and was continued during surgery. EC were removed 72 hours after placement by sterile technique. The part of the catheter from tip to skin was incubated in sterile tube and transferred to the laboratory. EC were rinsed in 1% dextrose. After 10 hours incubation period on 37°C, all materials were spread out on blood agar and incubated at 37°C for 10 days. Differential analysis of microorganisms was performed after incubation using morphological, physiological and serological criteria. Data analysis was performed by Chi square test. $P < 0.05$ was considered as significant.
Results: Epidural punction was successful after first attempt in 34.6% (27/78) in thoracic region and 67.9% (53/78) in lumbar region. The maximum number of TEC attempts was 9. Significantly greater number of epidural punctions was in TEC (3 vs 1, Chi square test, $p = 0.003$). TEC 78.2% (61/78) and LEC 74.4% (58/78) were steril. Staphylococcus epidermidis was isolated on 19.2% of EC in both groups (15/78). Accinetobacter spp was isolated in 1.3% of EC in both groups (1.3%). Enterobacter spp was isolated on 1.3% (1/78) LEC. Staphylococcus aureus was present in 1.3% (1/78) TEC and 2.6% (2/78) in LEC. Escherichia coli was present in 1.3% (1/78) in LEC. No infection on punction sites neither meningitis nor epidural abscess were recorded in these patients. There is no significant difference between groups in bacterial presentation on epidural tips in TEC and LEC (Chi square test, $p = 0.640$).
Conclusion: Although the number of epidural punction attempts was significantly greater in thoracic group, the number of contaminated EC was greater in lumbar group. This finding suggest that kind of operation as colorectal surgery had influence. We suggest routine catheter check whenever CSE technique is employed.

A-416

Ropivacaine vs. Bupivacaine for epidural PCA. The incidence of urinary retention assesed by bladder ultrasound, a randomized controlled study

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Background and Goal of Study: Epidural PCA (EPCA) may cause urinary retention [1]. We hypothesized that use of Ropivacaine (Rop), a local anesthetic with less motor blockade [2] than Bupivacaine (Bup) and with no opioids added [3] will be associated with less urinary retention.
Materials and Methods: After ethical committee approval and informed consent, 72 patients undergoing joint arthroplasty under general anesthesia, with no previous urinary problems were included and randomly assigned to one of three groups of EPCA: Rop (0.2%) from 8 to 10 cc/h; Bup 0.125% with Fentanyl (F) 5 mcg/cc 4 to 6 cc/h; and Rop (0.2%) with F 5 mcg/cc 4 to 6 cc/h. Urinary bladder volume was determined using the ultrasound scanner and a volume of 400 cc was used as threshold for catheterization. Categorical variables were compared between the 3 treatment groups using the Chi-square test and Fisher exact test. Data presented as mean ± SD.
Results and Discussions: Urinary retention was found in 34.7% of the patients. Analgesia was adequate and similar in all three groups. There was no difference in the incidence of urinary retention or motor block between all three groups (Table).

Variables	Rop	Bup + F	Rop + F
Gender (F/M)	15/9	15/9	14/10
Age	67.46 ± 9.1	72.67 ± 9.8	74.29 ± 8.0
Urinary bladd. volume (ml)	412 ± 271	412 ± 384	434 ± 337
Urinary catheterization	9/24 (37.5%)	8/24 (33.3%)	8/24 (33.3%)
Maximum VAS	5 ± 3	3 ± 3	3 ± 2

Conclusion(s): No advantages were found for using Ropivacaine. Epidural opioids did not influence the incidence of urinary retention. The urinary bladder scan might be useful to assess post-operative urinary retention.
References:
1 Riordan JA. et al. EJA 2000; 17: 431–435.
2 Kampe S. et al. Anesth Analg 1999; 89: 395–398.
3 Dray A. Anesthesiology 1988; 68: 323–324.

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A-417

Parasacral sciatic nerve block: Which component to stimulate?

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Background and Goal of Study: Mansour described an approach to the sciatic nerve block that is easy to perform and to teach (1). The aim of this prospective randomised double blind study was to compare the efficacy of the block performed by this approach when stimulation was obtained either by the tibial or the peroneal motor response.

Materials and Methods: After local ethics committee approval, 26 ASA 1–3 patients scheduled for elective lower limb surgery who gave informed consent were included. Patients were randomised to receive a parasacral sciatic nerve block, as described by Mansour's technique, using a nerve stimulator (intensity $< 0{,}5$ mA, time 100 μs, frequency 1 Hz), looking for tibial motor response (Group 1: N = 14) or peroneal motor response (Group 2: N = 12). After the desired motor response was obtained, a solution of 10 ml 2% lidocaïne with epinephrine 1/200 000 and 10 ml 0,75% ropivacaïne was slowly injected through the needle. Sensory and motor blocks were assessed every 5 min during 30 min by an anaesthesiologist blinded to the type of motor response that was elicited. If the block was not complete 30 min after injection of the local anaesthetics, it was considered as having failed, and anaesthesia was supplemented with intravenous agents. Variables were compared between groups using unpaired t-test and Fisher's exact test where appropriate.

Results and Discussions:

	Group 1*	Group 2	P
Age (years)	41 ± 20	50 ± 12	NS
Weight (kg)	73 ± 18	76 ± 16	NS
Height (cm)	172 ± 9	170 ± 8	NS
Sex (M/F %)	57/43	50/50	NS
Time to perform the block (sec)	180 ± 89	222 ± 63	NS
Min stimulation (mA)	0.42 ± 0.04	0.40 ± 0.06	NS
Max stimulation (mA)	2.56 ± 1.40	3.22 ± 1.21	NS
Success rate (%)	78.6	16.6	0.002

* in one case, the randomised motor stimulation could not be obtained.

Success rate for complete block was higher in group 1 than in group 2. This might be explained by local anatomic reasons (diffusion capacities according to the importance of each component).

Reference:

1 Mansour NY. Reg Anesth 1993; 18: 322–323.

A-418

Phantom pain after amputation: Interest of preoperative regional anaesthesia?

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Introduction: 60% of amputees suffer from phantom limb pain within the first week after amputation and pain remain incapacitating from 10% to the first year.

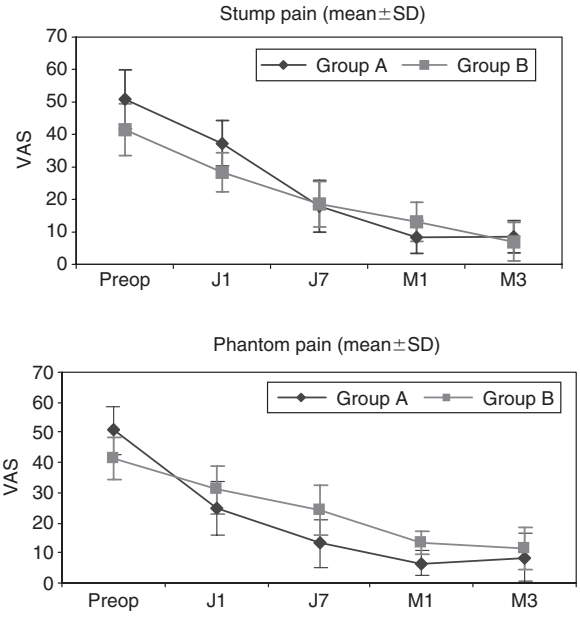
Preoperative epidural blockade may reduce the incidence of phantom pain. However, when patients are under anticoagulant or antiagregant therapy, epidural analgesia may appear hazardous. The regional analgesia by peripherical block may be a solution.

Patients and Methods: After approval by the Hospital Ethical Committee, 50 patients were scheduled for lower limb amputation, because of ischemic disease. They were allocated in two groups randomised: group A (n = 23) received a regional anaesthesia with blockade of the lumbar plexus (posterior approach) and blockade of the sciatic nerve by ropivacaine 7.5 mg/ml, just before the general anaesthesia, group B (n = 27) received general anaesthesia. Both groups had the same post operative analgesia, using propacetamol and morphin.

Each patient was asked about preamputation pain, phantom and stump pain (visual analogy score was recorded) after one day, seven days, one month and three months after amputation.

Results: There was no significant difference for the both group for the phantom limb and stump pains in all periods.

There was no difference in the onset between groups at any of the postoperative assessments for phantom limb pain. There was a significant relation between preamputation pain and stump pain at one day ($p = 0{,}046$) and seven days ($p = 0{,}014$).



Conclusion: Preoperative regional analgesia does not decrease the incidence of phantom limb and stump pains until three months. Preamputation pain significantly increases the incidence of stump pain at one and seven days.

References:

1 Ann R Coll Engl 94; 76: 324–326.
2 Anesth Analg 91; 72: 300–303.

A-419

Propofol versus sevoflurane in the prevention of epidural morphine-induced pruritus

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Background and Goal of Study: We examined the efficacy of intraoperative propofol administration to prevent pruritus induced by epidural morphine.

Materials and Methods: Seventy patients ASA I and II undergoing combined epidural and general anaesthesia for hysterectomy participated in this prospective, randomised study. They were randomly assigned to two groups: the group in which anaesthesia was induced with propofol and fentanyl, and maintained with propofol-N_2O (group P), and the group in which anaesthesia was induced with thiopental and fentanyl and maintained with sevoflurane-N_2O (group S). All patients received 3 mg epidural morphine bolus one hour before the end of surgery. The incidence and severity of pruritus were evaluated every 4 hours for the first 12 hours postoperatively by blinded observers.

Results and Discussions: The total incidence of pruritus was significantly higher in group S compared to group P ($p = 0.024$). This difference was established between 4 and 8 hours postoperatively. There were also significantly more patients reporting severe pruritus in group S compared to group P ($p = 0.03$).

Conclusion: Propofol used for induction and maintenance of anaesthesia may reduce the incidence and severity of pruritus induced by epidural morphine, the first 8 hours postoperatively.

Reference:

1 Kjellberg F, Tramer M. Pharmacological control of opioid-induced pruritus: a quantitative systematic review of randomized trials. EJA 2001; 18: 346–57.

A-420

MLAC Determination of Levobupivacine in continuous femoral nerve block for analgesia after total knee replacement

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Background and Goal of Study: Excellent postoperative analgesia after total knee replacement (TKR) could be achieved by a continuous femoral

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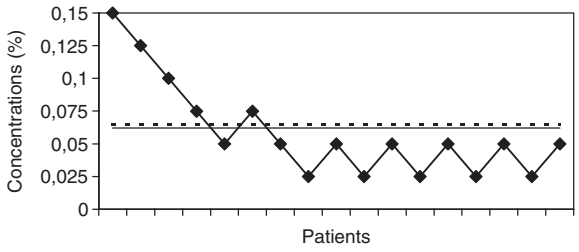
nerve block[1] (FNB). The local anesthetic concentration should be adjusted to provide adequate pain relief, while preventing side effects and useless motor block. We designed this study to determine the minimal local anesthetic concentration (MLAC) of Levobupivacaine in a continuous FNB after TKR.

Materials and Methods: After approval of our local ethic committee, 25 consecutive ASA 1–3 patients aged 60 to 85 years were included in this study. Under light sedation, we performed a FNB, inserted a perineural catheter (Contiplex 50 mm, B.Braun, Germany) and administred 3 ml/kg of Levobupivacaine 0,5% with epinephrine 1:200000. After completion of anesthesia, the first enrolled patient received a PCA device with a 0,15% concentration of Levobupivacaine running at 5 ml/h (and 5 ml boluses). For the other patients, we used the Dixon's sequential allocation method, briefly: if visual analogical scale (VAS) pain score became greater (stayed lower) than 4, at any time during the first 36 hours for the anterior knee area, analgesia was estimated insufficient (sufficient) and the next patient would then receive an incremental (decreased) dosage concentration of 0,025%.

Results and Discussion: The successive concentrations administered are presented in figure. Calculated ED50 or MLAC Levobupivacaine for postoperative analgesia was 0,062%. Derivated ED95 was 0,065% in our study ($R^2 = 0.99$).



Conclusion: The minimal effective local anesthetic concentration of Levobupivacaine for perineural postoperative analgesia after TKR is 0,065%.

Reference:

1 Singelyn FJ. *Anesth Analg* 1998; 87: 88–92.

A-421

MLAC Determination of Ropivacaine in continuous femoral nerve block for analgesia after total knee replacement

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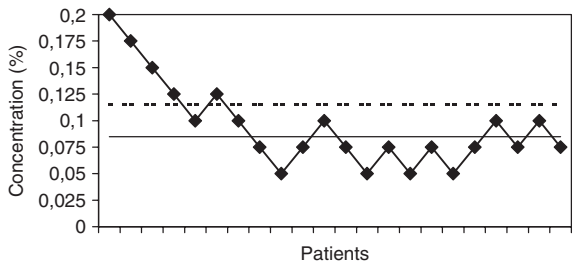
Background and Goal of Study: Excellent postoperative analgesia after total knee replacement (TKR) could be achieved by a continuous femoral nerve block[1] (FNB). The local anesthetic concentration should be adjusted to provide adequate pain relief, while preventing side effects and useless motor block. We designed this study to determine the minimal local anesthetic concentration (MLAC) of Ropivacaine in a continuous FNB after TKR.

Materials and Methods: After approval of our local ethic committee, 22 consecutive ASA 1–3 patients aged 60 to 85 years were included in this study. Under light sedation, we performed a FNB, inserted a perineural catheter (Contiplex 50 mm, B.Braun, Germany) and administred 3 ml/kg of Ropivacine 0,5% with epinephrine 1:200000. After completion of anesthesia (Propofol Sufentanil), the first enrolled patient received a PCA device with a 0,2% concentration of Ropivacaine running at 5 ml/h (and 5 ml boluses). For the other patients, we used the Dixon's sequential allocation method, briefly: if visual analogical scale (VAS) pain score became greater (stayed lower) than 4, at any time during the first 36 hours for the anterior knee area, analgesia was estimated insufficient (sufficient) and the next patient would then receive an incremental (decreased) dosage concentration of 0,025%.

Results and Discussion: The successive concentrations administered are presented in figure. Calculated ED50 or MLAC Ropivacaine for postoperative analgesia was 0,085%. Derivated ED95 was 0,115% in our study. ($R^2 = 0.86$)]



Conclusion: The minimal effective local anesthetic concentration of Ropivacaine for perineural postoperative analgesia after TKR is 0,115%.

Reference:

1 Singelyn FJ. *Anesth Analg* 1998; 87: 88–92.

A-422

Using stimulating or nonstimulating catheters for continuous peripheral nerve block. A prospective randomized, blind investigation

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Background and Goal of Study: We tested the hypothesis that a stimulating catheter-guided perineural placement improves the efficacy of postoperative analgesia as compared to a conventional sham nonstimulating technique.

Materials and Methods: With ethic committee approval and written consent we studied 100 patients, undergoing continuous popliteal sciatic nerve block for orthopedic foot surgery. After eliciting a sciatic mediated response stimulating through an introducer needle at ⩽0.5 mA, the perineural catheter was inserted 2–4 cm beyond the tip of the introducer either blindly (group Control, n = 50) or while stimulating via the catheter (group Stimulating, n = 50). If foot twitches decreased or disappeared during insertion, the catheter position was adjusted until eliciting adequate foot movements at ⩽1 mA. Surgical block was induced with 30 mL of 1.5% mepivacaine, and postoperative analgesia maintained with propacetamol 2 g IV every 8 hours and a patient-controlled infusion of 0.2% ropivacaine (basal infusion: 3 mL/h; incremental dose: 5 mL; lock-out time: 20 min with maximum 2 boluses per hour). Opioid rescue analgesia was available if required.

Results and Discussions: No differences in quality of pain relief at rest and during motion were reported between the two groups. Local anesthetic consumption during first 24 h was 122 ± 26 mL in group Stimulating and 148 ± 39 mL in group Control (P = 0.04). No further differences in local anesthetic consumption were reported during the 2nd day. Rescue opioid analgesia was required by 28 patients of group Control (57%) and 12 patients of group Stimulating (25%) (P = 0.004).

Conclusion(s): We conclude that direct confirmation of correct catheter placement results in shorter onset time of sciatic nerve block, less postoperative consumption of local anesthetic, and less needs for rescue pain medication.

A-423

Infection following epidural catheterization: Risk factors

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Background and Goal of Study: Systemic and deep infection is a rare complication derived from the use of epidural catheters (EC) for postoperative analgesia (range from 0 to 0.7%)[1]. The aim of our study was to determine the incidence of colonization of EC tips and its correlation both with clinical infection and patient's risk factors[2].

Materials and Methods: We prospectively studied 108 adult surgical patients (6 ASA I, 44 ASA II, 56 ASA III, 2 ASA IV) undergoing postoperative epidural analgesia. They were reviewed twice a day and the EC tips were semiquantitatively cultured after removal. Insertion site, body temperature and plasma leukocyte were collected on removal. Risk factors studied were: ASA, diabetes mellitus (DM), chronic renal failure (CRF), corticosteroids treatment (CC), neoplasic disease, surgical speciality (urologic, general, vascular or thoracic), type of surgery (emergency/ programmed) and epidural technique executor (senior-resident). Pearson Chi-Square analitic test was used for statistical analysis.

Results and Discussions: Mean time of EC removal was of 69 ± 34 hours. The incidence of positive cultures was of 23.6%. Of all positive cultures, 1 patient (3.7%) showed erythema in the insertion site (p = 0.33), 17 patients (68%) had leukocytosis (p = 0.44) and 6 (25%) had fever (p = 0.41). No serious systemic infection was recorded. Significant risk factors associated with culture's results are summarized in the table:

	CRF	CC	EMERG	PROGR
+culture	9 (36%)	6 (24%)	8 (32%)	17 (68%)
−culture	8 (9%)	3 (4%)	11 (14%)	70 (86%)
	p = 0.02	p = 0.01	p = 0.036	

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Conclusion(s): In short term EC we did not find a significant correlation between positive tip cultures and clinical signs of infection. Patients with chronic renal failure, corticosteroid treatment and those undergoing emergency surgery showed a greater incidence of EC tip contamination. In these group of patients, special antiseptic care could be reccomended.

References:
1 Dawson S.J. Journal of Hospital Infection 2001; 47: 3–8.
2 Kostopanagiotou G. Surg Infect 2000; 3(4): 359–65.

A-424

Implementing thoracic epidural analgesia for postoperative pain relief within a clinical pathway reduces the incidence and severity of early non-surgical complications in patients undergoing open radical prostatectomy

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Background and Goal of Study: Methods of pain relief, which offer both analgesia and sympathicolysis can attenuate stress related side effects following surgery and consequently play a major role within modern clinical pathways. In 1993 a collaborate clinical pathway was established at our institution, including: standards for surgery, transfusion regime, postoperative care and postoperative pain relief. The purpose of the underlying study was therefore to evaluate the impact of this method of pain relief on incidence and severity of non-surgical complications in patients undergoing radical retropubic prostatectomy.

Material and Methods: The records of 1165 consecutive patients receiving radical retropubic prostatectomy between 1/1994 and 12/2003 were analysed regarding co-existing diseases and incidence and severity of any kind of postoperative non-surgical complications. Patients received thoracic or lumbar epidural analgesia (TEA or LEA) or alternatively patient controlled intravenous opioid analgesia (PCIA) if contraindications or refusal for epidurals existed.

Results: Three different methods of analgesia were applied: TEA, LEA or PCIA. There were no differences regarding demographic data, patient characteristics, duration of surgery, and blood loss between groups. However, cardiopulmonary complications were significantly reduced in the TEA group (table) as well as overall minor and major complications.

	TEA	PCIA	LEA	
	(n = 831)	(n = 225)	(n = 109)	p-value
Cardiac complication	3.0%	6.7%	7.3%	0.01
Myocardial infarction	0.2%	0.9%	0.9%	0.1
Pulmonary complic.	2.6%	6.7%	10.1%	0.001
Pulmonary embolismn	0.5%	0.5%	0.9%	n.s.
Neurological	1.3%	1.3%	5.5%	0.06
Delayed mobilisation	1.4%	0.4%	25.7%	0.001
ICU-admission	3.0%	7.1%	4.5%	0.01

Conclusions: As compared to LEA and PCIA thoracic epidural analgesia provided a striking benefit in reducing early non-surgical complications and unplanned ICU admission in radical prostatectomy patients.

A-425

Compatibility of regional anesthesia with low molecular weights heparins and thrombembolism prophylaxis

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Background and Goal of Study: Deep venous thrombosis and fatal pulmonary embolism are common and serious complications after orthopedic surgery, considered a high-risk surgery.The moment of performing regional anesthesia to patients receveing preoperative thrombembolic prophylaxis or in whom this should be initiated postoperatively is still controversial. Spinal hematoma is a rare complication of spinal or epidural anesthesia but potentially catastrophic in the absence of an immediate treatement.

Material and Method: We studied the compatibility of regional anesthesia with the thrombembolic propylaxis, represented by the spinal hematoma incidence in patients undergoing orthopedic lower member surgery from November 1999 to October 2004, in our hospital. From the 5303 patients, 3486 (65.67%) have begun the first LMWH at 6–8 h postoperatively, while 820 bed-rested patients (15.46%) have receveid LMWH preoperatively; in this group the last LMWH dose had been administered 12 h before the spinal punction; the next LMWH dose at 6–8 h postoperatively.

Results: The incidence of spinal hematoma was zero, irrespective of the regimen of LMWH administration.

Conclusion: In the absence of European guidelines, our experience shows that preoperative (12 h) or postoperative (6 h) administration of LMWH in 5303 patients receiving spinal/epidural anesthesia was safe and not complicated by spinal hematoma.

References:
1 Tryba M. *Anaesthesiol Intensivmed notfall Schmerzther* 1993; 28: 179–181.
2 Vandermeulen EP. *Anesth Analg* 1994; 79: 1165–1177.

A-426

Systematic review of nerve block and incisional local anaesthetics for analgesia in herniorraphy

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Background and Goal of Study: The PROSPECT initiative is a collaboration of surgeons and anaesthesiologists that provides evidence-based recommendations for PROcedure-SPECific pain managemenT.[1] Given that local anaesthetic techniques are widely used for analgesia in herniorraphy, PROSPECT examined the evidence to support this practice.

Materials and Methods: Systematic literature review (1966–January 2004) using the Cochrane protocol; randomised trials in adult herniorraphy of inguinal nerve block (INB) or wound infiltration (WI) using local anaesthetics (LA) *vs.* placebo (or pre- *vs*. post-incisional administration) reporting pain scores (VAS 1–100 mm). Where possible, data were grouped and weighted mean differences (WMD) and odds ratios (OR) calculated.

Results: Total number of studies (n) = 16; 20–100 patients per study.

Pre-incisional INB ± pre-incisional WI vs. *placebo (n = 7)*. Reduction in: VAS scores at rest 0–6 h (n = 6), and 48 h (n = 1) but not 8–24 h (n = 2), WMD at 3 h −18.21 p = 0.002 (n = 2); VAS scores on movement at 3–10 h (n = 1) and 1–24 h (n = 1); and morphine use WMD −4.58 mg/24 h p = 0.04 (n = 3).

Intra-operative INB + intra- + postoperative WI vs. *placebo (n = 2)*. Reduction in: VAS scores on lying, sitting and walking for 0 h–10 days (n = 1) and at rest for 0–24 h (n = 1); and supplementary analgesic use (n = 2).

Intra-operative WI vs. *placebo (n = 4)*. Reduction in: pain at rest at 1–3 h (n = 3), 5, 12 (n = 1), and 48 h (n = 1) but not 4, 6 (n = 1), 5 (n = 1) or 24 h (n = 1) or 10 days (n = 1), WMD at 3 h −35.83 p = 0.006 (n = 2); pain on movement at 4, 6 (n = 1), 24 and 48 h (n = 1); and number of analgesic tablets WMD −0.65 p = 0.01 (n = 2).

Pre- vs. *post-incisional INB or WI (n = 3)*. Non-significant for pain scores (n = 3); or supplementary analgesic use (n = 2 out of 3).

Conclusion(s): This review supports the current clinical practice of using local anaesthetic techniques for analgesia in herniorraphy, and shows that they provide significant and clinically meaningful reductions in pain regardless of whether they are given pre-, intra- or postoperatively.

Reference:
1 Kehlet H, Bonnet F, Camu F *et al*. *European Journal of Anaesthesiology* 2003; **20** (Supplement 30); 6.

A-427

Can local techniques for anaesthesia improve patient outcome following hernia repair?

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Background and Goal of Study: PROSPECT provides evidence-based recommendations for PROcedure-SPECific postoperative pain management, through collaboration of an international Working Group of surgeons and anaesthesiologists.[1] PROSPECT presents a systematic review on the postoperative analgesic effects of local anaesthesia in adult herniorraphy.

Materials and Methods: Systematic literature review (1966–January 2004) using the Cochrane protocol; randomised trials in herniorraphy of local techniques for anaesthesia (nerve block and wound infiltration with local anaesthetics (LA)) *vs.* other anaesthetic techniques, reporting pain scores (VAS 1–100 mm); where possible, data were grouped and weighted mean difference (WMD) and odds ratios (OR) calculated.

Results: Total number of studies (n) = 8. All local techniques were ilioinguinal and iliohypogastric nerve blocks plus wound infiltration. For spinal studies: one used LA plus strong opioid, another LA alone and two did not specify; one spinal group included 18% epidurals.

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Local vs. *general anaesthesia (n = 7).* Local anaesthesia reduced: VAS scores in 6/7 studies at different times up to 8 days, WMD at 1 h −19.51 p = 0.00001 (2 studies), WMD at 24 h −4.38 p = 0.04 (3 studies); postoperative nausea and vomiting OR 0.19 p < 0.00001 (5 studies); sore throat OR 0.14 p < 0.0001 (3 studies), and hospital stay WMD −3.10 h p < 0.00001 (2 studies).

Local vs. *spinal anaesthesia (n = 4).* Local anaesthesia reduced maximum VAS scores in 3/4 studies at different times up to 30 days, reduced hospital stay WMD −3.10 h p < 0.00001 (2 studies), and produced less urinary retention OR 0.02 p < 0.00001 (3 studies).

Conclusion(s): In herniorraphy, local anaesthesia with nerve block and infiltration has superior postoperative analgesic and recovery benefits compared with general or spinal anaesthesia.

Reference:

1 Kehlet H, Bonnet F, Camu F *et al*. *European Journal of Anaesthesiology* 2003; **20** (Supplement 30); 6.

A-428

Single injection paravertebral block prevents from chronic pain after breast cancer surgery

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Background and Goal of Study: Chronic pain symptoms are prevalent after breast surgery (1). Preincisional paravertebral block (PVB) provides significant immediate postoperative analgesia (2) possibly reducing the incidence of chronic pain. Therefore, a one-year follow-up was performed.

Material and Methods: A prospective, randimized, placebo controlled and blinded outcome study in 60 patients who underwent breast surgery for cancer was conducted. Before general anaesthesia 30 patients were given a PVB with bupivacaine and 30 patients a sham block with saline (SHAM). The follow-up consisted of a 14-day symptom diary and telephone interviews 1, 6 and 12 months after the operation. The data were analysed using Kruskal-Wallis or Chi-square tests.

Results and Discussions: During the first two weeks the overall consumption of analgesics was similar in both groups. One month after the operation there was less motion related pain [median 2(range 0–7) vs. 4(0–10)] (p = 0.005) and a lower incidence of nausea and vomiting (0 vs. 5 patients) (p = 0.02) in the PVB group. There were no significant differences between the groups at 6 months after the operation when most patients were having chemotherapy or radiotherapy. However, 12 months postoperatively there were less pain (Table) and other symptoms in the PVB than the SHAM group:

Pain	*Number*	*P-value*	*Intensity (0–10)*	*P-value*
At rest	1 vs. 8	0.03	0(0–1) vs. 0(0–8)	0.01
In motion	9 vs. 18	0.05	0(0–6) vs. 2(0–8)	0.003
Sharp	3 vs. 12	0.02		
Neuropathic	2 vs. 3	0.64		
Maximum			5(0–10) vs. 8(0–10)	0.04

Conclusions: In addition to providing acute postoperative pain relief (2), preoperative PVB seems to prevent painful conditions still one year after breast cancer surgery. These extended benefits should encourage a more extensive use of PVB analgesia associated with breast cancer surgery.

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A-429

Fast-track colonic surgery: First experience in a French hospital care

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Introduction: Multimodal rehabilitation programs after colonic surgery have been proposed to shorten postoperative stay and therefore decrease morbidity, primarily thought to be linked to postoperative ileus (1). The aim of this study was to evaluate such a fast track program in a non-teaching hospital with a nurse/patient ratio of 1/10.

Patients and Method: 38 consecutive patients were included in a fast track colonic surgical program consisting of a conventional resection surgery, lack of drain, continuous thoracic epidural analgesia, restricted intravenous (IV) fluids administration, early oral nutrition, enforce mobilization, planned over the 4 postoperative day. Morbidity and hospital length of stay were assessed during the five postoperative day. Results are expressed as median (range) or percentage.

Results: Age and ASA score were 74 years (30–92) and 2 (1–3) respectively. Epidural catheter was withdrawn on day 2 (1–5) and bladder drain on day 1 (0–5). Gaz and defecation occurred respectively on day 1 (0–5) and day 2 (0–5). 47% of patients had postoperative nausea. Pain at cough and fatigue scores were 3 (0–10) and 6 (0–10), respectively. IV postoperative fluids were not used in 21 (55%) patients. Postoperative variation of serum creatinine was low (15 μmol/l) and not dependant on patient's age or the use of postoperative IV fluid administration. Patients were ready to be discharged on the 4.5 (4–111) day. However, actual hospital length of stay was 6 days (4–111). Incidence of anastomotic leak was 8% (3) and infectious disease was 10.5%(4).

No readmission was recorded.

Conclusion: As reported in other recent studies (2), fast track colonic surgery was not associated to a high incidence of surgical, infectious or renal complications. This fast track procedure has the ability to shorten the hospital stay despite a low nurse/patient ratio**.**

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A-430

Anesthetic techniques used in Catalonia in 2003

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Background: The proportion of the different anaesthetic techniques (AT) used in a region can influence both the structural resources distribution and the training programs contents.

Goal: Assessment of the different AT used in Catalonia in 2003 and the factors related.

Methods: Data regarding the type of AT were obtained from a cross-sectional survey (ANESCAT) of all anaesthesias performed in 14 randomised days along 2003 in all public and private hospitals in Catalonia (6704146 inhabitants and 131 hospitals). AT were recorded as: *general* (inhalation, TIVA or balanced), *regional* (epidural, subarachnoid, CSE, ophtalmic plexus and peripheral blocks), *combined* general + regional, and *sedation*. AT were related to: type of surgery, age and gender, ASA class and type of hospital.

Results: 23136 anaesthesias during the 14 cut-off days were collected: *General*: 33.5%, *Regional*: 41.4% distributed in Subarachnoid 46.7%; Epidural 22.8%; Retro-peribulbar 13.9%; Plexus 8%; CSE 2.2%; Peripheral <4%, *Combined*: 3.5% and *Sedations*: 21.6%.

Regional anaesthesia was used in more than 50% of cases for orthopedic, obstetric, vascular and urologic surgery. Combined general-regional was used in more than 25% of cases of abdominal, orthopedic and urologic surgery. Regional anaesthesia was used: >39.6% in ASA I–III, <17.9% in ASA IV–VI, <6% under 14 yrs and 84% over 95 yrs. Epidurals were more used in women and subarachnoid blocks in men in all ASA classes. Teaching and non-teaching hospitals showed similar proportions of AT except for epidurals that were more frequently used in the former (32.1% vs. 18.5%).

Conclusions: The use of regional anaesthesia in Catalonia in 2003 is the highest reported in the literature. Combined CSE or general + regional AT have limited use. The poorer physical status the higher the use of general anesthesia. The presence of residents have little influence in the type of anesthesia applied except for epidurals. Plexus and ophthalmic blocks are frequent in the anesthesiologists practice and should be reinforced in the training programs.

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A-431

Compressing spinal epidural haematomas during central neuraxial block performance. An 8-year survey

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Background and Goal of Study: Risk factors for development of spinal epidural hematoma (SEH) following central neuraxial blocks have been reported, however, incidences are hard to determine in prospective studies because occurrence is rare and extrapolations are based on case reports. Recently, a large survey was reported indicating a much higher incidence of such events than previously hypothesized. The purpose of the underlying study was to evaluate the occurrence of such events in our hospital during an 8-year period of computer documentation of anaesthetic and intensive care units (ICU) records.

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Materials and Methods: In 1996 a computer anaesthesia documentation system was introduced in our department allowing detection of critical events during anaesthesia as well as post hoc identification of surgical procedures. The data of 28,933 patients that received central neuraxial blocks were analysed (15,205 spinals; 13,728 epidurals). In addition, ICU records were reviewed regarding admission diagnoses.
Results and Discussions: During the observation period 4 compressing SEH were identified. One hematoma was admitted for surgical decompression after spinal anaesthesia in other hospital. One hematoma developed in a male with difficult anatomical conditions leading to unintended cephaled puncture for spinal anesthesia (possibly Th12 level) for orthopedic surgery and was additionally complicated by an abscess after surgical decompression. One hematoma (previously reported) developed following lumbar epidural analgesia in an orthopedic patient after (concealed) self administration of a high dose of ibuprofen. The fourth SEH occurred during postoperative pain therapy with thoracic epidural analgesia in a patient who developed heparin induced thrombocytopenia. All diagnoses were confirmed by magnetic resonance imaging and all but one patient were operated on within 12 hours after appearance of first clinical signs. However, only the last two patients recovered completely.
Conclusion(s): Especially in orthopedic patients there might be an increased risk of spinal epidural hematoma following neuraxial blocks. Despite large studies reasons for SEH have not clearly been identified. One might speculate, that the risk of spinal epidural hematoma could be related to concomitant therapy with non-steroidal antiphlogistic drugs which are common in such patients.

A-432

Impact of thoracic epidural analgesia on revenue using G-DRG M01B, OPS-301 5-604.0 (radical retropubic prostatectomy)

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Background and Goal of Study: The recent introduction of the diagnosis related healthcare reimbursement system G-DRG in Germany initiates a previously unknown competition within the public healthcare system aiming towards a reduction of cost-intensive over-capacities. Accordingly, the patient-oriented optimization of operative processes and a simultaneous increase of quality and patient satisfaction became a vital interest of healthcare providers. Using the surgical procedure OPS 5-604.0 (radical retropubic prostatectomy) as an example our study identifies revenue-relevant patient characteristics and describes the impact of the perioperative application of thoracic epidural analgesia (TEA).
Materials and Methods: Factors affecting duration of stay were determined in 460 patients undergoing OPS 5-604.0 in the year 2001 and 2002 using multifactorial regression analysis. Preoperative parameters served as factors for matched pair analysis of the effects of TEA.
Results: Characteristics significantly affecting length of postoperative hospital stay were ASA-status, age, preoperative haemoglobin concentration, post operative tachycardia, number of transfused packed red cells, wound infection and surgical revision procedures. Based upon identical matching criteria 27 pairs (with/without TEA) could be formed. While the induction time in the TEA-group was 8 ± 18 min longer ($p = 0{,}04$), emergence was briefer by 3 ± 9 min ($p = 0{,}05$). Neither duration of anaesthesia nor anaesthesia presence time or anaesthesia costs (TEA €489 ± 87/GA €456 ± 83) differed significantly between the pairs. In contrast, the postoperative length of hospital stay after TEA was reduced by 1,6 ± 2,8 days ($p = 0{,}007$), which was accompanied by an extended duration of pain therapy, corresponding with an total increase of efficiency by around 12,5%. If this increase is used for an increase in the number of OPS 5-604.0 procedures, then excesses proceeds with a value of €207.040 per annum can be expected.
Conclusion: At first sight combined anaesthesia procedures require more human resources and material, which, however, play a minor role in calculation of total case costs. As a result of shortened hospital stay and optimized pain therapy "customer satisfaction" increases and leads to a substantial potential for increased revenue.

A-433

Clinical efficacy of the brachial plexus block via the posterior approach

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Background and Goal of Study: The posterior approach to the brachial plexus block remains under-used (1,2). We assessed the clinical efficacy of this technique for shoulder surgery.
Materials and Methods: One hundred and eighty seven consecutive patients scheduled to undergo shoulder surgery were assessed following a single injection nerve stimulation technique using ropivacaine 0.75%. Sensory and motor blocks were evaluated in the distribution area of each terminal branche of the brachial plexus every 10 minutes for 30 minutes. Postoperative analgesia was evaluated at regular time intervals at rest and on passive movement, up to 24 hours postoperatively.
Results and Discussions: The brachial plexus was reached at a depth of 6.5 ± 0.9 cm. One attempt was sufficient in 85% of patients. Neck pain during insertion of the needle was encountered in six (3%; 95% CI, 0.7%–5.6%) patients. Thirty minutes following the ropivacaine injection, the axillary, radial, median, musculocutaneous and ulnar nerves were anesthetized in 100%, 100%, 97%, 96% and 68% of cases respectively. The succes rate of the block was 98%. Postoperative analgesia was satisfactory in 97% of patients up to 12 hours following the initial injection. Dysphonia and Horner's syndrom were observed in 14 (7%; 95% CI, 3.7%–11.2%) and 12 (6%; 95% CI, 2.9%–9.9%) patients, respectively. One patient (0.5%; 95% CI, −0.5%–1.5%) had documented hemidiaphragmatic paresis. No complication was noted during the three month follow-up period.
Conclusion(s): This study reports the clinical efficacy of the single injection nerve stimulation technique for the brachial plexus block via the posterior approach in patients undergoing shoulder surgery. It appears to be effective, relatively safe and well tolerated.
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A-434

Continuous interscalene brachial plexus block (CIBPB) is the analgesic technique of choice after minor open shoulder surgery

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Background and Goal of Study: The use of CIBPB after minor open shoulder surgery remains questionable. The aim of the present prospective, randomised, blinded study was to compare 3 different analgesic techniques after such a surgery.
Materials and Methods: Thirty patients scheduled for open supraspinatus muscle tendon repair under general anaesthesia were divided into 3 groups. In G1, no block was performed; in G2, a single shot interscalene block with 20 ml 0.5% ropivacaine + epinephrine; and in G3, a CIBPB with a bolus dose of 20 ml 0.5% ropivacaine + epinephrine followed by a continuous infusion of 0.2% ropivacaine at 7 ml · h^{-1}. An iv PCA with morphine (1 mg – 7 min) was available for rescue analgesia in all patients. Pain intensity at rest and on movement (VAS: 0 = no pain; 100 = severe pain), morphine consumption, side-effects, and patients' satisfaction score were recorded at 4, 24 and 48 h. Results are expressed as mean ± SD. $P < 0.05$ was considered significant.
Results and Discussions: Interscalene block was successful in all patients in G2 and G3. No difference in demographic data and side-effects was found between the groups. When compared with G1, pain scores and morphine consumption were lower in G3 (Table 1). When compared with G2, morphine consumption at 24 and 48 h was lower in G3. Patient's satisfaction was higher in group 3 when compared with G1 (71 ± 22, 86 ± 11 and 94 ± 11 in groups 1, 2 and 3 respectively).
Conclusion(s): After minor open shoulder surgery, CIBPB is the analgesic technique of choice. Single shot interscalene block provides efficient but too short lasting analgesia.

Table 1.

		Group 1	Group 2	Group 3
VAS_R	4 h	33 ± 20	16 ± 17	7 ± 12*
	24 h	35 ± 18	30 ± 19	14 ± 16
	48 h	18 ± 14	11 ± 9	8 ± 9
VAS_M	4 h	49 ± 28	28 ± 27	10 ± 20*
	24 h	58 ± 16	52 ± 19	29 ± 26*
	48 h	40 ± 19	32 ± 18	20 ± 14*
Morphine	4 h	19 ± 13	5 ± 7	1 ± 1*§
	24 h	38 ± 11	33 ± 20	13 ± 8*§
	48 h	49 ± 20	54 ± 35	21 ± 14§

(*group 3 vs group 1; §group 3 vs group 2)

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Axillary plexus block according to Weber is more effective than Büttner's method in supine position

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Background and Goal of Study: Using the axillary brachial plexus block (AP) according to Weber with lateral positioning combined with 20° Trendelenburg positioning it is possible to reach more proximal nerves (1) than with Büttner's method in supine position (2). It is not clear whether the two methods are equally efficient. Therefore, in this prospective, randomized, single-blind study we compared the sensory and motoric quality, spread and time to obtain a complete block, tourniquet, frequency of supplemented nerve blocks and the need for general anaesthesia.

Materials and Methods: After a positive vote of the local Ethics Committee 108 patients undergoing hand surgery were separated into 2 groups: B (Büttner) and W (Weber). The block was performed (using a nerve stimulator) with 45 mL mepivacaine 1% (MEPI1%) and $NaHCO3^-$ (1:10). The musculocutaneous nerve was separately blocked with 5 mL MEPI1%. Only in group W patients were positioned onto the anaesthetized side for 30 minutes according to Weber. Incomplete blocks were supplemented 30 min after the initial block.

Results: A greater success rate of a complete sensory block was found in group W (88,9%* vs. 71,3%). Incomplete blocks were more successfully supplemented in group W (8,3%* vs. 19,4%). The need for general anaesthesia was lower in group W (2,8%* vs. 9,3%). Only in group W a complete sensory block of axillary nerve (NA) occurred (65,7%** vs. 0,0) and 21,3% vs. 13,9% of incomplete sensory block was found. Motor blocks of the NA (74,1%** vs. 0,0), of the thoracodorsal nerve (NT) in (64,8%** vs. 0,0), and the subscapular nerve (NS) (74,1%** vs. 0,0), occurred only in group W.

Statistics: Chi-quadrat-test corrected by Yates ($p < 0.05$; sign. = *, $p < 0.001$; sign. = **).

Conclusion: The axillary brachial plexus block according to Weber with positioning onto the anaesthetized side reduces the need for supplemented nerve blocks and the need for general anaesthesia, when compared to the method in supine position according to Büttner.

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A-436

Axillary brachial plexus block using ultrasound

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Background and Goal of Study: The success rate of axillary nerve block has become higher after an electrical stimulator has been introduced. However, the risk of the intravascular injection of local anesthetics or the risk of nerve injury has remained. Recent ultrasound (US) can provide us the fine image of axillary brachial plexus (1). This study is, therefore, conducted to examine how useful is US to perform axillary nerve block.

Materials and Methods: After obtained informed consents, seventeen subjects (7 volunteers and 10 patients) were included in this study. Firstly, we examined how clearly each nerve in axillary sheath was identified using a linear transducer (3–11 MHz) connected with an ultrasound (Sonos 5500, Phillips Inc). Secondary, we inserted the block needle (21G, 70 mm) into axillary sheath in the 10 patients (Pts) under US guidance. We decided the position of the needle tip as seeing US image and assessed how local anesthetic solution distributed in an axillary sheath during the injection. In 5 among 10 Pts, we used electrical nerve stimulator together with US to assessed weather the nerve image on US screen was the target nerve. The effect of block was evaluated with a loss of cold sense. The complication assessed the next day of operation.

Results: US provided distinct images of axillary nerves in all subjects except one female. In 10 subjects (59%), three nerves (ulnar, median and radial nerves) could be identified. Two nerves could be seen in 5 subjects (27%). During the injection of local anesthetic, US showed that the solution was spreading in axillary sheath in all 10 Pts. In all of the 5 Pts with nerve stimulator together, the target muscle contraction could be elicited easily at the low stimulation current (0.3 to 0.7 mA). Anesthetic effects were confirmed in all patients. No intravascular injection of local anesthetic was occurred and no complication after block was observed.

Conclusions: Our results demonstrated that US could image the target nerve and the distribution of injected solution so clearly and easily. In conclusion, we believe that US guidance for axillary block could increase the success rate and decrease the complications.

Reference:

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A-437

Small dose levobupivacaine added to mepivacaine has greater analgesic effect than clonidine in axillary block

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Background and Goal of Study: Clonidine added to local anesthetics prolongs anesthesia and analgesia after axillary block.[1] We hypothesized that a small dose of levobupivacaine added to mepivacaine may have similar effects.

Materials and Methods: Consentient ASA 1–2 patients undergoing hand surgery were randomized to axillary block, with electrostimulated needle and multiple injection technique, receiving: 1) 2% mepivacaine 5 ml for each terminal branch of the plexus (M); 2) as in group M plus 0.5% levobupivacaine 5 ml injected only near the branch mainly related to the surgical procedure (ML); 3) as in group M plus clonidine 150 mcg (MC). Patients unsuited for regional anesthesia, non compliant, undergoing procedures involving a field covered by >1 branch or leading to negligible postoperative pain (e.g. carpal tunnel release) were excluded. All patients received paracetamol 1 g every 8 hours po. Ketoprofen was used as iv rescue analgesic. A blinded observer registered time of block onset and recovery, VAS pain scores at 1-2-4-6-8-12-24 hours, total consumption and time of first request of rescue analgesic. Data (mean ± SD) are compared using analysis of variance with Bonferroni correction. Time of first analgesic request is described by Kaplan Meier curves and compared by log-rank test.

Results and Discussions: 70 patients were studied (age: 18–70 years; M/F: 47/23). Anesthesia was adequate in all cases. Pain scores were lower only in group ML than in M (among groups, $p = 0.01$; M vs ML, $p = 0.01$; M vs MC, n.s.). Rescue analgesic consumption was similar. The proportion of rescue analgesic-free patients had a slower decrease in groups ML and MC than in M (analgesic-free at 24 hours 34% in group M, 73% in group ML, 55% in group MC; $p < 0.001$). Time of sensory and motor block was similar in groups M and ML. Recovery was significantly longer in MC (M: 212 ± 61; ML: 257 ± 100; MC: 288 ± 61 min. $P = 0.02$ M vs MC).

Conclusion(s): Selective addition of levobupivacaine improves analgesia after axillary block with mepivacaine, without affecting onset and duration of sensory and motor block. Clonidine prolongs anesthesia but not analgesia

Reference:

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A-438

Anesthesia and postoperative analgesia in upper extremity and shoulder surgery

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Background and Goal of Study: Shoulder and upper extremity surgery often causes severe pain which requires high doses of opiates. Inadequate treatment of postoperative pain causes the patients to suffer pain and as a result their satisfaction decreases. In postoperative study we tried to determine the best method of anesthesia and postoperative analgesia (POA) in upper extremity surgery.

Materials and Methods: After obtaining approval of the local ethic committee, 51 ASA I, II patients were randomly allocated to one of three groups. In Group G (n = 17); General anesthesia (GA) was applied to shoulder surgery and for POA intravenous (iv) PCA (patient controlled analgesia) with morphine was used. In Group IS (n = 17); Interscalane block (ISB) was performed with 0.6% 40 mL ropivacaine (R) to the consciousness patients, for POA IS catheter was used with PCA 0.2% R, Group ISG (n = 17); ISB was performed with 0.6% 40 mL R and IS catheter was placed. When surgery block was formed, GA was applied. For POA IS catheter was used with PCA 0.2% R. PCA in all the groups was set as both basal infusion and bolus. Pain was evaluated by VAS and VRS. For statistical analyses ANOVA, Kruskal-Wallis and Chi-square tests were used.

Results: Demografical and intraoperative hemodinamical data were similar in all group. Side effects such as Horner's syndrome 34% (group IS: 23%, group ISG: 11%) and recurrent laryngeal nerve block 11.8% (group IS: 5.9%, group ISG: 5.9%) and agitation 5.9% (only group IS) nausea 84.2% in group G, 17.6% group ISG and vomiting 58.8% in group G were observed. 64% of the patients with Group G, 10% of the patients with group IS, 5% of patients with group ISG required additional bolus analgesic during the postoperative 24 h. Pain measurement by VAS and VRS clearly demonstrated the advantages of ISB with or without GA. The patients ISG and IS were more satisfied with their anesthesia and POA than the patients in G (87.12 ± 12.04, 92.65 ± 10.53 versus 78.24 ± 13.24, respectively, $p < 0.05$).

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Discussion and Conclusion: ISB (with or without GA) reduces intraoperative doses of opiates, facilitates postoperative pain managements and increases patients satisfaction. As a result we recommend ISB for patients undergoing: upper extremity and shoulder surgery.

Reference:

1 Best Pract Res Clin Anaesthesiol 2002 Jun; 16(2): 211–25.

A-439

Posterior radial nerve blockade: an easy route for upper limb locoregional anesthesia?

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Background and Goal of Study: We previously described a new route in surgical procedures of the upper limb (1). The aim of this study was to determine wether the posterior approach of the radial nerve (PARN) could provide both adequat conditions during the realisation of the block and excellent perioperative anesthesia.

Materials and Methods: After institutional and patient approval, we prospectively studied 150 consecutive patients undergoing upper limb surgery. The radial nerve block was performed with a short bevel needle (Stimuplex®, Neuro stimulator HNS), all patients were in the beach chair position, with the hand of the limb to block on the opposite shoulder. Punction site is located 3 cm behind the humeral insertion of the deltoide muscle. The radial nerve is blocked in the triangle delimited by the Humerus, the Teres Major and the Long Head of the Triceps muscles. Only two neurostimulation responses are accepted to localise the radial nerve: wrist and finger extension or contraction of the humero-stylo-radial nerve. A contraction of the triceps muscle is not accepted because of the possibilty of distal nerve stimulation. Distribution of anesthesia in the nerve territory was assessed at 5, 10, 15, and 20 min by cold testing.

Results and Discussions: (The data is evaluated as average $\pm$ ecart type). Duration procedure (min): 1.43 $\pm$ 0.5; Time for complete sensitive block (min): 13 $\pm$ 3.53; minimal stimulation intensity (mA): 0.5; volume of ropivacaine 5 mg/mL: 12 mL. Supplementation was not needed by further LA in any case. Quality of anesthesia was considered excellent in all cases, without complications.

Conclusion(s): PARN is a very efficient technique for radial nerve block.

Reference:

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A-440

Nerve stimulators: are they all the same?

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Background and Goal of Study: Nerve stimulation is the 'gold standard' method for confirmation of peripheral nerve location during regional anaesthesia. Nerve stimulators (NS) are essential for improving both the success rate and the risk-benefit ratio of regional anaesthesia (1). We investigated the safety and reliability of a series of NS available in France.

Materials and Methods: Eighteen different NS were subjected to a battery of tests (2) performed by two independent observers under standardized conditions using a digital oscilloscope (Tektronix TDS 3034) and a calibrated resistance of 1 kΩ. Individual scores (0 = least satisfactory to 5 = most satisfactory) for the signal waveform, current intensity, impulse duration, maximal output load and safety were averaged in order to obtain a single score. NS were ranked according to their performance.

Results and Discussions: A group of 'high performers' (overall score $>$ 4) has been identified: Stimuplex HNS 11 (B Braun), Hadomed HNS 11 (B Braun), Plexival (Medival) and MultiStim Vario (Pajunk). 'Poor performers' (score $<$ 2.5) included: Stimuplex S (B Braun), Electra version A and B (Gamida), Innervator NS 272 (Fischer & Paykel), TOF-Watch (Organon Teknika), M-NMT AS 3 (Datex Ohmeda), Electra version C (Gamida), Anaestim MK III (Meda), Digistim 3 Plus (Neuro Technology). 'Average performers' were: Stimuplex Dig (B Braun), Stimuplex Dig RC (B Braun), Polystim (Polymedic) MultiStim LA (Pajunk), MultiStim Plex (Pajunk) and Tracer II (Life-Tech).

Conclusion(s): The implication of this variation in performance is that – for a safe and successful nerve block – the operator should be aware of the design and functional limitations of the stimulator being used in any clinical setting. Standardization of features is equally required when manufacturing NS.

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A-441

Ultrasound-guided distal nerve blocks of the upper extremity and relevant sonoanatomic considerations

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Background and Goal of Study: Distal blocks of the median-, ulnar- and radial nerve provide good anaesthesia for the hand combined with maximal haemodynamic stability. The present study evaluated the sonoanatomic fundamentals and the feasibility of ultrasound guidance, a method shown to increase quality in other regional anaesthetic approaches.

Materials and Methods: We examined 200 ultrasound planes in 50 volunteers (f:25/ m:25, age 34 yrs [21–74], body mass index 23.1 [17.6–32.2], mean [range]) to provide sonoanatomic data relevant for blocks. Nerve depths, dimensions, visibilities and relations to vessels were recorded with a 12 MHz scanner at 4 levels from the elbow to the wrist and correlated to morphometric body parameters. Based on this, a case series of local anesthetic blocks was performed in surgical patients.

Results and Discussions: All 3 nerves were visible in each volunteer showing the typical fascicular pattern. The median- and ulnar nerve could be depicted at all 4 levels with a maximum depth of 19 $\pm$ 3.7 mm for the median nerve and 13 $\pm$ 2.3 mm for the ulnar nerve shortly distal to the elbow at the second level (mean $\pm$ SD). The radial nerve could only consistently be visualized shortly proximal to the elbow at the first level because of variable branching more distally. Correlation of depth measurements with morphometric parameters were strongest (Pearson coefficient: 0.64, $p < 0.01$) between the median nerve at the second level and body weight.

All 23 ultrasound-guided distal nerve blocks could be performed without complications and were clinically successful. The amount of local anaesthetic (mepivacaine 1.5%) could be reduced down to 2 ml each without the need for any additional systemic analgetics.

Conclusion(s): Ultrasound-guided distal blocks of all 3 nerves are technically feasible and highly effective. With this newly developed technique the median- and ulnar nerve can be blocked anywhere down to the wrist, while radial nerve block is only recommended at the elbow.

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Comparison of total analgesic requirement and total blood loss in patients undergoing primary total hip replacements with and without lumbar plexus block, a retrospective study

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Background and Goal of Study: The object of this study was to compare the effectiveness of Lumbar Plexus Block (LPB) in reducing the Total Analgesic Requirements (TAR) and Total Blood Loss (TBL) in Patient undergoing Total Hip Replacement (THR).

Materials and Methods: Sixty ASA I and II Patients who had Primary THR were studied from year 2002 to 2004. Patients were divided in to two groups. Group I (G I) of 30 patients with LPB (posterior approach) and Group II (G II) of 30 patients without the LPB. All these patients had general anaesthesia, and patient controlled analgesia post operatively. The patients in G I received 30 mls of 0.375% plain bupivacaine (up to maximum 2 mg/kg) in LPB. The patients of ASA III and above were excluded from the study. One individual performed all these procedures using the same techniques.

Results and Discussions: The TAR was lesser in G I than G II ($p < 0.05$). The TBL was lower in G I than in G II ($P < 0.05$).

The following table shows patient Characteristics comparable in both the groups.

Table I	G I	G II
Sex (M/F)	13/17	16/14
Age(mean)Yrs	64.83	68.1
ASA (I/II)	5/25	9/21

The following table shows TAR it terms of Mean (SD)

Table II	G I	G II
TAR(M/SD)	14.06 (7.08)	26.86 (12.36)

The following table shows TBL in terms of Mean

Table III	G I	G II
TBL(Mls)	654.33	956.5

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Conclusion: Lumbar plexus blockade provides better surgical field with minimum blood loss/comfortable recovery and reduced TAR and TBL. The similar prospective studies using continuous infusion with catheterisation may provide total analgesia for THR.

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A-443

Blood loss after total hip arthroplasty: a prospective audit comparing psoas compartment block to intrathecal morphine

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Background and Goal of Study: Psoas compartment block (PCB) reduces blood loss after total hip arthroplasty (THA) possibly as a result of superior postoperative analgesia compared to patient controlled morphine (1). Intrathecal morphine (ITM) provides similar postoperative analgesia as PCB (2).

Materials and Methods: As part of a prospective audit comparing two anaesthetic techniques for blood loss after primary THA, data from forty-eight patients were reviewed. Anaesthesia consisted of bupivacaine spinal anaesthesia with either ITM (Group M) or PCB (Group P) for postoperative analgesia. IRB approval was waived. The same surgeon performed all surgery. Pre- and postoperative haemoglobin (Hb) and haematocrit (HCT) were measured. Intraoperative blood loss measurement was standardized. Postoperative blood loss was recorded for 24 hours. Unpaired t test, Mann Whitney and Fisher's exact tests were used for analysis as appropriate.

Results and Discussions: Data presented as Mean ± SD. The groups were similar except for intraoperative blood loss (Table). Blood transfusion was not required in either group.

	Group P(n = 24)	Group M(n = 24)
Age (years)	67 ± 10	66 ± 11
Weight (kg)	78 ± 16	75 ± 12
Pre Hb (g/dl)	13.5 ± 1.0	13.0 ± 1.6
Post Hb (g/dl)	10.6 ± 1.3	11.0 ± 1.3
Pre HCT (l/l)	0.404 ± 0.024	0.388 ± 0.048
Post HCT (l/l)	0.310 ± 0.067	0.329 ± 0.038
Intraop BL (ml)	351 ± 123	279 ± 92*
Postop BL (ml)	395 ± 197	410 ± 158
Total BL (ml)	748 ± 257	690 ± 187

(*P = 0.015. BL = Blood Loss)

Conclusions: PCB does not reduce blood loss after THA when compared with equivalent analgesia. While ITM use reduces intraoperative blood loss by 70mls, the clinical insignificance of this amount is confirmed by the absence of differences in postoperative haematological parameters.

References:

1 Stevens RD, Van Gessel E, Flory N, et al. *Anesthesiology*. 2000;93:115–21.
2 Souron V, Delaunay L, Schifrine P. *Can J Anaesth.* 2003;50:574–9.

A-444

The effect of psoas compartment block on postoperative blood loss after primary total knee arthroplasty

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Background and Goal of Study: Psoas compartment block (PCB) reduces blood loss after total hip arthroplasty possibly as a result of superior analgesia (1,2). Whether PCB has similar benefits for total knee arthroplasty (TKA) on postoperative blood loss is unknown.

Materials and Methods: As part of a prospective audit comparing two anaesthetic techniques for blood loss after primary TKA, data from forty-six patients were reviewed. Anaesthesia consisted of bupivacaine spinal anaesthesia with either intrathecal morphine (ITM), (Group M) or PCB (Group P) for postoperative analgesia. IRB approval was waived. The same surgeon performed all surgery. TKA was performed using a tourniquet intraoperatively. Pre- and postoperative haemoglobin (Hb) and haematocrit (HCT) were measured. Postoperative blood loss was recorded for 24 hours. Unpaired t test, Mann Whitney and Fisher's exact tests were used for analysis as appropriate.

Results and Discussions: Data presented as Mean ± SD. The groups were similar except for patient weight (Table). Two units of packed red cells were transfused in Group P and three units were transfused in Group M (P = 1.0).

	Group P(n = 19)	Group M(n = 27)
Age (years)	70 ± 7	69 ± 9
Weight (kg)	85 ± 14*	71 ± 9
Pre Hb (g/dl)	13.8 ± 1.1	13.7 ± 1.4
Post Hb (g/dl)	10.5 ± 0.8	10.5 ± 1.3
Pre HCT (l/l)	0.418 ± 0.027	0.412 ± 0.032
Post HCT (l/l)	0.318 ± 0.028	0.315 ± 0.035
Postop BL (ml)	771 ± 336	707 ± 353

(*P = 0.0002. BL = Blood Loss)

Conclusions: PCB combined with spinal anaesthesia for postoperative analgesia, does not reduce blood loss after TKA. This may be because as compared to patient controlled morphine (1), ITM provides equivalent postoperative analgesia as PCB (3).

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A-445

Ultrasound-guided approaches to the ilioinguinal and iliohypogastric nerve: accuracy of a highly selective new technique confirmed by anatomical dissection

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Background and Goal of Study: Ilioinguinal (IN) and iliohypogastric (IH) nerve blocks may be used to diagnose chronic neuropathic groin pain or to provide perioperative analgesia for hernia repair. The present study describes a new ultrasound-guided approach to these nerves and determines its accuracy using anatomical dissection control.

Material and Methods: Thirty seven ultrasound-guided approaches to the IN and IH nerve were performed in 11 embalmed cadavers. After injection of 0.1 ml of dye the cadavers were dissected to evaluate needle position and colouring of the targeted nerves.

Results: Thirty three of the 37 needle tips were located at the exact target point, in or directly at the IN or IH nerve. In all these cases the entire nerve was coloured by the dye. In two of the remaining four cases parts of the targeted nerves were coloured and in the two others the needle tip was found 5 mm away from the uncoloured nerve. This corresponds to a simulated block success rate of 95%. In contrast to the standard "blind" techniques of inguinal nerve blocks the nerves were targeted 5 cm cranial to the superior anterior iliac spine where the nerves could be visualised accurately by ultrasound. The median (range) diameters of the nerves measured by ultrasound were: IN: 3.0 (2.0–4.0) × 1.6 (0.7–2.1) mm. IH: 2.9 (1.8–3.5) × 1.6 (0.5–3.0) mm. The IN nerve was found at a median distance of 6.0 (4.0–11.0) mm medial to the iliac bone reflex and the median distance between the two nerves was 10.4 (7.0–14.3) mm.

Conclusions: The anatomical dissections confirmed that our new ultrasound-guided highly selective approach to the IN and IH nerve is accurate. Thus, ultrasound could become an attractive alternative to the "blind" standard techniques of IN and IH nerve block in pain medicine and anaesthetic practice.

A-446

Association of lumbar plexus block and sciatic nerve block as alternative loco-regional technique to rachianesthesia for therapeutic knee arthroscopy

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Background and Goal of Study: As some adverse events of the rachianesthesia could cause unplanned hospitalization of ambulatory patients, some authors suggest general anesthesia for knee arthroscopy. Nevertheless, patients often request to watch the procedure. Since peripheral nerve blocks give excellent postoperative analgesia we have, here, evaluate the feasibility of an association of lumbar plexus block[1] (LPB) and sciatic nerve block[2] (SNB) for ambulatory arthroscopic meniscectomy (AAM) in our teaching hospital.

Materials and Methods: Forty-six ASA1–2 consecutive patients (aged 20–83 years, M:F ratio 1:1) scheduled for AAM and demanding loco-regional anesthesia were included in this study. Under light sedation, the patient laying on the side, a 100 mm isolated short-bevel needle (Stimuplex, B.Braun, Germany) and a neurostimulator were used to perform the SNB through the

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parasacral approach and the LPB through the posterior approach. Fifteen ml (SNB) and 25 ml (LPB) of lidocaine 1,5% with epinephrine 1:200000 were injected. The nerve block was considered unsuccessful when a surgical block was not achieved within 20 min.

Results and Discussions: In 39 patients (85%), the block was successful. For the 7 other patients, a general anesthesia had to be done. The reasons for failure were: accidental intravascular injection (1) and anxiety, pain felt under the tourniquet or at the medial side of the knee (5). In these later 5 patients the block was complete after surgery. Propacetamol and ketorolac were sufficient for every patient's adequate postoperative analgesia. Success rate of trainees (71%) was lower than senior anesthesiologist (88%, $p < 0,01$). All the patients could leave the One Day Clinic on time.

Conclusions: The success rate of SNB + LPB is acceptable and could be increased 1) if a longer onset time was accepted, 2) with appropriate training. The association of LPB and SNB is a suitable alternative for AAM in a teaching hospital.

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A-447

An anatomical study of the lumbar plexus and the psoas compartment in 95 cadavers

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Background and Goal of Study: Psoas compartment blocks for postoperative analgesia following total knee joint replacement may result in incomplete blocks even if accurate neurostimulation is applied. The underlying reasons have not clearly been identified. Anatomic dissections in small numbers of cadavers suggest intramuscular location within separated muscle folds. The purpose of the underlying study was to describe the relation of the lumbar plexus to the psoas muscle at the L4 level

Materials and Methods: In 95 formalin-fixed cadavers bilateral dissection of the lumbar region was performed by a ventral approach. The lumbar vertebrae and intervertebral discs of L5–L2 as well as the cranial border of the sacrum could be identified by dissection. The corresponding sites of the psoas muscles were marked in situ. Measurements were performed in situ on transversal and sagittal cross section dimension of both psoas muscles. The femoral (FEM), lateral cutaneus femoris (CFL) and obturator nerve (OBT) were marked. Then nerves were cut caudad to the muscles. Muscles were carefully separated from their insertion site at the spine and the fusion site with the iliacus muscle. The location of the corresponding nerves within or outside the muscles was studied with special regard to the L4 level.

Results and Discussions: Complete measurements were performed in 95 cadavers (46 female, 49 male, age 81 ± years, height 165 ± 9 cm, weight 58 ± 12 kg). Respective mean cross section dimension at the L4 level were 2.3 ± 0.5 cm (transversal) and 3.9 ± 0.8 cm (sagittal) for the left, and 2.4 ± 0.5 cm and 3.8 ± 0.7 for the right muscle. All diameters decreased with age. At the L4 level the FEM was located within the posterior part of the muscle in 71.6% and the CFL in 57.4% of the cadavers. In 19 muscles the FEM consisted of 2 branches, whereof 6 had an extramuscular course. The OBT never was located within the muscles and was covered by fat and connective tissue between vertebral bodies and psoas muscle. The CFL was divided in 2 portions, whereof 2 had an extramuscular course.

Conclusion(s): The course of the three nerves varies considerably at the L4 level. Nerves dividing into branches and differences in location either within or outside of the muscle may explain incomplete block during psoas compartment block due to anatomical barriers inhibiting local anaesthetic spread.

A-448

Efficiency of combined psoas compartment block and sciatic nerve block for total knee joint replacement

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Background and Goal of Study: Psoas compartment blocks (PCB) have been increasingly applied for intraoperative supplementation and postoperative pain relief following knee or hip surgery. In most cases PCB is performed in combination with general anaesthesia (GA). Therefore, little is reported concerning PCB and additional sciatic nerve block (SCB) for surgery. The purpose of the underlying study was to evaluate the efficiency and safety of PCB and SCB without additional GA for total knee joint replacement (TKJR) and to identify causes of block failure.

Materials and Methods: The records of 391 consecutive patients undergoing TKJR with tourniquet application in combined PCB and SCB were examined. All blocks were performed under the supervision of one of two anaesthetists, mostly by means of ultrasonic guidance with additional peripheral nerve stimulation (PNS). There were two analgesic regimen used: ropivacaine 0.5% 100 mg and mepivacaine 1% 200 mg or ropivacaine 0.375% 75 mg and prilocaine 1% 200 mg by personal preference of the anesthetist. If pain during surgery in the operated limb due to incision or from tourniquet occurred additional i.v. application of 1 μg/kg fentanyl was given. If pain persisted additional general anesthesia (GA) was performed. Need for additional GA or i.v. fentanyl was considered as block failure. Multivariate linear regression analysis was performed to identify causes of block failure.

Results and Discussions: Identification of the SCN was successful in all patients. In 2,5% of the patients identification of the lumbar plexus by PNS was not possible, hence alternative anaesthetic procedure was chosen. 2,3% of patients received additional intravenous opioid analgesia for moderate pain relief. 11,7% had pain during incision or due to tourniquet application and were converted to GA. Multivariate regression analysis ($r^2 = 0.161$) revealed the following risk factors for block failure: height (beta coefficient 0.245), duration of block performance (0.237), weight (0.184), history of rheumatism (0.118). The local anaesthetic used did not influence block success.

Conclusion(s): The combination of PCB and SCB allows TKJR without additional GA in 88,3% of cases. Technical difficulties during block performance in particular obesity as well as a history of rheumatism may predict block failure.

Pharmacology

A-449

The influence of sevoflurane on the antagonism effect of neostigmine for rocuronium-induced neuromuscular blockade

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Background and Goal of Study: Volatile anesthetics decrease the effect of neostigmine administrated for neuromuscular recovery. In addition, these effects differ among each volatile anesthetic (1). The aim of this study was to examine the effect of sevoflurane on the antagonism effect of neostigmine during the recovery period after administering rocuronium.

Materials and Methods: 65 adult patients were randomly allocated into 3 groups (Propofol, Sevoflurane, and Enflurane group). After induction, the continuous infusion of rocuronium was initiated when a twitch was noticed in accelomyography and the infusion rate of rocuronium was determined to maintain a 15 ± 5% twitch height. 20 $$/kg neostigmine and 0.2 mg glycopyrrolate were then injected. After injecting neostigmine, the initial twitch height, the maximum twitch height, the onset and duration of neostigmine were measured, and the antagonism effect was calculated as a percentage of the pre-existing twitch depression immediately before administering the neostigmine (2). All values are expressed as mean ± SD. ANOVA was used for statistical analysis.

Results: The maximum twitch heights and antagonism effects of the Sevoflurane and Propofol groups were larger than that of the Enflurane group (76.4 ± 15.3%, 73.6 ± 18.2%; 80.2 ± 18.8%, 76.2 ± 20.4% vs 56.2 ± 14.9%, 47.6 ± 17.0% $P < 0.001$) and the durations of the neostigmine effect were longer (70.0 ± 34.8 min; 80.7 ± 19.7 min vs 49.4 ± 15.4 min $P < 0.05$). The rocuronium infusion rate was significantly higher in the Propofol group than the other groups (10.3 ± 1.6 $$/kg/min vs 6.6 ± 1.3 $$/kg/min; 6.0 ± 1.3 $$/kg/min $P < 0.001$). There were no significant differences in the initial twitch height and the onset of neostigmine.

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Conclusions: The effects of sevoflurane on the antagonism effect and duration of neostigmine were less than enflurane, and there was no difference between sevoflurane and propofol except for the rocuronium infusion rate.

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A-451

Gender differences in the intubating conditions of rocuronium

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Background and Goals: There is increasing evidence for sex differences in the pharmacodynamics (PD) of anaesthetic drugs and neuromuscular blocking agents (NMBA), e.g. rocuronium (Roc; 1). The sensitivity of women to Roc was higher compared with men, requiring 30% less of the drug to achieve the same degree of neuromuscular block (2) and onset times were shorter. However, whether gender influences the intubating con-ditions (IntCond) after Roc and leads to an improvement of the IntCond in female patients (Pat) is unclear.

Materials and Methods: After Ethics Committee approval and informed consent, 60 female and 60 male Pat were randomised each in 2 groups (Gr) to receive Roc 0.6 mg/kg or succinylcholine (Sux; Control-Gr) 1.0 mg/kg. Induction: thiopentone (5 mg/kg), fentanyl (3 μg/kg), Roc (Roc-Gr) or Sux (Sux-Gr). 60s later, endotracheal intuba-tion(Int) was performed. Time of Int, difficulty of intubation (Cormack), and IntCond (3) were assessed. Stat: χ^2 test.

Results and Discussion: Men were significantly larger and heavier ($p < 0.001$) than women, but the body mass index was comparable (n.s.). Int time, and Cormack grades were comparable (n.s.). However, clinically acceptable (Clin accept; excellent and good) IntCond after Roc were significantly increased in the Female Gr compared to the Male Roc Gr: 80% vs. 47%, respectively; $p < 0.05$.

	Roc groups		Sux groups	
IntCond	Female (n = 30)	Male (n = 30)	Female (n = 30)	Male (n = 30)
Excellent	8†	5‡	18	16
Good	16*†	9	6	11
Poor	6*	16‡	6	3
Clin accept	24*	14 ‡	24	27

Values are numbers. $^{*}p < 0.05$ vs. Male Roc Gr; $^{\dagger}p < 0.05$ vs. Female Sux Gr; $^{\ddagger}p < 0.05$ vs. Male Sux Gr.

Conclusions: The IntCond after Roc were significantly better in women than in men, moreover it is an additional evidence for gender-related differences in PD. Thus, the incidence of clinically acceptable IntCond in the Female Gr was comparable with those in the Sux Gr (80%). The observed gender difference was related to Roc; the sex-related differences did not occur among the Control Gr.

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A-452

Muscle relaxation does not influence venous oxygen saturation during cardiopulmonary bypass surgery

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Background and Goal: We investigated whether the omission of a continuous infusion of neuromuscular blocking drug (NMBD) during cardiac surgery is associated with increased anaesthetic requirements, a higher incidence of intraoperative movement and increased oxygen consumption during CPB.

Materials and Methods: We compared two groups of patients planned for a cardiosurgical procedure with hypothermic CPB (28°C). Group 1 ($n = 15$) received a $3 \times ED_{95}$ bolus dose of cisatracurium at induction and thereafter no more NMBD. Group 2 ($n = 15$) received cisatracurium 0.15 mg kg^{-1} at induction; after 30 min a continuous infusion of cisatracurium was begun at a rate of 1 μg kg^{-1} min^{-1} before CPB, 0.75 μg kg^{-1} min^{-1} during CPB, and 1 μg kg^{-1} min^{-1} following CPB. Both groups had received a standardised anaesthetic with BIS-guided propofol TCI (BIS between 45% and 55%) and a remifentanil infusion steered by haemodynamic changes. Venous oxygen saturation (SvO_2) was continuously measured during CPB using the CDI 100 Hematocrit/Oxygen saturation monitoring system (Terumo, USA).

Results and Discussion: In group 1, 14/15 patients had a train-of-four (TOF) ratio >0.9 at the end of surgery. In group 2, 13/15 patients did not reach a TOF ratio >0.9 during registration in the operating room. A TOF ratio >0.9 was reached 56 ± 41 min after their arrival in the intensive care unit. Propofol consumption was 5.4 ± 1.7 and 4.4 ± 1.0 mg kg^{-1} h^{-1} in groups 1 and 2, respectively ($P = 0.07$). Remifentanil consumption was 0.15 ± 0.05 and 0.17 ± 0.05 μg kg^{-1} min^{-1} in groups 1 and 2, respectively ($P = 0.19$). During CPB, SvO_2 was 82% [76–85%] in group 1 and 81% [73–85%] in group 2 ($P = 0.53$). In groups 1 and 2, no patient recalled any intraoperative phenomena; none had moved or had diaphragmatic contractions. No SvO_2 below 65% was noted in either group.

Conclusion: Omitting the continuous administration of NMBDs during cardiac surgery did not increase the anaesthetic requirements. No intraoperative movements occurred, nor was there a decrease in SvO_2 during CPB. We suggest that the continuous maintenance of depth of anaesthesia and analgesia by propofol and remifentanil probably prevented muscular activity and hence decreases in SvO_2 during CPB.

A-453

Reversal by Org 25969 is not affected by sevoflurane compared with propofol

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Background and Goals: The modified γ-cyclodextrin, Org 25969, provides a novel approach to neuromuscular block reversal by quickly encapsulating steroidal neuromuscular blocking agents and preventing their action. This phase II trial was designed to study efficacy and safety of Org 25969 when used with either sevoflurane or propofol maintenance anaesthesia.

Materials and Methods: After Ethics Committee approval, 42 patients aged 19–82 years with ASA Class 1–3 were enrolled. Each subject received a dose of 0.6 mg/kg rocuronium after propofol induction. For maintenance of anaesthesia, subjects were randomized to receive propofol (n = 21) or sevoflurane (n = 21). At reappearance of T_2, 2.0 mg/kg of Org 25969 was administered as a single IV bolus. Anaesthesia was maintained until the end of surgery. Neuromuscular function was monitored and recorded using acceleromyography (TOF Watch SX). The primary endpoint was time from start of Org 25969 administration to recovery of T_4/T_1 to 0.9. A difference of ⩽1 min in recovery time was considered not clinically relevant. Equivalence between the 2 groups was considered to be demonstrated if the 2-sided 95% CI for the difference between the 2 groups was within the range −1 min to +1 min.

Results and Discussion: Mean recovery time from Org 25969 administration to T_4/T_1 ratio to 0.9 was 1 min 50 sec with propofol and 1 min 48 sec with sevoflurane for maintenance of anaesthesia. The estimated mean time difference between the groups was −1 sec with 95% CI (−28 to 26 sec), well within the predefined range for equivalence. No recurarization was observed. There were 13 (31%) subjects with ⩾1 AEs: 4 in the propofol and 9 in the sevoflurane group; 6 AEs were considered treatment related. All 10 serious AEs (n = 8, QTc prolongation) were reported with sevoflurane, none were considered treatment-related. All AEs, except one, were mild to moderate, and there were no discontinuations or deaths.

Conclusion: After 2.0 mg/kg Org 25969 at reappearance of T_2, recovery of the T_4/T_1 ratio to 0.9 was equivalent under propofol and sevoflurane maintenance anaesthesia. The safety profile in the former was somewhat more favourable.

A-454

Variability in the duration of action of Succinylcholine

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Background and Goal of Study: The short duration of action of Succinylcholine (SCh) is due to a rapid hydrolysis by pseudocholinesterase. It was questioned to be short enough to avoid severe hypoxia in a situation where ventilation and intubation are impossible. Therefore a dose reduction of SCh was suggested (1,2). The aim of this study was to determine the variability of duration of action of SCh in daily practice.

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Materials and Methods: All patients with a clinical indication for the use of SCh were included. After induction of anesthesia, time from administration of SCh 1 mg/kg to return of neuromuscular function was recorded. Relaxation was measured by tactile assessment of muscle response following train-of-four stimulation of the ulnar nerve. Induction drugs, dosage and a short medical history including indication for use of SCh was noted. Two groups were compared using Student t-Test and multiple groups using ANOVA.
Results and Discussions: A total of 495 patients mean age 54 yr (15–93 yr) from both sexes (46% males), mean weight 75 kg (35–145 kg), were included. ASA status was I in 5%, II in 49%, III in 43% and IV in 3%. Indication for use of SCh was gastroesophageal regurgitation in 45%, fasting time <6 h in 30%, peritonism in 16%, obesity in 4% and other 5%. Duration of action of SCh varied from 90–1800s (mean 497s). Higher ASA resulted in longer recovery time (435, 440, 560 and 678s for status I, II, III and IV respectively, $p < 0.001$). History of carcinoma or hepatic disease prolonged time to recovery (712s vs 494s, $p < 0.01$, and 642s vs 494s, $p < 0.05$). Metoclopramid had no significant influence on recovery time (537s vs 496s, n.s.).
Conclusions: Our results show a large variation in duration of action of SCh from 90 to 1800 seconds. ASA status and concomitant disease showed a significant influence on SCh duration of action. Such acquired deficiency of pseudocholinesterase activity, as well as genetic variations in this enzyme must be considered. Given the variability in pharmacokinetics of SCh a general dose reduction does not protect from over- or underdosage of this drug.
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A-455

Onset and duration of mivacurium-induced blockade in children with Charcot-Marie-Tooth disease

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Background and Goal of Study: The aim of this investigation was to compare the onset and the spontaneous recovery from mivacurium induced neuromuscular block (NMB) at the adductor polllicis (AP) and orbicularis oculi (OO) muscles in children with Charcot-Marie-Tooth (CMT) disease.
Materials and Methods: After obtaining approval of the local Ethic Committee the response to mivacurium was characterized in five children (ASA I, 6–11 yrs old) with CMT1. They were anaesthetised using propofol/fentanyl, the lungs ventilated with oxygen in air. After stable baseline signal a single bolus dose of 0.2 mg $\cdot$ kg^{-1} mivacurium was given over 15 sec. Neuromuscular transmission was monitored by acceleromyography (TOF Watch SX) simultaneously at AP and OO muscles using train of four stimulation with online data recording. Onset time and spontaneous recovery to 10%, 25%, 75% and 90% of baseline were obtained, and recovery time (RT) calculated. The study was done according to the consensus conference (1). Testing of plasma cholinesterase levels revealed normal values.
Results and Discussions: Lag time was 57 $\pm$ 13 sec and 34 $\pm$ 8 sec at AP and OO, respectively. Table 1 shows the time course of the response to mivacurium at AP and OO muscles. Overall, the documented response to mivacurium at AP is similar to data from children without neuromuscular disease (2). The recovery was faster at OO muscle. This is in accordance with data from adults (3). Remarkable is the recorded faster onset at AP compared to OO. This is in contrast to previous reports from patients without neuromuscular disease (3). Whether this finding indicates beginning involvement of hand muscles by CMT remains unclear.

Neuromuscular data (mean $\pm$ SD, s = sec, m = min)

Site	Onset	$T_1$25%	$T_1$90%	TOF90%	RT
AP	120 $\pm$ 34 s	13 $\pm$ 8 m	21 $\pm$ 11 m	24 $\pm$ 15 m	12 $\pm$ 10 m
OO	169 $\pm$ 50 s	10 $\pm$ 2 m	16 $\pm$ 3 m	19 $\pm$ 6 m	8.7 $\pm$ 5 m

Conclusion(s): In this small series mivacurium effected a normal response in children with CMT type 1.
References:
1 Acta Anaesthesiol Scan 1996; 40: 59–74
2 Acta Anaesthesiol Scan 2002; 46: 512–18
3 Br J Anaesth 2000; 85: 856–60

A-456

Predictability of rocuronium-induced neuromuscular block

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Background and Goal: Following bolus dose of rocuronium, the average duration of neuromuscular block until 25% recovery (clinical duration) can be predicted by the dose-duration relationship. However, interindividual variations in drug responses make such prediction less accurate for the individual patient. In the present study, we investigated the use of both the dose and its onset time to predict the duration of rocuronium-induced neuromuscular block more precisely.
Material and Methods: Following local ethics committee approval and obtaining informed consent, 210 patients scheduled for elective surgery under general anaesthesia with tracheal intubation were randomly allocated into seven groups with different rocuronium doses administered (0.30; 0.45; 0.60; 0.75; 0.90; 1.05; 1.20 mg $\cdot$ kg^{-1}, respectively). After setting up neuromuscular transmission monitoring (Datex-Ohmeda S/5 Anaesthesia Monitor with NMT module, ulnar nerve stimulation, TOF pattern, electromyographic evaluation of evoked response of the adductor pollicis muscle), tracheal intubation was performed after 80% depression of T_1. For each consecutive patient the onset time for 95% effect and the length of clinical duration were determined. Statistical analyses were performed by simple and multiple linear regressions (least-square method) to predict clinical duration for different values of the independent variables (dose and onset time). The squared correlation coefficient (r^2) was used as the primary criterion for evaluation of the relevant model.
Results: The duration of action was better predicted by dose ($r^2 = 0.64$) than by onset time ($r^2 = 0.54$). The predictability was improved by a multiple regression model of these variables ($r^2 = 0.71$). The explanatory power was best when using the logarithm of clinical duration as the dependent variable ($r^2 = 0.74$).
Conclusion: The duration of rocuronium-induced neuromuscular blockade can be predicted more accurately by the combined use of dose and onset time than by dose (or onset time) alone.
Reference:
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A-457

Neuromuscular block induced by rocuronium and reversed by the encapsulating agent Org 25969 can be re-established using the non-steroidal neuromuscular blockers succinylcholine and cis-atracurium

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Background and Goal of Study: Org 25969 is a reversal agent which acts by a new mechanism: encapsulation of steroidal neuromuscular blocking agents. After reversal of rocuronium-induced neuromuscular block by Org 25969, there will be a short period during which a second administration of rocuronium will have a variable effect. Aim of this study is to determine whether the non-steroidal neuromuscular blocking agents succinylcholine and cis-atracurium can be used in these circumstances, since these to agents are not encapsulated by Org 25969.
Materials and Methods: Male guinea pigs were deeply anaesthetised with urethane and artificially ventilated. Single twitch M. gastrocnemius contractions were induced by electrical stimulation of the sciatic nerve. Catheters were placed in the jugular vein and carotid artery for intravenous drug administration and blood pressure measurements.
Results and Discussions: Bolus administration of 429 ng/kg rocuronium resulted in complete neuromuscular block, which was completely reversed with 500 nmol/kg Org 25969. Three minutes after complete reversal, the animals received 650 nmol/kg succinylcholine (n = 4), 180 nmol/kg cis-atracurium (n = 4) or 429 nmol/kg rocuronium (n = 4). Succinylcholine caused complete block with a slightly delayed onset (ref 1) (3.0 $\pm$ 0.2 min vs. 1.2 $\pm$ 0.5 min in untreated group; mean $\pm$ SEM) and a normal speed of recovery.

Cis-atracurium caused complete block with normal speed of onset (2.0 $\pm$ 0.5 vs 8.3 $\pm$ 3.5 min in untreated group) and normal speed of recovery.

Rocuronium caused variable degrees of neuromuscular block, ranging from no block to 97% block. However, when rocuronium was administered 30 min after administration of Org 25969, complete block could be induced in all animals
Conclusion: When re-intubation is required immediately after administration of Org 25969, the non-steroidal neuromuscular blocking agents succinylcholine and cis-atracurium are still able to induce neuromuscular block, since they are not encapsulated by Org 25969.
Reference:
1 Can. J. Anaesth., 1997, 44(11): 1144–1147

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A-458

Reversal of high-dose rocuronium with Org 25969

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Background and Goals: Org 25969, a cyclodextrin derivative, is an effective agent for reversing rocuronium (ROC) induced neuromuscular block in animals and humans [1,2,3]. The objective of this study was to evaluate the dose response relationship of Org 25969 given for reversal of high-dose ROC (1.0 mg/kg) induced neuromuscular block.

Materials and Methods: Following ethics committee approval, 87 ASA 1–3 patients (aged 18–80 yrs) consented to participate in this phase II multicentre trial. Neuromuscular block was measured accelero-myographically (TOF-Watch® SX). T4/T1 ratio values were used for analysis. Each patient received 1.0 mg/kg ROC for intubation, followed 3 (n = 59) or 15 (n = 27) min later by placebo or 2.0, 4.0, 8.0, 12.0 or 16.0 mg/kg Org 25969. The efficacy and safety (i.e. adverse events, vital signs, and EKG) of Org 25969 were studied. The primary end-point was the time from administration of Org 25969 until recovery of the T4/T1 ratio to 0.9.

Results: The table shows the recovery times (min:sec) of the T4/T1 ratio to 0.9 following different doses of Org 25969, given in mean (SD).

Dose Org	3 min after ROC	15 min after ROC
Placebo	108: 26 (31:10)	127: 22 (92:46)
2.0 mg/kg	44: 44 (22:11)	8: 32 (1:07)
4.0 mg/kg	6: 56 (2:52)	5: 28 (3:08)
8.0 mg/kg	2: 24 (1:10)	1: 51 (0:33)
12.0 mg/kg	2: 25 (2:07)	1: 47 (0:52)
16.0 mg/kg	1: 46 (1:08)	0: 56 (0:08)

In total 6 serious adverse events were reported. None were considered related to Org 25969. No recurarization was observed.

Conclusion: Org 25969 is well tolerated and has a good safety profile. Profound neuromuscular block after high-dose ROC (1.0 mg/kg) was on average reversed within 2.5 min for doses of 8.0 mg/kg Org 25969 or higher. A clear dose-response relationship in the time to recovery of the T4/T1 ratio to 0.9 was determined for both time points of administration.

References:

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2 Gijsenbergh F, et al. Anesthesiology 2002; 96: A1008
3 Sorgenfrei I, et al. Europ J Anaesth 2004; 21: A571

A-459

Model-independent calculation of k_e0 values

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Background and Goal of the Study: The k_{e0} value is the first order rate constant determining the efflux from the effect compartment. Normally, a fractional sigmoid E_{max} model is used for estimating individual k_{e0} values. Up to now no model-independent method was available to estimate k_{e0} for increasing and decreasing anaesthetic drug concentrations. In this study we calculated model-independent k_{e0} values for isoflurane (Iso), sevoflurane (Sevo) and desflurane (Des). The Bispectral index (BIS XP, Aspect, USA) and the Narcotrend index (MonitorTechnik, Germany, version 4.0) were used as electroencephalographic measures of the drug effect.

Methods: With IRB approval and written informed consent we investigated 45 patients (15 each group) scheduled for a radical prostatectomy. After lumbar epidural catheterisation, patients received remifentanil and propofol solely for induction of anaesthesia. Thereafter, epidural analgesia was initiated, and iso-, sevo- or desflurane were added to maintain unconsciousness. At least 45 min later, end-tidal concentrations were varied between 0.5 and 2 MAC. We estimated an individual k_{e0} value for each patient using prediction probability (P_K). The computations were performed on a spreadsheet using the Excel 2000 software program (Microsoft, USA), the k_{e0} value was optimized to maximize the P_K value to predict EEG indices versus effect site concentrations. Data are mean ± SD with $P < 0.05$ indicating statistical significance.

Results:

	Bispectral Index		Narcotrend Index	
	k_{e0}	P_K	k_{e0}	P_K
Iso	0.19 ± 0.09	0.69 ± 0.09	0.23 ± 0.12	0.69 ± 0.08
Sevo	0.23 ± 0.23	0.81 ± 0.04$^{\$}$	0.21 ± 0.10	0.84 ± 0.04$^{\$}$
Des	0.33 ± 0.22*	0.73 ± 0.05*	0.34 ± 0.19*§	0.77 ± 0.05$^{\#}$*

$^{\#}$Narcotrend vs BIS, $^{\$}$Sevoflurane vs Isoflurane,
* Desflurane vs Isoflurane, § Desflurane vs Sevoflurane

Conclusion: The k_{e0} value of Des is significantly higher than the k_{e0} values of Iso or Sevo. Prediction probability depends on the respective volatile anaesthetic.

A-460

Evaluation of predicted effect-site propofol concentration with conventional PK model during induction of anaesthesia

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Background and Goal of Study: The predicted concentrations of propofol at the time of loss of consciousness are used for investigation of concentration-effect relationship of propofol. However, a three-compartment pharmacokinetic model has limitations for describing initial distribution of propofol (1, 2). The goal of this study is to evaluate the predicted effect-site concentration of propofol during the induction of anaesthesia.

Materials and Methods: Twenty patients were randomly allocated to two groups according to the propofol target concentrations (10 patients each). They were premedicated with midazolam 0.02–0.05 mg kg^{-1} IM 30 min before the induction of anaesthesia. After the dose of fentanyl 1–2 μg kg^{-1}, propofol TCI was commenced at a target plasma concentration of 3 μg ml^{-1} (L group) or 6 μg ml^{-1} (H group) using a target-controlled infusion pump (Diprifusor™, AstraZeneca). The effect-site concentration (Ce) of propofol at the time of loss of response to verbal command (LOR) and the time from the start of propofol infusion to LOR (Time to LOR) were recorded. The two-sample unpaired t test and chi-squired test were used for comparing continuous and categorical variables, respectively. P value less than 0.05 was considered significant.

Results: The patient demographic data, Ce at LOR, and Time to LOR (mean ± SD) are shown in the table.

	L group	H group	P value
Age (yrs)	50.3 ± 19.3	56.0 ± 18.8	0.511
Sex (male:female)	3:7	3:7	>0.999
Weight (kg)	56.3 ± 10.9	53.8 ± 8.5	0.574
Height (cm)	157.6 ± 10.6	158.1 ± 5.9	0.898
Ce at LOR (μg·ml^{-1})	0.51 ± 0.10	0.77 ± 0.18	<0.001
Time to LOR (sec)	49.2 ± 8.9	43.5 ± 7.8	0.145

Conclusion: It was suggested that the value of predicted effect-site concentration was inappropriate during the induction of anaesthesia, because there was a significant difference in Ce at LOR between the groups.

References:

1 Upton RN, Ludbrook GL, Grant C, et al. *Anesth Analg.* 1999;89:545–552
2 Krejcie TC, Henthorn TK, Niemann CU, et al. *J Pharmacol Exp Ther.* 1996; 278:1050–1057

A-461

Pharmacokinetics of isoflurane: elimination from body and brain

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Background and Goals: Our previous study has demonstrated the dynamic changes of inspiratory (CI), end-tidal (CE), arterial (A), pulmonary arterial (PA) and jugular bulb (J) isoflurane (iso) concentrations immediately after administering iso, but no study available shows the above changes after an iso vaporizer was shut down during emergence from anaesthesia in humans. The study was designed to look into iso elimination from the body in surgical patients.

Materials and Methods: Sixteen patients (aged from 48 to 78), undergoing coronary arterial bypass grafting surgery were enrolled in this study. At least 30 min before skin closure, 2% iso in 6 l of O_2 was given into an anaesthetic circuit under controlled ventilation. An iso vaporizer was shut down when skin was closed. 20 min before and 40 min after the operation was ended, blood was withdrawn from a radial artery, pulmonary artery, jugular bulb via 3 different catheters and was analyzed to determine iso concentration by a head-space gaschromatograph. Additionally, Cliso and CEiso were also measured with a multi-gas analyzer.

Results: The CEiso was decreased rapidly during washout time compared to Aiso, Jiso and PAiso. At the 30th and 40th min washout, CEiso/PAiso were 68% and 57%, respectively. There were no significant differences among Asi, Jiso and PAiso, but the absolute value of PAiso was the lowest during the 10th min to the 40th min washout time.

Conclusions: The study demonstrated the concentration-time profiles of Cliso, CEiso, Aiso, Jiso and PAiso before and after an iso vaporizer was closed.

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From these profiles, we found that CEiso is decreased more rapidly than Aiso, Jiso and Paiso and there is a relatively large gap existed between CEiso and Aiso, Jiso or PAiso. Thus, it should be taken account into if CEiso is considered to be an indicator of emergence from anaesthesia.

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Systematic curarisation is not essential during retroperitoneoscopy in urosurgery

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Background and Goal of Study: Systematic curarisation is recommended during laparoscopy to facilitate abdominal distension and ensure low respiratory pressure. This study aim was to evaluate benefit of curarisation in laparoscopic (Lp) and retroperitoneoscopic (Rp) urosurgery.

Materials and Methods: We planned to study 2 groups of 20 patients operated by Rp or Lp. Anaesthesia and intubation were achieved with midazolam, propofol, sufentanil and maintained by isoflurane (0,6 MAC), and sufentanil (0,2–0,4 μg/kg/hour). Atracurium (0,5 mg/kg) was only injected 30 min after insufflation. Ventilation was controlled (O2:N_2O = 50:50) with a tidal volume (Vt) of 8 ml/kg and a respiratory rate adapted to obtain $PetCO_2$ between 30–35 mmHg before insufflation. Peak, mean and plateau inspiratory pressures, $PetCO_2$, mean arterial pressure, and train of four were recorded before insufflation and every 15 min after. The static compliance (Cst) and CO2 production (VCO_2) were calculated:

$$\textbf{Cst} = \text{expired Vt/Inspiratory Plateau P.}$$

$$\textbf{VCO}_2\ (\text{ml/kg/min}) = \frac{PetCO_2\ (\text{mmHg}) \times \text{Vm (ml)}}{(\text{Pbarometric} - PH_2O)\ \text{mmHg} \times \text{Weight(kg)}}$$

Results and Discussions: Lp group was interrupted after 8 patients because of the difficulties expressed by the surgeon in realisation of pneumoperitoneum for 2/8 patients. In Rp group, only two patients out of 20 required curarisation before insufflation to facilitate space dissection. For the other 18 patients, after curarisation, the compliance remained unchanged and the VCO_2 continued to increase.

		15 min	30 min	15 min	30 min
Rp (n = 18)	Before	After Insufflation		After Curarisation	
CO_2 ml/min/kg	3,95	4,58	4,68	4,98*	5,20*
Δ VCO_2 %		+16,1		+6,5	
Cst ml/cmH_2O	32,2	26,5	25,3	27,4	27,3
Δ Cst %		−17,8		+8,3	

* $p < 0{,}005$ vs 30 min after insufflation, (student t test)

Conclusion: Insufflation and space dissection were satisfactorily performed in 90% of the patients operated by Rp and without any difficulty in ventilation. Curarisation at the 30th minute did not improve Cst. Systematic curarisation is not essential during Rp in urologic surgery.

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Concentration-dependent instability of propofol in whole human blood

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Background and Goal of Study: Propofol is strongly associated with both plasma proteins and blood cell constituents[1], therefore quantification in whole blood is recommended. We developed a novel solid phase extraction procedure for extracting propofol from whole blood prior to analysis by high performance liquid chromatography with fluorescence detection. The assay requires only 100 μL of whole blood and hence is suitable for the determination of propofol concentrations in vulnerable patient groups. The assay was used to investigate propofol stability in whole blood during refrigerated storage.

Materials and Methods: Whole human blood was spiked to six clinically relevant concentrations (ranging from 0.1 to 8 $\mu g\,mL^{-1}$) and stored in a refrigerator (4–5°C). Propofol quantification was performed immediately prior to storage. Quantification was repeated after one day of storage, at weekly intervals for up to six weeks of storage, and after 8 and 12 weeks of storage.

Results and Discussion: At concentrations of 2 $\mu g\,mL^{-1}$ and below, the mean rate of propofol loss was less than 1 ng per day and the slope of the regression lines were not significantly different from zero ($p > 0.4$). However, propofol loss from high concentration samples was significant ($p < 0.01$). The respective mean rates of propofol loss at 4 and 8 $\mu g\,mL^{-1}$ were 6 and 9 ng per day respectively (95% confidence intervals: 3 to 10, and 3 to 14).

Conclusion: The stability of propofol in whole blood during refrigerated storage was found to be significantly dependent on the propofol concentration. The data obtained in this study suggest that propofol quantification should be performed as soon as possible after sample collection, and for samples likely to contain high concentrations of propofol (>2 $\mu g\,mL^{-1}$) certainly within six weeks.

Reference:

1 Dawidowicz AL, Fijalkowska A, Nestorowicz A *et al.* Biomed Chromatogr 2001; 15: 408–12

A-466

Comparison of two propofol doses for intubation without myorelaxant using remifentanil

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Introduction: Orotracheal intubation without myorelaxant could be attractive especially in the event of myorelaxant allergy. However an incomplete opening of the vocal cords or the occurring of a motor response can increase the risk of laryngeal trauma. Our objective was to compare intubation conditions depending on the initial dose of propofol, associated with remifentanil.

Material and Methods: This prospective study was carried out on 80 patients ASA 1 or 2 allocated randomly in two groups. The initial dose of propofol was 2.5 mg/kg ($P_{2.5}$ group) or 3 mg/kg (P_3 group) infused during one minute. Remifentanil was associated at 1 mcg/kg during 30 sec then 0.5 $mcg \cdot kg^{-1} min^{-1}$ (2 mcg/kg as total dose before intubation). The patients were intubated 2 min after the end of propofol administration. In case of incorrect conditions for intubation, the patients received one or several other injections of propofol (0.5 mg/kg). The intubation conditions were evaluated using Scheller's criteria (1) (mask ventilation, inferior jaw mobility, glottis exposure, vocal cords opening, and motor response at intubation time).

Results: All patients were intubated without myorelaxant. There was no significant difference between the two groups in terms of mask ventilation, inferior jaw mobility, glottis exposure. 11 patients in the $P_{2.5}$ group (27.5%) received one or several additional injections of propofol whereas none in the P_3 group ($p = 0.0003$). Despite this dose increase, 22 patients of $P_{2.5}$ group (55%) had motor response whereas only 5 (20%) in the P_3 group ($p = 0.002$).

Conclusion: The association propofol-remifentanil allows intubation without myorelaxant in good conditions. However, an initial dose of 3 mg/kg of propofol was necessary in order to limit the risk of motor response and an eventual laryngeal trauma. These results suggest that the use of a single initial bolus infusion of 3 mg/kg of propofol is more efficient than 2.5 mg/kg with eventual additional injections for intubation without myorelaxant.

Reference:

1 Scheller MS. Anesth Analg 1992; 75: 638–640

A-467

Onset of neuromuscular block and intubating conditions one minute after administration of rocuronium bromide in different regiments. The value of the priming technique

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Background and Goal of Study: The onset time of an intubating dose of Rocuronium is faster than that of all available nondepolarizing neuromuscular blocking agents, this being close related with the rate of development of adequate intubating conditions. Various studies have shown that administration of "priming" doses of Rocuronium is not necessary for the induction of good to excellent intubating conditions at 60 sec., nor not it decreased the onset time.

The goal of this study was to compare intubating conditions that are achived using priming technique and different doses of rocuronium.

Materials and Methods: The study was prospective (1.05.2004–1.12.2004) and included 167 patients with ASA I–II, scheduled for abdominal surgery under general balanced anesthesia. After induction of anesthesia with Fentanyl (3 μg/kgc) and Propofol (1.5–2 mg/kgc) three groups of patients received 0.6 mg/kgc of rocuronium (group 1, *n = 61*), 0.6 mg/kgc of rocuronium with a priming dose (group 2, *n = 57*), and 0.9 mg/kgc (group 3, *n = 49*). Intubating conditions at 60 sec. after the administration of the bolus of rocuronium were assessed by a clinical intubating score – excellent (1) to impossible (4). Neuromuscular function was evaluated using the TOF values measured at 45 sec. 60 sec. and 90 sec. after administration of rocuronium.

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Intubating scores of the three groups were compared using nonparametric statistical tests (Mann-Withney).

Results and Discussions: All three doses induced good to excellent clinical conditions of intubation at 60 sec. after administration of rocuronium: (Group 1 mean = 2.26, SD = 0.95; group 2 mean = 1.74, SD = 0.81; and group 3 mean = 1.69, SD = 0.90) with significantly better scores in groups 2 and 3 versus group 1 ($p = 0.002$ respectively $p = 0.001$). The TOF values measured in group 2 were significantly smaller then those in group 1 at 45 and 60 sec. ($p < 0.0001$, respectively $p = 0.003$) and were similar with group 3 at 60 sec. ($p = 0.757$).

Conclusion(s): Standard doses (0.6 mg/kgc) of rocuronium given with priming technique can achieve within 1 min. intubating conditions as good as those induced with the high dose (0.9 mg/kgc), and still avoiding the longer clinical duration of this latter.

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Rocuronium valoration as an indicator of the hepatic function during the vascular reperfusion of the hepatic graft: effect of changing the order of the vascular clamp release

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Background and Goal of Study: Effect of rocuronium is directly related to the plasmatic concentration that depends on the bleeding, blood volume changes and hepatic metabolism. Several studies have suggested it might be used to assess liver function during liver transplantation. The goal of our study was to demonstrate the variations in rocuronium pharmacokinetics and pharmacodynamics when the order of the vascular clamp release at reperfusion of the hepatic graft was changed.

Materials and Methods: After excluding patients with neuromuscular diseases, acute hepatic failure, renal failure and amyloidosis, thirty patients were randomised in two groups. One group (n = 15) where portal vein was released first and the other (n = 15) where hepatic artery is released first. Anaesthesia was induced with an intravenous bolus of rocuronium of 1 mg/kg of ideal weight. After 15 min. a rocuronium infusion was initiated at 0.3 mg/kg/h. Changes of ±0.05 mg/kg/h were done to maintain response for the first stimulus of the train of four between 10 and 25% of the control. We measured rocuronium plasmatic concentration at induction, at the anhepatic phase, after the first and second reperfusions, 60 min. after and at the end of surgery.

Results and Discussions: There were no statistical differences in the patients-demographic characteristics neither in the degree of hepatic failure. There were no differences between groups in rocuronium needs in the phases of the proceeding. Rocuronium plasmatic concentrations of eleven patients are shown in the table (mean ± SD, *$p < 0.05$, non-parametric tests).

Plasmatic Values	Artery1st n = 5	Portal1st n = 6
After induction (ng/ml)	2041 ± 394	2921 ± 957
Anhepatic phase	2379 ± 425	2300 ± 523
After 1st reperfusion	2053 ± 631	1897 ± 843*
After 2nd reperfusion	1670 ± 635	1820 ± 494
60 min. later	1318 ± 966	1735 ± 911
End of surgery	995 ± 375	918 ± 360

Conclusion(s): During portal reperfusion, sudden blood volume variation did affect rocuronium plasmatic concentrations in both groups. At the end of the procedure rocuronium plasmatic concentrations might be related to graft metabolism.

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Renal effects of magnesium sulphate after supraceliac aortic unclamping in experimental dogs

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Background and Goals: Intravascular administration of magnesium (Mg) causes vasodilation (1) and increases renal blood flow (2). We hypothesize that Mg might effectively augment renal perfusion, and prevent renal dysfunction following cross clamping of the aorta.

Materials and Methods: We compared 14 dogs, 7 control group (C) and 7 Mg group. In the Mg group, 30 mg/kg $MgSO_4$ was injected over 3 minutes as a bolus immediately prior to unclamping the supraceliac aorta and thereafter as an infusion (10 mg/kg/h). Renal vascular resistance (RVR), renal cortical blood flow (RCBF), renal oxygen delivery (R-DO_2), and renal function were measured at 1 and 6 hours after aortic unclamping.

Results: Data (mean ± SD) are shown in the table:

		Baseline	Unclamp-1	Unclamp-6
RVR (dyn·s/cm^5)	C	59.6 ± 14.6	110.9 ± 48.5*	92.7 ± 29.2*
	Mg	67.3 ± 24.5	72.9 ± 34.6	70.9 ± 10.8
RCBF (ml/min/100 g)	C	57.0 ± 11.9	44.7 ± 22.1	40.0 ± 11.3*
	Mg	66.3 ± 24.3	57.3 ± 27.1	90.4 ± 43.6†
R-DO_2 (mL/min)	C	23.2 ± 4.4	14.0 ± 2.6*	11.8 ± 3.4*
	Mg	25.1 ± 7.9	16.8 ± 4.3*	17.6 ± 3.6†
Renin activity (ng/mL)	C	7.46 ± 1.44	–	10.24 ± 4.06
	Mg	7.96 ± 1.11	–	10.64 ± 4.95
Creatinine (mg/dL)	C	0.78 ± 0.07	–	0.84 ± 0.24
	Mg	0.84 ± 0.21	–	0.92 ± 0.24
Cystatin-C (mg/L)	C	0.13 ± 0.01	–	0.12 ± 0.03
	Mg	0.13 ± 0.04	–	0.10 ± 0.02

*$P < 0.05$ vs baseline; †$P < 0.05$ vs group C.

Conclusions: Mg infusion attenuates the increase in RVR and the decrease in R-DO_2, and improves RCBF after aortic unclamp in dogs. However, despite these beneficial effects, we did not observe any improvement in renal function when Mg was administered after supraceliac aortic unclamp.

References:

1 James MF. *Anesth Analg* 1992; 74: 129–136.
2 Nadler JL, Goodson S, Rude RK. *Hypertension* 1987; 9: 379–383.

A-471

Xenon acts by inhibition of glutamatergic neurotransmission in Caenorhabditis elegans

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Background and Goal of Study: The mechanism of action of the anesthetic gas xenon is ill-defined. In vitro electrophysiological studies implicate antagonism of several types of postsynaptic ion channels, the most prominent of which is the NMDA subtype glutamate receptor[1], as potential mechanisms of action. We have previously provided genetic evidence that nitrous oxide (N_2O), an anesthetic gas similar to xenon, acts through inhibition of the NMDA receptor in vivo[2]. The goal of this study was to determine the behavioral effects of xenon in the nematode C. elegans and furthermore to test the hypothesis that the main mechanism of action of xenon is through inhibition of NMDA subtype glutamatergic neurotransmission.

Materials and Methods: Well-fed one-day post-L4 adult *C. elegans* animals were transferred by platinum wire to agar pads with no bacteria; the pads were placed into glass chambers containing either a 75%:25% xenon:O_2 mixture or air. After a 10-min incubation period, locomotion was scored over a seven-minute period. At least 10 animals were scored for each data point or strain.

Results and Discussions: Xenon produced behavioral effects similar to those seen with N_2O. Like N_2O but unlike volatile anesthetics, xenon did not affect gross locomotion but markedly changed the character of movement. Xenon greatly reduced the frequency of reversals of direction of movement in wild-type worms, an unusual behavioral effect otherwise only seen in worms with reduced glutamatergic neurotransmission. The EC_{50} for xenon was 19% ± 0.9%. Surprisingly, a mutant lacking the NMDA receptor NMR-1 was normally sensitive to xenon whereas being resistant to N_2O. However, a non-NMDA receptor null mutant *glr-1(ky176)*, which is sensitive to N_2O, was not affected by and thus resistant to xenon.

Conclusion(s): Our findings show that the main mechanism of action of xenon in C. elegans is by inhibiting glutamatergic neurotransmission. The sensitivity of the NMDA receptor null mutant to xenon argues that, unlike N_2O, xenon does not act through the NMDA receptor; rather a non-NMDA receptor is more central to xenon's action in C. elegans.

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A-472

Cyclooxygenase-2 expression in opioid-tolerant mice during CFA-induced monoarthritis

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Background and Goal of Study: Opiods are used in the management of chronic inflammatory pain in humans, but the development of tolerance

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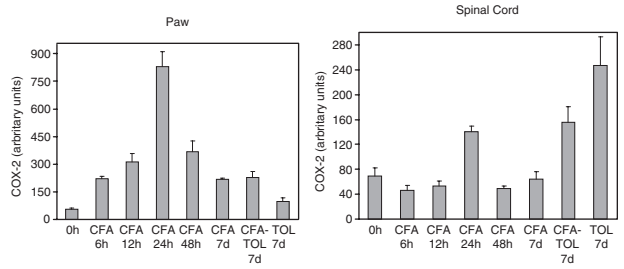
(TOL) is poorly characterised. Prostaglandins have been reported to play a role in the development of TOL [1]. Our aim was to determine COX-2 expression in mice with chronic monoarthritis chronically exposed to opioids.

Materials and Methods: After approval by the Animal's Ethic's Committee, monoarthritis was induced by the subplantar injection of CFA. Tolerance was obtained after the subcutaneous implantation of a 75mg morphine pellet, 4 days after CFA. COX-2 expression was assessed by western blot in the spinal cord (SC) and the inflamed tissue (paw) from 6 hours to 7 days after CFA, and in TOL and CFA + TOL animals at 7 days. ANOVA was used for the statistical analysis.

Results and Discussion: In the paw, COX-2 expression was increased 15-times 24 h after inflammation ($p < 0.001$) but no changes were observed in TOL mice. In the SC, COX-2 expression increased 2-fold 24 h after inflammation ($p < 0.001$) and returned to basal values at 48 h. In the same tissue, TOL significantly increased COX-2 expression ($p < 0.002$) in controls (7 days), but not in CFA-tolerant mice. Results are expressed as mean values and vertical bars indicate the standard error.



Conclusions: Our results show that chronic exposure to morphine significantly enhances COX-2 expression in the spinal cord, but not in peripheral tissues (paw).

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A-473

Xenon induced preconditioning involves increased HSP27 translocation and actin-HSP27 colocalisation

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Background and Goal: Xenon induces myocardial protection by pharmacological preconditioning (PC) in vivo[1]. We demonstrated that this mechanism involves increased phosphorylation of MAPK-activated protein kinase-2 (MAPKAPK-2) and HSP27 downstream of PKC-ε p38 MAPK[2]. The present study elucidated whether xenon induces HSP27 translocation to the particulate fraction and which protein-protein interactions between HSP27 and the actin cytoskeleton are initiated by Xe-PC.

Materials and Methods: Anaesthetised rats inhaled xenon (Xe-PC, n = 6) during three 5-min periods interspersed with two 5-min and one final 10-min washout period. Control rats (n = 6) remained untreated for 45 min. Additional rats were pretreated with the p38 MAPK inhibitor SB203580 (1 mg kg^{-1}) with and without anaesthetic preconditioning (each, n = 6). Hearts were excised for immunohistochemistry of F-actin stress fibers and tissue fractionation followed by Western blot of HSP27. HSP27 and actin co-localisation was investigated by co-immunoprecipitation. Statistical analysis: One-way ANOVA followed by Bonferroni's correction for multiple comparisons. Data are expressed as arbitray units of average light intensity (AVI, western blot), means ± SEM.

Results: Xenon increased the amount of HSP27 in the particulate fraction (2.3 ± 0.4 vs. 0.8 ± 0.2 in controls, $p < 0.05$). This translocation to the particulate fraction was blocked by the p38 MAPK inhibitor SB203580 (0.7 ± 0.2, $p < 0.05$ vs. Xe-PC). SB203580 alone had no effect on HSP27 translocation (0.9 ± 0.4, $p > 0.05$ vs. controls). Xe-PC increased F-actin polymerisation. Actin and HSP27 were co-localised after Xe-PC.

Conclusion: Xe-PC induces the translocation of HSP27 downstream of p38 MAPK. Moreover, actin and HSP27 are co-localised after Xe-PC, linking the cardioprotection by Xe-PC to the actin cytoskeleton.

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A-474

Beta-3-adrenoceptors are involved in beta-adrenoceptor signaling pathway dysfunction in diabetic cardiomyopathy

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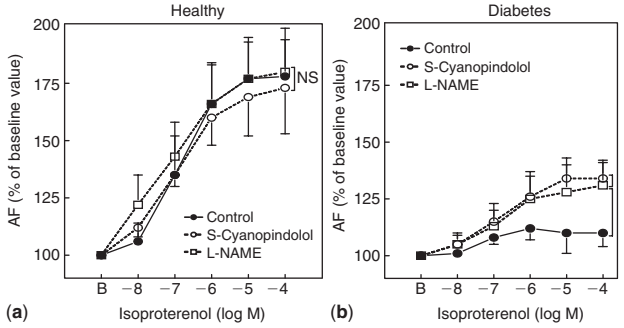
Background: Positive inotropic response to β-adrenoceptor stimulation is markedly altered in diabetic myocardium (1). Although down-regulation of β_1-adrenoceptors and up-regulation of β_3-adrenoceptors have been observed in diabetic cardiomyopathy (2), the effect of β_3-adrenoceptors stimulation remains unknown in diabetic cardiomyopathy.

Methods: Effect of β_3-adrenoceptor inhibition (directly by S-cyanopindolol or indirectly by L-NAME) on the inotropic responses of β-adrenoceptor stimulations (isoproterenol: 10^{-8} to 10^{-4} M) were studied, *in vitro* (Krebs-Henseleit solution, 29°C, pH 7,40, Ca^{++} 0,5 mmol, stimulation of 12/min), in papillary muscles of diabetic rats (four weeks after intravenous injection of streptozotocin). Maximum isometric active force normalized per cross-sectional area (AF) was measured and comparison between groups was performed using ANOVA.



Figures: Inotropic response to β-adrenoceptor stimulation in healthy (panel A) and diabetic (panel B) rats, under high load. S-cyanopindolol (β_3-adrenoceptor antagonist) and L-NAME (inhibition of NO induced by β_3-adrenoceptor stimulation) markedly restored the positive inotropic of β-adrenoceptor stimulation in diabetic rats. Data are mean percentages of baseline values ± SD (n = 8 in each group).

Conclusion: β_3-adrenoceptors play an important role in the dysfunction of β-adrenergic signalling pathway in diabetic cardiomyopathy.

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A-475

Changes in the viscosity of simple artificial phospholipid membrane by volatile anesthetics

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Background and Goal of Study: The mechanism of volatile anesthetics has been still controversial. In this study, we evaluated the direct effect of sevoflurane (sevo) and isoflurane (iso) on the simple artificial phospholipid membrane. For this, we measured the changes in the phospholipid membrane viscosity under various anesthetic concentrations by using fluorescene depolarization method.

Materials and Methods: The simple artificial phospholipid membrane was prepared from DPPC (Dipalmitoyl-L-α-Phosphatidylcholine). We set the volatile anesthetics solution at 0.1, 0.2, 0.5, 1, 2, 4 mM and assayed their concentration by gas chromatography. The 0.5 mM of sevo and iso corresponded to 5% and 2.8%, respectively. The phospholipid membrane viscosity was estimated by calculated phase transition tem-perature, which was measured by fluorescene depolarization method. The lower temperature means lower viscosity. We measured the changes in the viscosity under each concentration of both anesthetics by 20 times.

Results and Discussions: In the solution without anesthetics, the phase transition temperature of phospholipid membrane was 42 ± 0.17°C. The solutions with 0.1 and 0.2 mM anesthetics indicated no changes in phase transition temperature regardless of iso or sevo. In the solutions with anesthetics at

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0.5 mM and more, the phase transition temperature decreased to 40°C and below, which meant the lowering of the membrane viscosity.
Conclusion(s): In the clinical concentration of sevo and iso, viscosity of the phospholipid membrane was not almost changed. This result may support the recent findings that phospholipid membrane is not the major action site by volatile anesthetics.

A-476

Isoflurane enhances inactivation of A-type K channel current in rat substantia nigra

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Background and Goal of Study: The authors previously demonstrated that isoflurane (Iso) increased excitability in principal neurons in rat substantia nigra pars compact (SNc)[1]. We studied effects of Iso on voltage dependent K channels to clarify mechanisms of the increase in excitability in these neurons.
Materials and Methods: Voltage-clamp whole cell recording were made in rat midbrain slices in the presence of tetrodotoxin, cadmium, and bicuculline. We recorded the outward membrane currents in response to the depolarizing voltage steps from −120 mV and −25 mV. We isolated the transient outward current mediated through A-type K channels by subtracting the current traces following the prepulse of −25 mV from those following the prepulse of −120 mV. After baseline recordings were obtained, Iso groups were perfused with the solution bubbled with 1.5 and 3% Iso for 10 min before the recordings were made again, while control group received no Iso.
Results and Discussions: Although the amplitudes of the transient outward current were not different among the groups, exposure to Iso accelerated the decay of the transient outward current resulting in significant decreases in the time to 50% of the peak value (control 1.27 ± 0.19 of baseline, Iso 1.5 % 0.72 ± 0.27, Iso 3% 0.52 ± 0.1, mean ± SD). Analysis of the inactivation kinetics revealed that Iso delayed the recovery from inactivation without changing steady-state inactivation curves. Iso did not affect the non-inactivating outward current induced by depolarizing voltage steps from −25 mV.
Conclusion(s): These results indicate that Iso accelerated inactivation and delayed the recovery from inactivation of A-type K channels in principal neurons in rat SNc without affecting delayed rectifier K channels. These effects may contribute to excitation of these neurons and Iso-induced increase in spontaneous dopamine release reported in vivo before[2,3].
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A-477

Modulation of glycine receptors by phenol derivatives

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Background and Goal of Study: The important role of glycine receptors in modulating ascending nociceptive pathways and pain processing (1) makes them a potentially interesting target site for anti-nociceptive and spasmolytic agents. While phenol derivatives constitute a family of potentially neuromodulatory drugs (2), the only compound in clinical use at the present time is the anaesthetic propofol (2,6 diisopropylphenol). The aim of our study was to identify structural features in phenol derivatives that determine their modulatory effects at glycine receptors.
Materials and Methods: The effects of four methylated phenol derivatives and two halogenated analogues were studied on chloride inward currents via rat $\alpha_1\beta$ glycine receptors with standard whole-cell experiments. Receptors were heterologously expressed in HEK 293 cells.
Results and Discussions: All compounds investigated potentiated the effect of a submaximal glycine concentration (10 μM). While the degree of maximum potentiation of the glycine 10 μM effect in $\alpha_1\beta$ receptors was not different between the non-halogenated compounds, the halogenated compounds achieved half-maximum potentiating effects in the low μM range- at more than 30-fold lower concentrations compared with their non-halogenated analogues. Neither the number nor the position of the methyl groups significantly affected the EC_{50} for co-activation. When applied without glycine, only the bi-methylated compounds 2,6 and 3,5 dimethylphenol at concentrations >1000 μM directly activated $\alpha_1\beta$ receptors up to 30% of the maximum response evoked by 1000 μM glycine.
Conclusion(s): These results show that halogenation in the para position is a crucial structural determinant for the potency of a phenolic compound to positively modulate glycine receptor function while direct activation is only seen with compounds that carry at least 2 methyl groups.
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A-478

Ropivacaine attenuates lipopolysaccharide-induced monocyte chemoattractant protein-1 and matrix metalloproteinase-9 production in human monocytes

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Background and Goal of Study: Chemokines and matrix metalloproteinases (MMP) play important roles in inflammatory processes (1). The monocyte chemoattractant protein (MCP)-1 is a potent chemo-attractant for monocytes. Matrix metalloproteinases (MMP)-9 helps support the extravasation and infiltration of leukocytes through proteolysis of basement membrane and extracellular matrix(2). The aim of this study was to examine the effect of ropivacaine on lipopolysaccharide-induced MCP-1 and MMP-9 production, as well as MCP-1 induced chemotaxis by human monocytic cell line, THP-1.
Materials and Methods: Cultured THP-1 cells were incubated with LPS and/or ropivacaine (3×10^{-7} to 3×10^{-3} M). Enzyme-linked immunosorbent assay was used to examine the effect of ropivacaine on MCP-1 and MMP-9 synthesis, and their mRNA was examined using reverse transcriptase-polymerase chain reaction. Monocytes chemotaxis was determined by Micro chemotaxis plate. MMP-9 activity was examined by gelatin zymography.
Results and Discussions: Ropivacaine significantly inhibited the LPS-induced up-regulation of MCP-1, MMP-9 and their mRNA expression by THP-1 cells in a dose-dependent manner. MMP-9 activity was also attenuated by 100 μM–3 mM ropivacaine. Furthermore, we demonstrated that ropivacaine suppressed MCP-1 induced chemotaxis.
Conclusion(s): Our results suggest that ropivacaine may modulate inflammatory response, and this appears to be mediated to a significant inhibition of monocyte chemotaxis, as well as LPS-induced MCP-1, MMP-9 production and MMP-9 activity by human monocytes.
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A-479

Remifentanil but not sufentanil interacts with cerebral α_2-adrenoceptors in mouse brain

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Background and Goal of Study: α_2-adrenoceptor agonists and opioids share similar clinical effects such as analgesia and sedation. Especially for low potent opioids like meperidine and tramadol a specific interaction with cerebral α_2-adrenoceptors (α_2-AR) in rat brain has been demonstrated (1,2). The potent μ-opioid receptor agonist fentanyl does not show this interaction (1). Because it is still unknown whether or not different opioids of the 4-anilinopiperidine-series ("fentanyl-series") show possible α_2-AR-subtype-specifical interaction, we studied the effect of remifentanil and sufentanil on autoradiographically detected α_2-AR binding of [^{125}J]-paraiodoclonidine ([^{125}J]-PIC) in α_{2A}-, α_{2B}- and α_{2C}-knock-out (KO) mice brain.
Materials and Methods: With approval of the local animal care committee α_{2A}-, α_{2B}- and α_{2C}-AR-KO mice were sacrificed, brains removed and rapidly frozen to −70°C. Parasagittal brain sections of 15 μm were prepared using a cryostat. Total binding was determined by incubation of brain slices with 1 nM [^{125}J]-PIC. Unspecific binding was determined by addition of unlabeled clonidine at 200 μM and subtracted after autoradiography. Displacement of [^{125}J]-PIC from receptor binding was performed by incubation of brain slices in the presence of increasing concentrations of remifentanil and sufentanil. After removal of unbound radioactivity slices were attached to an autoradiography film for 3 days. Resulting autoradiograms were analysed densitometrically.
Results and Discussion: Sufentanil did not provoke any significant displacement of specifically bound [^{125}J]-PIC from α_2-AR in all sites of the

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mouse brain. In contrast, remifentanil was able to displace [^{125}J]-PIC dose dependently from all α_2-AR subtypes. At a concentration of 13 mM this displacement was almost complete. In α_{2A}-AR-KO-mice a reduced signal intensity of specifically bound [^{125}J]-PIC – according to the dominant role of this α_2-AR subtype – was seen but the displacement by remifentanil was comparable to α_{2B}- and α_{2C}-KO mice.

Conclusion: Our findings suggest that remifentanil but not sufentanil interact with all subtypes of α_2-AR in the central nervous system. This may indicate that clinical effects of remifentanil could be partially mediated by α_2-AR.

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A-480

Effect of abdominal surgery with or without vagotomy on tumor cells proliferation in rat

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Background: Immunosuppression in the perioperative period increases susceptibility to infectious complications and tumor cells proliferation (1). Vagus nerve plays a major role in immunomodulation and subdiaphragmatic vagotomy inhibits different acute phase responses (2). The present study evaluates the effect of a subdiaphragmatic vagotomy on surgery-induced tumor cells proliferation in a validated rat model of lungs metastases (3).

Material and Methods: Under sevoflurane anesthesia, adult male Wistar rats (n = 4–6 per group) underwent either a median laparotomy or a laparotomy associated to a subdiaphragmatic vagotomy. In all the rats as well as in a control group of unoperated animals, tumor cells (MADB106, from rodent mammary adenocarcinoma) were intravenously injected in the tail 5 hours after surgery as previously described (3). Three weeks later, animals were euthanazied and lungs removed to allow a count of surface metastases. Statistical analysis used ANOVA and posthoc test, $P < 0.05$ was significant.

Results: Pulmonary metastases counts are expressed in Table as mean ± SD (95% CI).

Controls	Abdominal incision	Abdominal incision and vagotomy
20.9 ± 14 (10.6–31.2)	51.3 ± 36.6 (20.7-81.8)*	107.5 ± 45 (60.6–154.4)**

*P < 0.05 with Controls; **P < 0.01 with control and abdominal incision groups.

Discussion and Conclusion: Association of vagotomy to abdominal surgery strongly potentiates the deleterious effect of surgical injury on tumor proliferation. Explanations might be related to the loss of immune control exerted by vagus nerve and maybe to the fact that vagotomy technique by itself involves a more invasive surgery.

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A-481

Effect of remifentanil on NMDA receptors in rat spinal cord: an electrophysiological study

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Background and Goal of Study: Remifentanil hydrochloride (Ultiva®) has been incriminated in direct N-methyl-D-aspartate (NMDA) receptors activation (1) whereas DAMGO, an other μ-opioïd, was described as a modulator of this receptor (2). Nevertheless, the involved mechanisms concerning remifentanil hydrochloride remain unclear. In the present study, direct activation of NMDA receptors and modulation of NMDA-induced current by remifentanil hydrochloride, with and without its vehicle glycine, were examined on neurons inside the lamina II from the dorsal horn of the rat spinal cord.

Material and Methods: whole cell patch-clamp recordings were performed on acute rats lumbar spinal cord slices. Considering that both components of Ultiva® (remifentanil hydrochloride and glycine) could be involved in NMDA receptors activation, experiments were performed first with 50 μM remifentanil hydrochloride, second with 3 mM glycine and third with Ultiva® containing 50 μM remifentanil hydrochloride plus 3 mM glycine. Modulation of NMDA receptors was examined with 3 μM remifentanil hydrochloride.

Results and Discussion: 22 cells were recorded. 50 μM remifentanil hydrochloride do not induce any current whereas 3 mM glycine induce a current that is abolished by the specific NMDA glutamate site antagonist D-2-amino-5-phosphonovalerate (APV). Ultiva® (50 μM remifentanil hydrochloride with 3 mM glycine as vehicle) also evokes an inward current that is abolished by APV and not significantly different from the glycine induced current (−96.42 ± 10.99 pA, n = 7 vs −94.53 ± 16.29 pA, n = 5, student's *t*-test, $p > 0.05$). Application of 3 μM remifentanil hydrochloride increases the NMDA-induced inward current by 61.3 ± 13% and this increase is abolished by the μ-opioid receptor antagonist naloxone.

Conclusion: remifentanil hydrochloride does not directly activate NMDA receptors. The NMDA current recorded after application of Ultiva® is related to the presence of glycine. Induced NMDA current is majored by application of remifentanil hydrochloride through a pathway involving the μ-opioid receptor.

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A-482

Effects of oxidative stress and propofol on the activity of glutamate transporter EAAC1 expressed in Xenopus oocytes

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Background and Goals: Although the mechanism of neuroprotective effect of propofol (PPF) is not clarified yet, recent reports suggest that it may be mediated by glutamate transporters.[1] In this study, we investigated whether oxidative stress by *tert*-butyl hydroperoxide (*t*-BOOH) decrease the activity of EAAC1, a neuronal subtype of glutamate transporter, expressed in *Xenopus* oocytes and whether PPF could recover it.

Materials and Methods: EAAT3 was expressed in *Xenopus* oocytes by injection of EAAT3 mRNA. After 3 day-incubation, *Xenopus* oocytes were exposed to 1, 2, 3, 5, and 10 mM of *t*-BOOH for 10 min. Using two-electrode voltage clamp, membrane currents were recorded after the application 30 μM L-glutamate. PPF diluted in Tyrode's solution to 30 μM was perfused at 4 mL/min over the oocytes preincubated in 5 mM *t*-BOOH. Responses were quantified by integration of the current trace and compared with control.

Results: Data (Mean ± SEM) are shown in the table. Each set of data has been normalized by using the mean value of the control group from the same batch of oocytes (n = 3 or 4).

t-BOOH conc.	Response
0 (control)	1.00 ± 0.06
1 mM	0.92 ± 0.08
2 mM	0.72 ± 0.06*
3 mM	0.66 ± 0.04*
5 mM	0.70 ± 0.05*
10 mM	0.57 ± 0.05*
5 mM + PPF 30 μM	0.97 ± 0.04

*$P < 0.05$ compared with control.
Data are mean ± SEM (n = 14–18).

Conclusions: Oxidative stress by *t*-BOOH decreased the activity of EAAC1, which was recovered by PPF. This effect of PPF may explain its neuroprotective property.

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A-483

Ketamine increases the intracellular magnesium concentration via Activation of mitogen-activated protein kinase in rat cardiac ventricular myocytes

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Background and Goal of Study: Magnesium is the second most abundant divalent cation in mammalian cellular systems and plays central roles in a multitude of biological processes. In the present study, we have investigated the effect of ketamine on the concentration of intracellular free Mg^{2+} concentration ($[Mg^{2+}]_i$) and signaling pathways which are responsible for the ketamine-induced modulation of the $[Mg^{2+}]_i$.

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Materials and Methods: We used the fluorescent dye, mag-fura-2-AM, to measure the intracellular free magnesium concentration ($[Mg^{2+}]_i$) in isolated rat cardiac ventricular myocytes. To determine the level of phosphorylation of the mitogen-activated protein (MAP) kinases, western analysis of threonine/tyrosine phosphorylated MAP kinases was used.
Results and Discussions: Ketamine increased the $[Mg^{2+}]_i$ in a dose-dependent manner with an EC_{50} of 266.61 ± 34.89 μM, and this was independent of extracellular Mg^{2+}/Na^+ or intracellular BAPTA-AM. The ketamine-induced increase of $[Mg^{2+}]_i$ was highly blocked by the pretreatment with (MAP) kinase inhibitors. Immunoblotting showed that ketamine induced the activation of MAP kinases (ERK1/ERK2, p38 MAP kinase) by increasing the level of phosphorylation of the MAP kinases.
Conclusion(s): These results suggest that ketamine increases $[Mg^{2+}]_i$ in rat cardiac ventricular myocytes, and the ketamine-induced increase of $[Mg^{2+}]_i$ might result from releasing Mg^{2+} from an intracellular pool through a MAP-kinase-involved pathway.

A-484

Dose-dependent neurotoxicity of amitriptyline in vitro

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Background and Goal of Study: Several reports suggest that tricyclic antidepressants (TCA) may be used topically to provide regional anesthesia and analgesia [1]. However, TCA may exhibit significant neurotoxic potential [1,2]. We therefore investigated clinically relevant doses [2] of amitriptyline as the prototype TCA in an established model of neurotoxicity *in vitro*.
Materials and Methods: Adult rodent dorsal root ganglion neurons were dissociated and treated with amitriptyline at 0 (control), 0.1 and 0.5 mM for 24 hours, followed by staining with anti-neurofilament antibodies. Neurons were evaluated with regard to survival and axon growth. Subsequently, we performed nuclear staining (Sytox) on neurons incubated with 0.1 mM amitriptyline, to detect cytotoxicity.
Results and Discussions: We found a dose-dependent toxic effect of amitriptyline. The average culture cell count as compared to controls (519 ± 191, n = 6) was decreased following incubation with amitriptyline 0.1 mM (211 ± 103, n = 5, $P < 0.05$) and 0.5 mM (11.5 ± 13, n = 6, $P < 0.001$). Likewise, the number of neurons exhibiting regular neurite outgrowth was diminished compared to controls (131 ± 77, n = 7) following incubation with amitriptyline 0.1 mM (58 ± 42, n = 6, $P = 0.06$) and 0.5 mM (0.8 ± 1, n = 7, $P < 0.05$). Sytox staining in neurons incubated with amitriptyline 0.1 mM was significantly increased as compared to control neurons ($P < 0.001$).
Conclusion(s): Amitriptyline causes a dose-related cytotoxic effect in neurons already at clinically relevant concentrations.
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A-486

Interaction of the CB1 agonist ACEA and propofol

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Background: ?9-tetrahydrocannabinol (THC) has among many other effects a sedative and an analgesic component. These effects are mediated by specific cannabinoid receptors. Specific cannabinoid receptor subtyp agonists and their interaction with i.v. anesthetics have not been investigated. Goal of this study was to investigate sedation and analgesia in an established mice model after aplication of propofol and ACEA.
Methods: Twenty SV 129 male mice received intraperitoneal (i.p.) injections with permission and according to the state laws of animal safety of propofol and the CB1 agonist ACEA. Sedation was monitored employing a rotating rod. A cut-off time of 60 s was defined as no sedation. Analgesic effects were determined by a tail flick unit with a cut-off time of 10 s to avoid tissue damage.
Results: After i.p. injection of 50 mg/kg of propofol a rapid onset of sedation was measured with a maximum after 2.5 min with 53 s on the rota-rod. There after sedation diminished until 7.5 min post injection, being abolished at this point. Propofol had no analgesic effect.

ACEA injection with 5 mg/kg lead to an increase in tail flick latncy with a maximum of 8.8 s after 15 min, baseline 3.9 s. The effect slowly deminshed and was abolished after ten hours. ACEA showed no significant sedation.

In the combinaion of both drugs propofol and ACEA rotating rod time was reduced to 7.4 s 5 min post injection. There after sedation diminished slowly until 45 min post injection, being abolished at this point.
Conclusion(s): The analgesic ACEA effect was not altered in combination with propofol. The depth as well as the duration of propofol sedation was augmented when combined with ACEA. The exact mechanism is not yet studied, but a possible interaction of cannabinoids with GABA neurons as been described (1) and might be an important future field of investigation.
Reference:

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A-487

Sevoflurane activates the p38 mitogen-activated protein kinase in human t-lymphocytes in vitro

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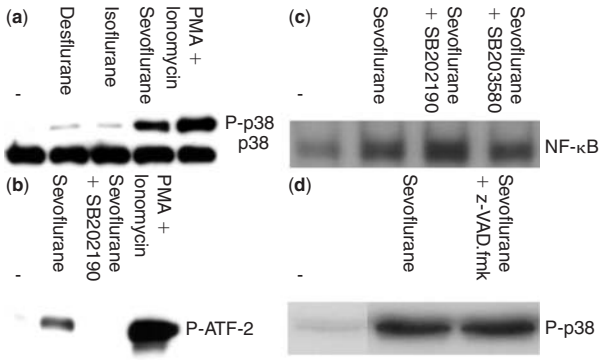
Background and Goal of Study: Sevoflurane (SEVO) is believed to mediate cytoprotective preconditioning, a process involving "Mitogen Activated Protein Kinases" (MAPK).[1,2] The aim of this study was to determine whether SEVO is able to induce the activity of p38-MAPK in human T-lymphocytes (HTL) and if this effect correlates with the inflammatory and apoptotic qualities of SEVO.[3]
Materials and Methods: HTL were incubated with SEVO, isoflurane (ISO), or desflurane (DES). Phosphorylation of proteins was evaluated by "Western Blot", activity of p38 by kinase assay, DNA-binding activity of the nuclear transcription factor κB (NF-κB) by "Electrophoretic Mobility Shift Assay" and apoptosis by flow cytometry after GFP-annexin-V staining.
Results and Discussion: While DES and ISO had no or little effect, SEVO dose-dependently induced phosphorylation (Fig. a) and activity (Fig. b) of p38. While SEVO increased apoptosis and NF-κB-activity, inhibition of p38 with SB203580 prevented neither DNA-binding of NF-κB (Fig. c) nor apoptosis. In addition, inhibition of apoptosis by Z-VAD.fmk did not prevent p38 phosphorylation (Fig. d).



Conclusion: SEVO specifically induces p38 stresskinase activity in HTL in vitro. This effect seems to be independent of SEVO-associated inflammatory or apoptotic effects.
References:

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A-488

Thiopental induces a heat shock response in human T-lymphocytes in vitro

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Background and Goal of Study: The induction of a heat shock response is characterised by the activation of the transcription factor HSF-1 and the expression of several heat shock proteins (HSP). The heat shock response is associated with a possible protection of cells and organs[1]. Several inducers of the heat shock response simultaneously inhibit the nuclear factor κB (NF-κB), a central regulator of the immune response.[2] The aim of this study was to determine whether the thiopental-mediated inhibition of NF-κB is associated with an induction of the heat shock response in human T-lymphocytes.[3]

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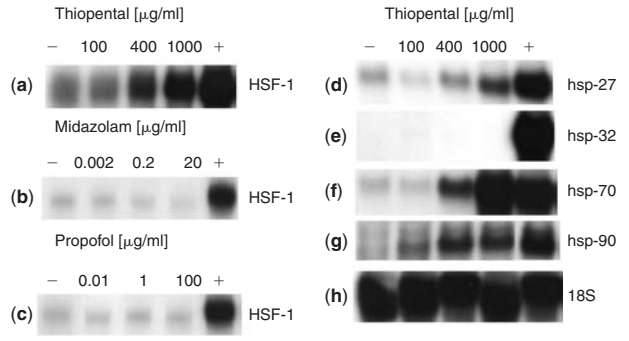
Materials and Methods: Human T-lymphocytes were incubated with thiopental, pentobarbital, thiamylal, secobarbital, methohexital, etomidate, ketamine, midazolam, or propofol. DNA-binding activity of HSF−1 was analysed by "Electrophoretic Mobility Shift Assay" and mRNA-expression of hsp−27, −32, −70 and −90 by "Northern Blot".
Results and Discussion: Thiopental (Fig. a) and thiamylal dose-dependently activated the DNA-binding activity of HSF-1. The other substances investigated had no influence on the HSF-1-activation (Fig. b + c). While there was no hsp-32-induction (Fig. e) by thiopental, it induced the expression of hsp-27 (Fig. d), −70 (Fig. f) and −90 (Fig. g).



Conclusion: Thiobarbiturates specifically induce a heat shock response in human T-lymphocytes. This could be indicative of a cytoprotective mechanism of action of these substances.
References:
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2 Crit Care Med 2002;30:S89–95.
3 Anesthesiology 2002; 96:1202–13.

A-489

The effect site half time of sevoflurane for burst suppression is longer than for hypnosis as determined by the bispectral index during routine anaesthesia and surgery

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Background and Goal of Study: The relationship between measures of drug effect such as bispectral index (BIS) and end-tidal (ET) levels of anaesthetic agents is described by the "effect site equilibrium half-time", $t_{1/2}$(ke0).

There is limited data on sevoflurane $t_{1/2}$(ke0), and none during routine anaesthesia and surgery. Preliminary observations suggested $t_{1/2}$(ke0) for the degree of hypnosis as estimated by BIS is different from that for eeg burst suppression, occurring at "deep" levels of anaesthesia. This study aimed to determine $t_{1/2}$(ke0) for these two "effects".
Materials and Methods: Large changes in ET sevoflurane were produced in 13 patients during routine surgery. ET sevoflurane, BIS and burst suppression ratio (BSR) were recorded every 10s. Data was divided into periods of "high BIS" (BIS >30) or burst suppression (BSR >10%) and $t_{1/2}$(ke0) was determined for each segment using a semi-parametric modeling technique.
Results and Discussions: There were 36 "high BIS" and 20 burst suppression zones. Mean $t_{1/2}$(ke0) for BIS was 3.59 min (sd 1.62 min) and for BSR 9.36 min (5.37 min). When compared with a binomial test these are highly significant differences ($p = 0.004$).
Conclusion(s): Different eeg effects of sevoflurane have different $t_{1/2}$(ke0) suggesting different sites or mechanisms of action. These results also establish values of $t_{1/2}$(ke0) which can be used to provide real-time estimates of effect-site sevoflurane concentration in clinical practice.
Acknowledgements: Supported by a grant from the Canterbury Medical Research Foundation.

A-490

Alfentanil-propofol co-induction for the insertion of the laryngeal tube airway versus the laryngeal mask airway

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Background and Goal of Study: Laryngeal tube airway (LTA) is a relatively new supraglottic device which, like the laryngeal mask airway (LMA), maintains airway patency during anaesthesia[1]. In a prospective randomised double-blind study we determined the propofol requirements (ED50) for the insertion of either tube. The ease and complications related to insertion were the secondary outcomes.
Materials and Methods: After Research Committee approval and informed consent, suitable unpremedicated patients aged 18–60 ASA I and II were allocated to the LTA (n = 27) or LMA group (n = 26). Alfentanil 5 $\mu g\,kg^{-1}$ i.v. was given to all patients. First patient in each group received propofol 2.5 $mg\,kg^{-1}$ i.v. for induction. The dose for consecutive patients in either group varied according to Staircase Design method with a step size of 0.5 $mg\,kg^{-1}$. Insertion of the device was attempted ninety sec later if mouth was relaxed, always by the same anaesthetist blinded to the dose of propofol. Three independent observers described the response to insertion. "Movement" was defined as any coughing, straining, laryngospasm or purposeful limb movements at insertion or within 1 min afterwards. ED50 was determined by calculating the mean of the midpoint dose of 6 independent pairs of patients who manifested crossover from "movement" to "no movement".
Results and Discussions: The ED50 of propofol for insertion of the LTA and LMA was 2.66 (SD 0.86) and 2.33 (SD 0.37) mg kg^{-1}, respectively ($p = 0.04$). Time to effective airway was significantly longer (52.85 vs. 33.00 sec, $p = 0.0002$) and more minor maneuvers were necessary in the LTA patients ($p = 0.02$). The incidence of airway complications was low and similar.
Conclusion: When alfentanil is used as co-induction agent, insertion of the LTA requires similar induction doses of propofol and it is not associated with an increased risk of complications compared to the LMA.
Reference:
1 Ocker H, Wenzel V, Schmucker P et al. A comparison of the laryngeal tube with the laryngeal mask airway during routine surgical procedures. Anesth Analg 2002; 95:1094–7.

A-491

Effect of hydroxyzine premedication on etomidate induction of general anaesthesia, including intubating conditions. A BIS controlled study

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Goal of Study: In a recent investigation, etomidate IV was administered as sole anaesthetic agent for induction of GA in 30 hydroxyzine-premedicated patients (1). Bispectral index (BIS) value consistently decreased to 50 for tracheal intubation with no purposeful movement in 29 of these 30 patients. Intubation is a highly reflexogenic phenomenon. Whether hydroxyzine premedication accounted for this high intubation rate was presently investigated.
Material and Methods: Sixty-seven ASA I–II patients were randomly allocated to receive 1.5 mg/kg oral hydroxyzine or placebo 90 min prior to induction of GA using etomidate 0.3 mg/kg IV, given alone. BIS values were continuously recorded. A tourniquet was placed on a lower limb to record purposeful movements. Tracheal intubation was facilitated by using rocuronium 0.6 mg/kg IV when the BIS value was 50. Anaesthetic data were compared between patients receiving hydroxyzine or placebo. Mann Whitney U-test, Fischer's test, Student's t-test were used.
Results: M (range), m ± SD, n

	Hydroxyzine (n = 35)	Placebo (n = 32)	P
Loss of eyelid reflex (sec)	83 (21–210)	97 (30–300)	0.1
Time to BIS = 50 (sec)	100 (21–266)	113 (30–510)	0.1
Time to BIS back to50 (sec)	431 (100–1429)	325 (75–1595)	0.3
Purposeful movements prior to intubation (yes/no)	7/28	5/27	0.9
BIS at intubation	41 ± 11	48 ± 17	0.07
Successful intub (yes/no)	26/9	17/15	0.07

Demographic data were similar. No recall was recorded.
Discussion and Conclusions: Hydroxyzine premedication did not alter etomidate induction of GA including intubating conditions. These findings are in line with previous data (2,3). Indeed, when hydroxyzine is compared to placebo in randomised, prospective studies, it produces questionable effects on both preoperative anxiety and postoperative analgesia (2). Moreover, etomidate 0.3 mg/kg I.V., given alone, was associated with a 62% likelihood of successful intubation on the first attempt as presently (3). It is of note that the intubation rate was smaller than previously (1). A larger sample size than previously may account for this discrepancy.
References:
1 Lallemand, *Br J Anaesth* 2003.
2 Glazier, *DICP* 1990.
3 Skinner, *Anaesthesia* 1998.

A-492

Preoxygenation enhances induction of anaesthesia with sevoflurane as assessed with BIS monitoring

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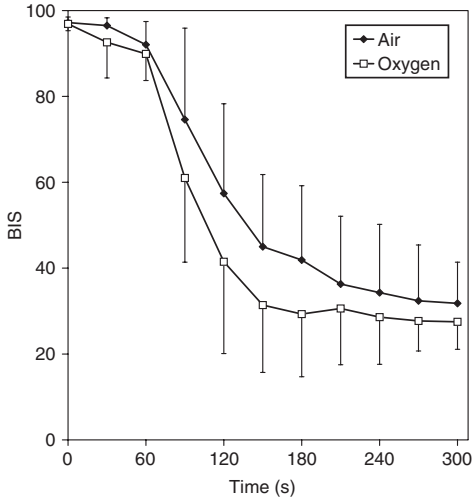
Background and Goal: Previous studies investigate methods enhancing the speed of inhalational induction of anaesthesia[1]. In a prospective randomized double-blind study we evaluated the speed of induction of anaesthesia with sevoflurane, with or without preoxygenation.

Materials and Methods: Forty patients scheduled for hysteroscopy under general anaesthesia received for 10 min air or 100% O_2 via a face-mask. Anaesthesia was induced with ⩾7% sevoflurane in 100% O_2 via a primed circle system. Zipprep™ electrodes were attached to the forehead of the patients for BIS monitoring. BIS values were recorded every 30 s, during the first 300 seconds of sevoflurane administration.

Results: Demographics did not differ between groups. The group which inhaled O_2 before induction exhibited significantly lower BIS values when compared to the group that received air ($F = 7.97$, $df = 1$, $p = 0.009$). Means ± SD are shown in Figure 1.



Conclusion: Preoxygenation for 10 min enhances the speed of inhalational induction of anaesthesia with sevoflurane.

Reference:

1 O'Shea H, Moultrie S, Drummond GB. Br J Anaesth 2001; 87: 286–8.

A-493

Intravenous infusion of lidocaine reduces sevoflurane requirements during laparoscopic colectomy

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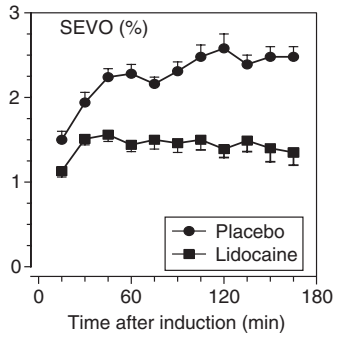
Background and Goals: Intravenous (i.v.) lidocaine (LIDO) is analgesic, anti-inflammatory, and anti-hyperalgesic.[1,2] LIDO blocks the *NMDA*-receptors.[3] We therefore tested the hypothesis that LIDO reduces sevoflurane requirements during laparoscopic colectomy (LAPCOL).

Material and Methods: After approval of our institution Ethics Committee, 40 patients scheduled for LAPCOL gave their consent to be included in this randomised double-blind placebo-controlled study. Patients were allocated in two groups: i.v. LIDO (bolus = 1.5 mg/kg before the induction of anaesthesia, then a continuous i.v. infusion 2 mg/kg/h) or saline. Anaesthesia was induced with propofol 2 mg/kg, sufentanil 0.15 μg/kg, and cisatracurium 0.2 mg/kg, and maintained with sevoflurane (SEVO) in O_2/air 80%. SEVO concentrations were adjusted to keep patients hemodynamically stable (pre-induction mean arterial pressure ± 15%). BIS scores were also monitored and kept below 50. Arterial pressure, heart rate, BIS scores, and end-tidal SEVO were recorded every 15 min. Data (mean ± sem) were analysed using ANOVA or Students' *t* test; $P < 0.05$ = statistical significance.

Results: Patient data were similar in the two groups. i.v. LIDO resulted in a significant reduction in heart rate ($P = 0.02$), mean arterial pressure ($P = 0.001$), and SEVO requirements (Fig., $P < 0.0001$).



Conclusions: i.v. LIDO significantly reduces the requirements in volatile anaesthetic and improves hemodynamic stability during LAPCOL.

References:

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2 Cornet P. et al, *Eur J Anaesthesiol* 2004;21:A764.
3 Sugimoto M. et al., *Br J Pharmacol* 2003;138:876–82.

A-494

Use of desflurane in renal transplantation. A comparison with isoflurane

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Background and Goal of Study: Aim of this study was the comparison of the postoperative effect of desflurane intraoperative administration versus the established use of isoflurane[1], based on biochemical markers of renal function in patients undergoing renal transplantation from living related donors.

Material and Methods: Forty patients with end-stage renal failure who were submitted to renal transplantation were studied. They were randomly allocated to two groups: group D (maintenance of anaesthesia with desflurane) and group I (isoflurane). The anaesthetic protocol was the same in both groups apart from the volatile agent used for the maintenance of anaesthesia[2].

For the evaluation of postoperative renal graft function, blood urea and serum creatinine changes fluctuation within each group preoperatively and from the first to third postoperative day were compared using two-way analysis of variance. Additionally, mean values of these parameters were compared between the two groups at each time of study by "t-test" ($P < 0.05$ considered significant). Patients' demographic data, MAC-hours, cold ischemia time, and intraoperative haemodynamic and metabolic parameters were also recorded.

Results: No significant difference between the two groups in age, body weight, MAC-hours, the time of cold ischemia of the graft and intraoperative metabolic parameters was observed. Intraoperative arterial pressure and heart rate were significantly higher in group D.

No statistically significant difference was observed in the fluctuation of blood urea with time in either group. Creatinine levels fluctuated with time (towards lower values) significantly both in groups D and I ($P < 0.01$).

Mean urea and creatinine values did not differ significantly between the two groups at any time of the study.

Conclusion: Postoperative changes in blood urea and serum creatinine after desflurane administration are similar to those observed after the already established isoflurane use in renal transplantation.

References:

1 Higuchi H, Adachi Y, Wada H, et al. *Anesth Analg* 2001; 92: 650–655.
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A-495

A single dose of propofol can produce excellent sedation and amnesia in cystoscopic examination

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Background and Goal of Study: Propofol is used to produces sedation and amnesia in patients undergoing invasive investigation and procedures such as dental and vitreoretinal surgery (1,2). Cystoscopy is one of the painful procedures which need to be done under anesthesia or full sedation. In this study we compared sedative and amnestic effects of propofol and midazolam in cystoscopy examination.

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Materials and Methods: This study was a prospective clinical trial which was done on 44 adult, ASA-I, II, III who were candidated for cystoscopic examination. Patients were divided into two groups according -10 convenience sampling method. Patients were excluded from the study if they had psychological problems, drugs or alcohol abuse, drug's allergy or pregnancy. Before beginning of the procedure vital signs were registered and then sedation was done with propofol 0.75 mg/kg I.V. plus fentanyl 50 μg in study group and midazolam 3 mg plus 50 μg fentanyl in control group. Then vital signs and SaO_2 in 1 and 10 minutes after beginning of examination and numerical patient's movement were registered during procedure, also frequency distribution of patient's recall, VAS for pain and satisfaction scores were evaluated in recovery room. All data were analyzed with T test and Chi-Square.

Results and Discussion: There were no statistical differences between two groups for age ($p = 0.87$), weight ($p = 0.83$), sex ($p = 0.61$), ASA physical statue ($p = 0.57$) and duration of examination ($p = 0.48$) There were a lower VAS pain score and higher VAS satisfaction scars in propofol group ($p = 0.009$ and $p = 0.041$ respectively).

Conclusion: We concluded that propofol can produce good sedation and amnesia and also good examination condition in patients undergo cystoscopic examination.

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A-496

Comparison of pupil reflex dilation after 100 Hz tetanos at the end of surgery and postoperative pain under a stable remifentanil concentration

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Background and Goal of Study: Painful stimuli dilate the pupil; this reflex is called pupil reflex dilation (PRD). Opiate drugs such as remifentanil reduce PRD. Our goal was to assess the relationship between PRD in anaesthetised patients at the end of surgery and postoperative pain in order to improve the postoperative pain management during the transition after a remifentanil TCI anaesthesia.

Materials and Methods: Nineteen ASA 1/2 patients undergoing gynaecological surgery were anaesthetised with propofol and remifentanil. At the end of surgery, target effect site concentration (CeT) of remifentanil was titrated down to 1.5 ng/ml and maintained at this level during the whole awakening period. Propofol TCI was maintained at the appropriate level to study PRD with an infrared pupillometer at rest and in response to four electrical tetanic stimulation at 100Hz (TET100) on the ulnar nerve during 10 seconds, applied randomly at 20, 40, 60, 80 mA.

Thereafter, propofol was stopped and VAS at rest was evaluated under constant remifentanil CeT of 1.5 ng/ml.

Results and Discussions: Fifteen women showed acceptable VAS less or equal to 3. Four women had a VAS greater than 3 with one having a VAS at 8. This patient was the only one showing a PRD greater than 1 mm at a low tetanic stimulation of 40 mA. However, no significant statistical difference was found in the mean PRD values at the different TET100 intensities between women with a VAS value under or over a value of 3.

Intensity of TET100	20 mA	40 mA	60 mA	80 mA
PRD ± SD of women with VAS $$ 3 at awakening	0.28 mm ± 0.27	0.58 mm ± 0.34	0.76 mm ± 0.40	0.93 mm ± 0.54
PRD ± SD of women with VAS > 3 at awakening	0.50 mm ± 0.40	0.75 mm ± 0.86	0.92 mm ± 0.78	1.42 mm ± 0.43

Conclusion(s): PRD testing at several intensities of tetanic stimulation under stable remifentanil concentration does not help the anaesthetist to predict pain in young healthy women undergoing low abdominal surgery.

A-497

Neurodegenerative effects of propofol exposure to newborn rats

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Background and Goal of Study: Propofol as a commonly used drug in pediatric anaesthesia has been shown to act primarily by $GABA_A$-receptors enhancement[1]. Recently, it has been demonstrated that exposure of the developing brain to anaesthetic drugs with $GABA_A$-enhancing and/or NMDA receptor-blocking properties may induce apoptotic neurodegeneration[2,3]. The aim of this study was to assess the neurodegenerative effects of propofol exposure to newborn rats.

Materials and Methods: 7-day-old Wistar rats ($n = 18$) were treated with repeated intraperitoneal injections of propofol (3 doses of 30 mg/kg body weight at 0, 90 and 180 minutes) and compared to controls ($n = 13$). Brains were examined histopathologically using the DeOlmos cupric silver staining 24 hours after exposure. A summation score of the density of apoptotic cells was calculated for every brain. In two propofol-treated animals blood pH measurement was performed during anaesthesia. For statistical analysis t-test with independent-samples was performed.

Results and Discussions: A significant increase in the density of apoptotic cells ($p < 0.001$) was found in animals treated with propofol (apoptotic score 27558 ± 7238/mm^3, versus 14438 ± 3659/mm^3 in controls). Normal pH values were measured and thus severe hypoxia or metabolic disorders could be excluded.

Conclusion(s): Propofol enhances the apoptosis in the developing brain of newborn rats and may induce neurodegenerative mechanisms. Transferability of these results to human beings and possible consequences for the anaesthesiological practice remains to be determined.

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A-498

Assessment of recovery from general anesthesia under sevoflurane, desflurane or propofol for long lasting surgery

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Background and Goal of Study: The aim of the study was to assess the recovery profile after long lasting surgery, using different anesthetic maintenance agents.

Materials and Methods: After a standardized induction 33 patients undergoing spinal stabilization were randomly assigned to one of the following groups of anesthesia maintenance: a) sevoflurane ($n = 13$), b) desflurane ($n = 10$), or c) continuous infusion of propofol ($n = 10$), titrated to maintain a BIS level of 40–50. Anesthesia was combined with remifentanyl infusion and morphine given 30 min before the end of the operation. Mean arterial pressure, pulse and SpO_2 preoperatively and 30 and 60 min postoperatively, were recorded. Recovery profile was assessed according to time of: opening eyes, beginning of spontaneous ventilation, involuntary or voluntary movement and extubation, all measured after the discontinuation of anesthetic agent. Data were analysed by SPSS 10.0 program using analysis of variance (ANOVA).

Results and Discussions: Groups were similar concerning age, weight, duration of surgery, duration of anesthesia and hemodynamics ($p > 0.05$). No statistical differences ($p > 0.05$) were found among the mean recovery times studied shown in the table (time in minutes):

	Sevoflurane	Desflurane	Propofol
Duration anesthesia	192.72 ± 106	160.5 ± 65.0	221.5 ± 82.5
Opening eyes	15.3 ± 3.9	12.5 ± 6.0	14.3 ± 5.0
Spontaneous breathing	15.1 ± 4.2	12.4 ± 5.8	15.1 ± 6.8
Involuntary movement	14,6 ± 3.0	11,3 ± 5.5	13,3 ± 5.1
Voluntary movement	18.1 ± 4,3	18.1 ± 4.3	17.4 ± 6.4
Extubation	17.4 ± 4.6	15 ± 5.1	18.1 ± 6.5

Postoperative hemodynamics and SpO_2 did not also differ significantly ($p > 0.05$)

Conclusion: Recovery profile according to measured characteristics in our sample seems to be similar, when sevoflurane, desflurane or propofol is combined with remifentanyl-morphine for long lasting anesthesia.

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1 Beaussier M. et al. Can J Anaes 1998;45:429–34.
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A-499

Influence of remifentanil in the prediction of propofol concentration at recovery of consciousness

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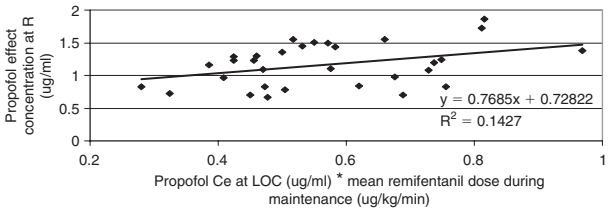
Background and Goal of Study: It would be clinically useful to predict the propofol (Prop) effect concentration (PropCe) at recovery of consciousness (ROC). We postulated that a patient's PropCe at ROC is related with PropCe at loss of consciousness (LOC) and requirements for remifentanil (Remi) during surgery.

Materials and Methods: Neurosurgical patients with Glasgow 15, ASA 1/2, and TIVA with effect site TCI Prop (Schnider[1]) and Remi (Minto[2]). Data were collected using RugLoop II® software every 5 s from A2000XP (BIS). Patients were premedicated *per os* with 10 mg of diazepam. Induction was performed with a Prop constant infusion of 200 ml/hr until LOC. At LOC, Remi started with a plasma target of 2.5 ng/ml, and Prop effect target (PropCt) was set to PropCe at LOC. Before ROC the PropCt was gradually reduced and Remi adjusted to patient's needs (data: mean ± sd).

Results and Discussions: Thirty one patients, age 48.7 ± 15, body mass index 26.5 ± 5, 21 female. PropCe at LOC were 4.9 ± 1 μg/ml. Time between the beginning of Prop infusion until LOC was 3.61 ± 0.7 min. PropCe at ROC were 1.16 ± 0.3 μg/ml. Predicted effect Remi concentrations at ROC were 3.41 ± 1.5 ng/ml. Different relations were tested, and a statistically significant ($p < 0.05$) correlation between PropCe at ROC and PropCe at LOC multiplied by Remi mean dose during surgery (0.12 ± 0.02 μg/kg/min), was observed.



Conclusion(s): The correlation between PropCe at ROC and PropCe at LOC[3] was improved by the inclusion of Remi dosage information. This study can be useful in a future ROC prediction model and brings more insight to drug interactions.

References:

1 Anesthesiology 1998, 88:1170–82.
2 Anesthesiology 1997, 86:24–33.
3 J Neurosurg Anesthesiol 2004, 16:342.

Acknowledgements: Portuguese Foundation for Science and Technology.

A-500

The effect of alfentanil on the localization of epileptogenic focus in pediatric patients with intractable seizure disorder

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Background and Goal of Study: Among the chemical stimulants to activate the electrical activity, opioids are helpful to localize the epileptogenic focus in adult patients with temporal lobe epilepsy (1,2). The aim of this study was to examine the effect of alfentanil on the localization of epileptogenic focus in pediatric seizure patients.

Materials and Methods: Six pediatric patients (aged 2–16 years old) received an anesthetic induction with thiopental sodium 5 mg/kg, rocuronium 0.6 mg/kg. Anesthesia was maintained with sevoflurane in 50% oxygen with 50% air. After dural opening, sevoflurane was maintained at 0.6% end-tidal concentration during the study.

Electrocorticography over the surface of the temporal lobe extending to hippocampus and amygdala was obtained, followed by 5 minute of recording before and after the administration of alfentanil 20 mg/kg. The most abundant spontaneous spiking area before alfentanil activation was defined as the suspected ictal zone. Any changes in cardiovascular variables were documented. Off-line analysis of electrocorticography was done by neurologist according to the changes of number of interictal epileptiform spike of suspected ictal and non-ictal zone before and after the administration of alfentanil. Values are mean ± SD. For statistical analysis Wilcoxon signed ranks test was performed.

Results: Alfentanil induced an significant increase in spike activity (20.0 ± 9.3 vs 36.0 ± 18.1 number of spike/1 minute epoch $P < 0.05$). The site of maximal activation was the hippocampus or amygdala and identical to the suspected ictal zone. No significant activation of the relatively infrequent independent spikes recorded over non-ictal zone was seen after the administration of alfentanil. There were no significant changes in the blood pressure and heart rate after the administration of alfentanil.

Conclusions: Alfentanil activates epileptiform activity in pediatric patients with temporal lobe epilepsy and can be used to assist in the localization of the epileptogenic focus during surgery.

References:

1 Ragazzo PC, Galanopoulou AS. Brain Research Reviews 2000; 32: 316–327.
2 Manninen PH, Burke SJ, Wennberg R, et al. Anesth Analg 1999; 88: 1101–1106.

A-501

Combining remifentanil to propofol and etomidate in cardioversion anaesthesia

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Background and Goal: In this study we added remifentanil for using propofol and etomidate in smaller induction doses and to decrease their side-effects in elective external cardioversion (EEC) anaesthesia. We also aimed to compare effects of them on haemodynamic and recovery parameters.

Material and Methods: 40 ASA II–III patients enrolled in this prospective and randomized trial. All patients received 1 $\mu g \cdot kg^{-1}$ remifentanil over 90 sec firstly,then group P received propofol 0.5 $mg \cdot kg^{-1}$ and group E etomidate 0.1 $mg \cdot kg^{-1}$ over 15 sec. When OAAS/S scale was 4–5, EEC was applied and this time was noted. Haemodynamic and respiratory parameters, awakening time (AT), comprehension time (CT), time when Aldrete Score was 9 (Ald 9), number of shocks, total amount of energy, patient and cardiologist satisfaction and side-effects were compared between groups. Chi-square and independent samples t tests were used in statistical analysis with significative $p < 0.005$.

Resuts and Discussion: Groups were similar in demographic and baseline data. If we compare with other studies (1) we induced anaesthesia with smaller doses of propofol and etomidate by combining remifentanil. In group P a statistically significant decrease in blood pressure occured after induction and returned to baseline in 8th min. In group E, blood pressure was not different compared to its baseline level. After EEC and throughout 2 min respiratory rate in group P decreased significantly when compared with group E. 8 patients in group P became apneic and needed assisted ventilation.

(min)	Group P	Group E	p
OAAS/S4-5	3.7 ± 0.5	4.1 ± 0.45	0.019
AT	11.6 ± 1.96	15 ± 2.45	0.000
CT	13.2 ± 1.88	16.6 ± 2.48	0.000
Ald 9	20.6 ± 2.98	24.6 ± 2.78	0.000

(Values reported as mean ± SD in Table). Number of shocks, amount of energy, pain existence, patient and cardiologist satisfaction and side-effects were comparable in both groups. Myoclonus wasn't seen in any groups.

Conclusion: We concluded that, although etomidate was having longer recovery parameters and propofol was having less stable haemodynamic and respiratory effects; both were acceptable for EEC anaesthesia. And also we could reduce induction doses and side effects of these drugs by combining remifentanil.

Reference:

1. Herregods LL et al. J Clin Anesth. 2003;15(2):91–6.

A-503

Intubating conditions after administration of remifentanil combined with sevoflurane or propofol without muscle relaxants in adults

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Background and Goal of Study: The combination of remifentanil with propofol provides satisfactory intubating conditions without the need for neuromuscular blocking drugs.[1] The aim of the study was to evaluate the intubating conditions after combination of sevoflurane-remifentanil (SR) compared to propofol-remifentanil (PR) when BIS < 40 without administration of muscle relaxants.

Materials and Methods: Thirty patients ASA I–II, scheduled for elective surgery, premedicated with iv clonidine 2 $mcg \cdot kg^{-1}$, received remifentanil 1 $mcg \cdot kg^{-1}$ before induction of anaesthesia. Patients were randomly allocated

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into two groups: Group PR received propofol 2.5 mg*kg^{-1} on induction and group SR sevoflurane (8% initially, falling to 4–2%). Laryngoscopy was performed when BIS $<$ 40 and intubating conditions were graded on a 4-point scale (ease of laryngoscopy, vocal cords position, jaw relaxation and degree of coughing and limb movement). Time for loss of consciousness, time for pupils to come to the midline position, time needed for BIS $<$ 40 and BIS immediately before and after intubation were also recorded as well as blood pressure and heart rate before induction, immediately after intubation and surgical incision. Data were analyzed using student's t-test.

Results and Discussions: Tracheal intubation was successful in all patients. Intubating conditions were satisfactory in both groups. Excellent intubating conditions were noted in 33.3% of patients in the PR group and 20% in the SR group. BIS values were significantly lower ($p < 0.05$) in the PR group. Time taken for pupils to come to the midline position was significantly lower in the PR group ($p < 0.001$). No statistical significance was noted between groups for the time taken for loss of consciousness, the time needed for BIS to fall $<$40 as well as the haemodynamic responses following intubation.

Conclusion(s): The combination of remifentanil with either propofol or sevoflurane provides satisfactory intubating conditions without neuromuscular blocking drugs, in patients premedicated with clonidine, with some of the measured parameters being better for the PR group.

Reference:

1 Stevens JB, Wheatley L. Anesthesia and Analgesia, 1998; 86:45–9.

A-504

The comparison of different doses of remifentanil on preventing myoclonus due to etomidate

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Background and Goal of Study: Etomidate is a rapid effective sedative-hypnotic agent, that have minimal cardiovascular and sedative effects. Opioids such as fentanyl, alfentanil and sufentanil are used to prevent myoclonus due to etomidate. In this study we aimed to compare effectiveness of different doses of remifentanil on preventing myoclonus due to etomidate.

Materials and Methods: After approval of local ethic committee, 45 patients in ASAI–II status, who will get general anesthesia were divided into 3 groups. Solutions of the study were prepared by an independent anesthesiologist as 5 ml solutions. Remifentanil was applied at 0.5 μg ml^{-1} dose in the group I, 1 μml^{-1} in group II in 30 second. In group III isotonic saline was used. 1.5 minutes later, 0.3 mg kg^{-1} etomidate was applied end patients was assessed with a 4 point scale (0 – absent, 1 – mild, 2 – moderate, 3 – severe), and also number of breathing and saturation values were recorded. Endotracheal intubation was performed after enough muscle relaxation obtained with 0.15 mg kg^{-1} cisatracurium. Mean arterial pressure, heart rate, peripheral oxygen saturation were recorded at the measurement point.

Results: In the group I, mild myoclonus was observed in one of the 15 patients (6.6%) and moderate myoclonus was observed in the other one (6.6%). In group II there was mild myoclonus only in one of the 15 patients (6.6%). In the control group in 3 patients (20%) myoclonus did not observed. Myoclonus observed in 1 patient mild (6.6%), in 4 patients moderate (26.6%) and in 7 patients severe (46.6%). After etomidate application the breathing rate was in group I 7, in group II 4.2 and in group III 25. Only in group II in 8 patients (53.3%) desaturation were appeared ($p < 0.05$).The hemodynamic values decreased in remifentanil groups and this decrease was in group II statistically significant ($p < 0.05$). T-test and chi-square tests were use for statistical analyses.

Conclusion: The effect of remifentanil used in 0.5 μg kg^{-1} or 1 μg kg^{-1} doses to prevent myoclonus due to etomidate was similar in both groups but 1 μg kg^{-1} remifentanil caused desaturation. Because of this reason 0.5 μg kg^{-1} remifentanil was more safe.

Reference:

1 Stockham RJ et al. Anaesth Intensive Care. 1988 May;16(2):171–6.

A-505

The effect of gabapentin on epidural analgesia after lower extremity surgery

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Background and Goal of Study: Recent clinical studies determined that, preoperative oral gabapentin decreased pain scores, morphine consumption and side effects in different surgical patients. In this randomized, controlled trial we aimed to examine whether oral gabapentin could have an effect on postoperative pain, local anesthetic consumption, discharge, side effects, satisfaction and recovery in patients after lower extremity surgery and epidural analgesia.

Materials and Methods: Following ethic committee approval and written informed consent, 40 patients scheduled for lower extremity surgery were randomly divided into two groups. Patients in the group I received oral placebo and those in the group II received 1200 mg gabapentin 1h prior to surgery. Patients received the same drug regimens in the postoperative 2nd and 3rd days in the morning according to their group allocation. Anesthesia was induced with propofol and maintained with sevoflurane in 50%O_2/N_2O with a fresh gas flow of 2 L/min and 2 μg/kg fentanyl i.v. The first loading dose of previously placed epidural anesthesia was given at wound closure(bolus 5 ml 0.125% bupivacaine + 1 μg fentanyl/ml) and PCEA pump was connected (bolus 5 ml, lockout 15 min). During the first 1h in the PACU, then at 4,8,12,16, 20, 24, 30, 36, 42, 48, 60 and 72 hrs patients were evaluated for pain scores, HR, SpO_2, MBP, respiratory rate, sedation and PCEA use. Patients were separated from the PCEA when no analgesia was needed for the last 4 hrs (time of separation was noted). Analgesia was continued with p.o. acetaminophen 500 mg as required. The time to first flatus, return of bowel function, and duration of hospitalisation were recorded. Dietary intake and ambulation time were also evaluated. Every morning after operation, patients were assessed for readiness for discharge from hospital.

Results and Discussions: Pain scores, bolus received per 24 hrs (21 $\pm$ 3, 15 $\pm$ 4, 8 $\pm$ 5; 14 $\pm$ 2, 10 $\pm$ 3, 2 $\pm$ 3), PCA use (38 $\pm$ 11, 57 $\pm$ 9 hrs), acetaminophen use (700 $\pm$ 523, 350 $\pm$ 400 mg) were lower in the groupII ($P < 0.05$). Patients had higher satisfaction levels ($P < 0.001$) and were more ready for discharge ($P < 0.001$). There was no difference between groups in return of bowel function, hospitalization, ambulation and resumption of dietary intake. Gabapentin decreased epidural and oral analgesic consumption while increasing patient satisfaction and readiness for discharge.

A-506

The use of lornoxicam in the prevention of pruritus caused by the administration of morphine epidurally

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Background and Goal of Study: The epidural administration of opioids can cause pruritus. One of the mechanisms of opioid-related itching is due to the release of prostaglandines (PGE_1, PGE_2).

Materials and Methods: Patients scheduled for total abdominal hysterectomy (40 patients, age 39–65, ASA I–II) gave consent and were randomized into two groups for this prospective double-blinded study. All the patients received epidurally 3 mg morphine plus 7 ml ropivacaine 0.2% before the end of the operation. Group 1 received 8 mg lornoxicam i.v. and Group 2 received 2 ml Normal Saline 0.9% i.v. on induction of anaesthesia. Every 12th hour all the patients received a bolus dose of morphine and local anaesthetic and lornoxicam or placebo respectively. Patients were checked for episodes of pruritus and abdominal pain intensity was assessed with VAS score. Patients were checked before living PACU and every 4th hour.

Results and Discussion: Patients in Group 1 had pruritus at 9% and the control group at 58% ($p < 0.05$), also VAS score was significantly lower in Group 1.

Conclusion: The administration of lornoxicam i.v. reduces the incidence of pruritus caused by the administration of morphine epidurally.

Reference:

1 Lee LH, Irwin MG, Lim J, Wong CK. The effect of celecoxib on intrathecal morphine-induced pruritus in patients undergoing Caesarean section. Anaesthesia 2004; 59:876–80.

A-507

Comparison of the effect of remifentanil and fentanyl on myoclonus due to etomidate

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Background and Goal of Study: The most common side effects of etomidate used in induction of anaesthesia are painful injection and myoclonus. In

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recent studies, fentanyl and alfentanyl were reported as the most effective opioids in preventing myoclonus. Our aim is to compare the effect of Remifentanil and Fentanyl on myoclonic muscle activity induced by etomidate.

Materials and Methods: 60 adult patients, ASA III scheduled for general anaesthesia were included. All patients were randomly allocated to receive 1 $\mu g \cdot kg^{-1}$ intravenous remifentanil (Group R, n = 20), 1 $\mu g \cdot kg^{-1}$ intravenous fentanyl (Group F), or the same doses of normal saline (Group C, n = 20). 60 seconds after the medications were given, induction of anaesthesia was maintained by 0.3 $mg \cdot kg^{-1}$ etomidate, 1 minute later 0.1 $mg \cdot kg^{-1}$ vecuronium bromide was given to obtain muscle relaxation and then intubation was performed. After the given doses of remifentanil, fentanyl and the same dose of serum physiologic, the level of sedation was recorded as none, light, mild, heavy and myoclonic movements were recorded as 0 = none, 1 = mild, 2 = moderate (Two body segments or two group of muscles moving lightly), 3 = severe (Two or more muscle group in active motion). Injection pain after etomidate was also assessed. Data were analysed by using chi-square test and ANOVA. A value of $p < 0.05$ was considered to be statistically significant.

Results and Discussions: Demographic data were similar in all groups. In Group R, myoclonus was seen in one case. In Group C, myoclonus was observed as severe in 9 cases, moderate in 3 cases and mild in 6 cases and none in 2 cases. In Group F, myoclonus was observed as severe in 2 cases, moderate in 4 cases, mild in 8 cases and none in 6 cases. The difference between groups was found to be statistically significant ($p < 0.05$). Injection pain was observed in 16 cases in Group C, in 12 cases in Group F, and in 6 cases in Group R.

Conclusion(s): Remifentanil, an opioid with short duration of action, decreased the injection pain of etomidate, incidence and intensity of myoclonus and had a better effect than fentanyl. As a result, remifentanil may be used clinically to decrease injection pain and myoclonus caused by etomidate with better results than fentanyl.

A-508

Remifentanil pharmacodynamic in liver trasplantation

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Background and Goals: Dysfunction of the hepatic system may alter the patterns of metabolism or elimination of the opioides. Patients with liver disease are more sensitive to remifentanil ventilatory depressant effects. (1) We aimed to exanimate the haemodynamic response to remifentanil in patients with end-stage of liver disease.

Materials and Methods: With IRB approval, 27 patients undergoing liver transplantation were recruited. Anaesthesia was induced with midazolam 0.03 $mg \cdot kg^{-1}$ fentanyl 3 ($\mu g \cdot kg^{-1}$, and etomidate 0.2 $mg \cdot kg^{-1}$. Rocuronium was given for tracheal intubation. Anaesthesia was maintained with 0.8% sevoflurane. Cardiac function was assessed using a continuous thermodilution cardiac output before (Baseline) and 8 min after 0.2 $\mu g \cdot kg^{-1} \cdot min$ remifentanil infusion (Remifentanil). Statistical analysis were made with t-Student paired test. A *p* value <0.05 was considered significant.

Results and Discussions: We have study 27 cirrhotic patients: 81% male, mean age 52 yr. The hepatic Child class were: A: 4%, B: 65%, and C: 31%. Haemodynamic result are in Table.

	Baseline	Remifentanil	P
HR	68 ± 10	61 ± 11	0.0001
MAP	80 ± 17	63 ± 16	0.0001
MPAP	20 ± 4	21 ± 7	0.62
CI	4.69 ± 1.4	4.4 ± 1.1	0.02
SVRI	1295 ± 462	1021 ± 438	0.0001
PVRI	128 ± 61	132 ± 66	0.51
LVSWI	61 ± 18	47 ± 13	0.0001
RVSWI	11 ± 11	9 ± 4	0.34

Conclusion: Remifentanil reduced cardiovascular parameters in liver disease patients. This result suggest that remifentanil dose necessary to provided analgesia in patients with cirrhosis is less than in patient without liver disease. Remifentanil must be careful titrated in this group patients.

Reference:

1 Dershwitz M, Rosow CE. J Clin Anesth 1996, 8: 88S–90S.

A-509

Haemodynamic effects of two distinct TIVA techniques for induction of anaesthesia

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Background and Goal of Study: Haemodynamic stability during induction is important for safe TIVA. We compared haemodynamic stability using two induction techniques: TCI with propofol (Prop) and remifentanil (Remi) versus constant Prop infusion.

Materials and Methods: Neurosurgical patients with Glasgow 15, ASA 1 to 3, received TIVA. Data were collected using RugLoop II® every 5 s from a Datex AS3 (HR and MAP) and A2000XP (BIS). Patients were allocated to two induction techniques. Group 1: induction was performed with a Prop constant infusion of 200 ml/hr until LOC followed by Remi. Group 2: induction with an effect site propofol (PropCe) target of 5.0 μg/ml (Schnider[1]) and a plasma Remi target of 2.5 ng/ml (Minto[2]). Data were collect until LOC.

Results and Discussions: Group 1: 16 patients, age 49.8 ± 16, body mass index 26.7 ± 5.5, 10 female. At awake: MAP 97 ± 13 mmHg, HR 73 ± 18 bpm, BIS 93.7 ± 5.6. Group 2: 16 patients, age 46.6 ± 12.7, body mass index 24.9 ± 3.7, 8 female. At awake: MAP 105 ± 17 mmHg, HR 70 ± 15 bpm, BIS 94 ± 4.54. Demographics, MAP and HR at awake did not differ between groups. Between awake and LOC, MAP and HR did not change in neither group. Main results are shown in table.

Data at LOC	Group 1	Group 2
PropCe (μg/ml)	5.1 ± 0.4	4.9 ± 0.2
RemiCe(ng/ml)	0	1.68 ± 0.4
Time to LOC (min)	3.63 ± 0.5*	2.3 ± 1*
Total Prop (mg/kg)	1.72 ± 0.4	1.5 ± 0.3
MAP (mmHg)	92.6 ± 16	103.6 ± 19
HR (bpm)	70.4 ± 14	69.7 ± 12
BIS	60.6 ± 20.2	62.4 ± 19.5

Data as mean ± SD, statistical significance with *$p < 0.05$.

Conclusion(s): Both techniques had similar haemodynamic stability until LOC. Time to LOC was significantly shorter in Group 2. Thus, induction with Prop and Remi TCI provides faster LOC and has no adverse haemodynamic effects for the same LOC PropCe.

References:

1 Anesthesiology 1998, 88:1170–82.
2 Anesthesiology 1997, 86:24–33.

Acknowledgements: Portuguese Foundation for Science and Technology.

A-510

Dexmedetomidine sedation in patients with end-stage renal failure

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Background and Goal of Study: Dexmedetomidine (DXM) is a selective α-2 adrenoreceptor agonist with sedative, analgesic and sympatholytic effects. The aim of the study was to determine the efficacy and safety of DXM for sedation of patients with end-stage renal failure during the formation of arteriovenous fistula under local anesthesia.

Materials and Methods: Fifty four ASA II/III patients were randomized to receive either DXM (n = 30, dose: 0,7–1 μg/kg/h during 10 min. followed by iv. infusion 0,3–0,5 μg/kg/h) or midazolam (MID) (n = 24, dose: 0,04 mg/kg followed by i.v. infusion 0,04–0,08 mg/kg/h). Groups were similar for demographic and clinical factors. Analgesia was provided with brachial plexus block (supraclavicular approach) with 30 ml 0,375% of bupivacaine with adrenaline. Blood pressure (BP), heart rate (HR), oxygen saturation (SpO_2) were recorded every 5 min. Ramsey (R) and McKenzie (M) scales as well as orientation score (0 – none, 1 – orientation in time or place, 2 – orientation in both) were used to assess sedation during and after infusion of the study drug. Time to achievement of R4° and M3° sedation scores and time needed for the individual patient to reach R2° and M1° sedation scores (recovery time) was assessed. Data were analyzed by ANOVA, U-Mann Whitney's test and Wilcoxon's test.

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Results: Mean time of infusion was 70 min. (35–125 min). Both drugs effected in appropriate sedation. In DXM group mean time to reach R4° and M3° sedation score was longer than in MID group (25 ± 8 min. vs 15 ± 9 min., $p < 0.01$). Recovery time was shorter in DXM group (23 ± 10 min. vs 35 ± 21 min., respectively, $p < 0.01$). Orientation scores during and after infusion were significantly lower in MID group ($p < 0.05$) with notable amnesia and mental slowness. Both agents were well tolerated. BP were decreased in both group. HR decreased more in DXM group ($p < 0.05$). SpO_2 after MID loading dose and during iv. infusion was lower compared to DXM and to baseline ($p < 0.001$). Seven MID patients (30%) required additional oxygen administration due to moderate hypoxemia. No serious adverse effects were observed.
Conclusion: DXM is effective, well tolerated as a single sedative agent for patients with end-stage renal failure.
Reference:
1 De Wolf A. *Anesth Analg* 2001;93: 1205–1209.

A-511

Endocrine stress response and haemodynamics following intubation. Propofol versus sevoflurane

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Background and Goal of Study: The stress response to intubation and surgery is characterized by increased secretion of pituitary hormones and activation of the sympathetic nervous system.[1] The aim of the study was to compare the fluctuation of cortisol and glucose levels and the haemodynamic changes following intubation and surgical incision in patients induced with propofol or sevoflurane without the use of muscle relaxants.
Materials and Methods: We studied 30 patients, ASA I–II, aged 25 to 65, scheduled for elective general surgery. Patients were premedicated with clonidine 2 mcg·kg^{-1} iv and remifentanil 1 mcg·kg^{-1} bolus followed by an infusion 0.1 mcg·kg^{-1}·min^{-1} to all patients prior to induction of anaesthesia. Patients were previously randomized in to two groups: the group of remifentanil-propofol (RP) received propofol 2,5 mg·kg^{-1} and the group of remifentanil-sevoflurane (RS) received sevoflurane (8% initially, falling to 4–2% subsequently). Intubation was performed when the BIS index became <40 without muscle relaxants. Cortisol and glucose levels were assessed prior to induction of anaesthesia, 5 min after intubation and 10 min after surgical incision. Systolic BP, diastolic BP and heart rate were recorded at the same time. Parametric data were analyzed using student's t-test.
Results and Discussions: Demographic data were similar among groups. Group PR demonstrated significantly lower cortisol levels ($p < 0,05$) after intubation. There was no statistical significance noted in the glucose levels or in the haemodynamic response to intubation and surgical incision between the two groups.
Conclusion(s): Our results showed that after intubation of the trachea a greater depression of stress response was observed in the PR group compared with the SR group. This could be considered advantageous in patients with cardiovascular or metabolic disorders.
Reference:
1 Desborough JP, Hall GM. In: Kaufman L. Anaesthesia Review, Vol. 10. Edinburgh: Churchill Livingstone, 1993; 131–48.

A-512

Propofol and midazolam versus midazolam alone for sedation following coronary artery bypass grafting

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Background and Goal of Study: Propofol and midazolam both have side-effects and synergistic use of these drugs may be optimal for sedation (1). The aim of this study was to compare the postoperative course of patients sedated with interventional midazolam combined with a constant, low dose of propofol versus interventional midazolam alone for sedation following coronary artery bypass grafting (CABG).
Materials and Methods: 42 patients were prospectively randomized to receive interventional midazolam (n = 22) or interventional midazolam combined with a constant, low dose of propofol (1 mg/kg/h) for sedation following uncomplicated CABG. Isoflurane-based anaesthesia with a maximal dose of 25 μg/kg fentanyl was used during the procedure. Observational period lasted 5 hours. Incidents of light sedation or pain were treated with repeated iv boluses of midazolam or morphine, respectively. Systolic blood pressure was kept in a range of 100–140 mmHg with the use of nitroglycerin infusion. Haemodynamic stability (automatic recording of HR and BP), usage of interventional drugs as well as extubation and ICU time was compared with the use of ANOVA or Mann-Whitney test and $p < 0.05$ was considered significant.
Results: Haemodynamic stability was comparable. Recovery times and the usage of interventional drugs were significantly different (see Table).

	Group I	Group II
Conciousness (min.)	*183 ± 13	143 ± 76
Ekstubation (min.)	*512 ± 86	661 ± 229
ICU stay (hours)	33,6 ± 22,9	32,8 ± 13,5
Morfine (mg)	*5,4 ± 2,8	9,2 ± 6,6
Midazolam (mg)	*2,9 ± 2,4	6,5 ± 4,9
Nitroglycerin (mg)	9,8 ± 9,5	8,1 ± 7,6

Conclusion(s): Synergistic sedation with low-dose propofol and interventional midazolam is safe and may be beneficial over interventional midazolam after CABG.
Reference:
1 Walder B, et al., Anaesth Intensive Care 2002;30:171–178.

A-513

Hemodynamic effects of intraoperative magnesium administration in patients undergoing coronary artery bypass grafting surgery (Preliminary results)

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Introduction: Magnesium, a *N*-MDA receptor antagonist, provides analgesia as well as attenuating hemodynamic effects during endotracheal intubation (1,2). In this study, we aimed to evaluate the hemodynamic effects of magnesium which has administered intraoperatively in patients undergoing coronary artery by-pass grefting surgery (CABG).
Material and Methods: Fourty ASA II–III patients undergoing CABG were enrolled to the study. After standart premedication and prior to the induction, patients in Group I (n = 20) received $MgSO_4$ 50 mg/kg i.v bolus followed by 7 mL/kg/h infusion intraoperatively. Group II (n = 20) received saline. Induction of anesthesia was performed with the same drugs in both groups. Mean arterial pressure, heart rate and peripheral O_2 saturation (MAP, HR, SpO_2) were recorded before and after induction, after intubation, after skin incision and sternotomy. O_2 in air 50% and sevoflurane 2% were used for maintenance of anesthesia. When hemodynamic measurements elevated more than 20% of initial values, 0.5 mg fentanil was administered i.v.
Results: Demographic data was similar in both groups. In Group I, MAP and HR did not increase after intubation, incision or sternotomy when compared with previous values. Moreover, MAP and HR were lower in Group I when compared with Group II at all time of measurements.
Discussion: Intubation, skin incision and sternotomy are the most important noxious stimulations which cause hemodynamic response during CABG. The present study suggested that bolus and infusion of $MgSO_4$ attenuated hemodynamic these responses in CABG.
References:
1 Anesth Analg. 1998; Oct; 87 (4): 808–11.
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A-514

Effects of dexmedetomidine and esmolol on hemodynamic response to tracheal intubation

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Introduction: To investigate the effects of dexmedetomidine and esmolol on hemodynamic response due to endotracheal intubation and incision, we designed this randomized, double-blind, placebo-controlled study.
Material and Methods: After the approval of Ethical Committee, 45 (n = 15 in each) ASA status I–II patients were randomly assigned to receive saline intravenous 10 mL bolus followed by 2 mL·kg·min^{-1} infusion (Group S), or

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esmolol 1 mg/kg^{-1} bolus followed by 250 mcg · kg · min^{-1} infusion (Group E), or dexmedetomidine 1 mcg · kg^{-1} iv followed by 0.5 mg · kg · h^{-1} infusion (Group D), 10 min prior to induction which was performed with propofol 2.5 mg kg^{-1} and atracurium 0.6 mg kg^{-1}. Systolic and diastolic arterial pressure and heart rate (SAP, DAP, HR) were recorded before, 1 and 5 min after intubation, after surgical incision.

Results: Demographic and initial hemodynamic data of groups were similar. SAP increased in all groups 1 minute after intubation; in Group S ($p < 0.001$) and D ($p < 0.05$) the increase were significant compared with the previous value, whereas in Group E, it was minimal ($p > 0.05$). Heart rate and DAP increased in Group S ($p < 0.001$, $p < 0.01$, respectively) and in Group D ($p > 0.05$, for both); HR decreased in Group E ($p > 0.05$). At 5th min after intubation, SAP and DAP changed minimally; HR decreased in Groups S and D, but minimal higher than initial values ($p > 0.05$). Incision caused increase of SAP and HR in Group S ($p < 0.01$) and D ($p < 0.05$).

Discussion: The present study suggests that, the effect of Esmolol on preventing hemodynamic response to intubation and incision is better than dexmedetomidine.

A-515

Theodrenalin produces transitory contraction of pig coronary artery pre-treated with propranolol

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Background and Goal of Study: It has been shown that akrinor (AKR), used as a pressor agent at hypotensive patients, produces transitory contraction of pig coronary artery pre-treated with propranolol (1). Since AKR is a mixture of theodrenalin hydrochloride (TDR) and cafedrine hydrochloride (CDR), we examined the effects of each substance on the pig left coronary *in vitro* and compared them to the effects of ephedrine (EDR).

Materials and Methods: The rings (n = 8 per group, 2 mm long) of pig left coronary artery were precontracted with 20 mM KCl and the effects of AKR, TDR or CDR (2×10^{-8} to 10^{-2}M) were examined. Some preparations were preincubated with beta-adrenergic blocker propranolol (1.3×10^{-5}M), alpha-1-adrenergic blocker prazosin (10^{-5}M), CGS (adenosine antagonist) or SCH (dopamine receptor antagonist).

Results and Discussions: AKR, TDR and CDR relaxed the preparations pre-contracted with KCl (EC50: 2.96 ± 0.83, 4.09 ± 0.95, and 3.79 ± 0.82) while EDR had no effect. In the preparations pre-incubated with propranolol only AKR and TDR, at concentrations of about 5 × 10-5 M, produced transitory contractions (% over maximal tension: 71 ± 15, and 49 ± 35). At higher concentrations only AKR produced complete relaxation (EC_{50} 2.16 ± 0.14) while TDR had only minimal relaxing effect (about 20%). That transitory contraction was abolished by incubation with prazosin. Pre-incubation with CGS or SCH did not influence relaxing property of AKR.

Conclusions: We found that AKR, TDR and CDR relaxed pig coronary artery *in vitro*. This effect was not mediated by the beta-2 adrenergic, dopamine or adenosine receptors. AKR and TDR produced transitory contraction in preparations pre-incubated with propranolol. These contractions were probably due to alpha-1-adrenoreceptor stimulation.

Reference:

1 Foellner S. *Eur J Anaesth* 2003; 20: 134.

A-516

The efficacy of esmolol with either sevoflurane, desflurane or propofol in controlled hypotension for middle ear surgery

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Background and Goal of Study: Controlled hypotension provides a satisfactory operative field by reducing intraoperative bleeding in middle ear surgery (1). β blockers such as esmolol allow sufficient control of intraoperative blood pressure thus might be valuable for intraoperative conditions for surgeon (2). In our study we aimed to evaluate the efficacy of esmolol as a hypotensive agent and the effects on recovery when combined with either sevoflurane, desflurane or propofol.

Materials and Methods: After the approval by the Medical Ethics Committee of our Hospital, ASA physical status I–II, 51 patients randomized into three groups. Anaesthesia was induced with propofol, fentanyl and atracurium and maintained with sevoflurane (1–2%) in Group S, desflurane (4–6%) in Group D, propofol (4–6 mg · kg^{-1} · h^{-1}) in Group P. Controlled hypotension was induced with esmolol 500 microg.kg^{-1} followed by a continuous infusion of 50–300 microg · kg^{-1} · min^{-1} to maintain the mean arterial pressure (MAP) 20% lower than the baseline values. Haemodynamic parameters (systolic, diastolic arterial pressure SAP, DAP, MAP, heart rate – HR), peroperative bleeding, recovery characteristics, side effects were recorded. ANOVA, Mann Whitney U and chi square tests were used for the statistical analyses. $P < 0.05$ considered as significant.

Results and Discussion: The mean infusion rate of esmolol in hypotensive period was comparable in three groups. HR values were significantly lower in three groups compared with baseline values ($P < 0.05$). 3 patients in Group P, 1 patient in Group S and Group D needed peroperative atropin treatment because of bradycardia. Peroperative bleeding was similar between the groups. Recovery was earlier in Group D compared with Group S and Group P ($P < 0.05$).

Conclusion: Esmolol combined with sevoflurane, desflurane or propofol enabled controlled hypotension and provided good surgical conditions for middle ear surgery. All three techniques also provided calm and quick recovery.

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2 Degoute CS, Ray MJ, Manchon M, et al. Can J Anaesth 48; 20–7, 2001.

A-517

Effects of cardiopulmonary bypass on plasmitic concentrations of propofol in patients undergoing coronary artery bypass grafting

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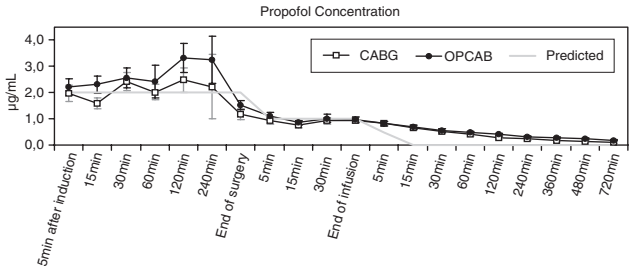
Background and Goal of Study: Cardiopulmonary bypass (CPB) can alter plasma concentrations of drugs[1]. The aim of this study was to compare the effects of CPB on plasma concentrations of propofol in patients undergoing coronary artery bypass grafting (CABG) or off-pump coronary artery bypass (OPCAB), and to correlate measured plasma concentrations with those predicted by target-controlled infusion (TCI).

Materials and Methods: Patients scheduled for CABG (n = 10) or OPCAB (n = 10) were anesthetized with sufentanyl, pancuronium bromide and TCI of propofol aiming plasma concentration of 2.0 μg · mL^{-1}. Blood samples were drawn 0, 5, 15, 30, 60, 120 and 240 minutes after induction and at the end of surgery. At the end of surgery TCI of propofol was reduced to 1.0 μg · mL^{-1} and blood samples were drawn after 5, 15, 30, 60 and 120 minutes and at the end of infusion. After the end of infusion, samples were drawn at 5, 15, 30, 60, 120, 240, 360, 480 and 720 minutes. Plasma



concentrations of propofol were measured through high-performance liquid chromatography. The groups were compared one to the other and to TCI predicted concentrations. Data was analyzed through ANOVA.

Results and Discussions: Predicted and measured concentrations of propofol are shown in the Figure. Both were significantly higher in the OPCAB at 120 minutes (3.32 ± 1.76 in the OPCAB and 2.48 ± 1.12 in the CPB group, $p = 0.005$) and 240 (3.24 ± 2.71 in the OPCAB and 2.23 ± 2.48 in the CPB group, $p = 0.02$) minutes after the beginning of surgery.

Conclusion(s): Measured concentrations of propofol were higher than those predicted by TCI in both groups, with higher values in the OPCAB group.

Reference:

1 Hiraoka H et al. *Clin Pharm acol Ther.* 2004;75:324–30.

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A-518

Prophylactic administration of ephedrine against hypotensive effect of anaesthesic induction without myorelaxant

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Background and Goals: The aim of this study was to determine the effectiveness of two prophylactic administrations of ephedrine against hypotensive effect of anaesthesic induction without myorelaxant.
Material and Methods: 60 patients were randomly allocated to one of the 3 groups (n = 20): normal saline bolus and infusion (Control), ephedrine 0.2 mg/kg bolus and normal saline infusion (Bolus group) or ephedrine 0.1 mg/kg bolus followed with 0.1 $mg \cdot kg^{-1} \cdot h^{-1}$ of ephedrine (Infusion group). Anaesthesia was induced with propofol (3 mg/kg) and remifentanil (1 mcg/kg followed with 0.5 $mcg \cdot kg^{-1} \cdot min^{-1}$ until intubation, then 0.2 $mcg \cdot kg^{-1} \cdot min^{-1}$). Mean arterial pressure (MAP) and Heart rate (HR) were measured before and every minute after induction (T0) during 20 minutes. In all groups additional bolus of ephedrine could be administrated in case of hypotension (MAP < 60 mmHg).
Results: Evolution of MAP was different in the three groups (Figure). HR was initially significantly higher and patients received more additional bolus of ephedrine in the Bolus group as compared to the Infusion group.

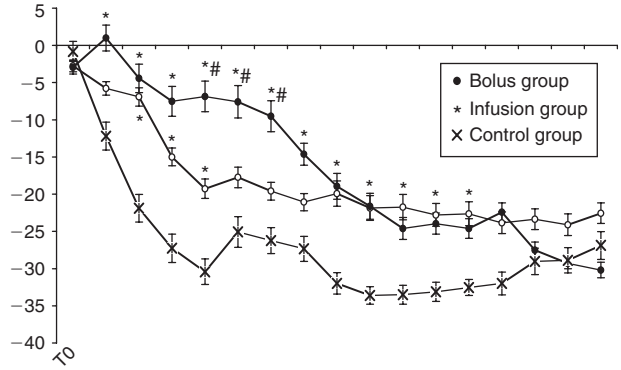

Figure. Evolution of MAP (Δ%) in the 3 groups.
*p < 0,05 *vs* Control; #p < 0,05 *vs* Infusion group.

Significant difference for p < 0,05 with ANOVA for repeated measures before Student t test.
Conclusion: Prophylactic administration of ephedrine (bolus then infusion) allowed to avoid hypotensive effect of anaesthesic induction without generating tachycardia.

A-519

Additional ondansetron does not enhance the effects of continuous ondansetron infusion during patient controlled analgesia

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Background and Goal of Study: This study was designed to determine the effectiveness of the continuous infusion of ondansetron for the prevention of postoperative nausea and vomiting (PONV) in intravenous patient-controlled analgesia (PCA).
Materials and Methods: One hundred and sixty patients undergoing spinal surgery were randomized into four groups according to the method of ondansetron administration, placebo (n = 40, group 1), ondansetron 8 mg mixed to IV PCA (n = 40, group 2), ondansetron 4 mg IV before induction or after surgery in addition to 8 mg mixed to IV PCA (n = 40, group 3 or n = 40, group 4). The incidences of nausea, vomiting, and side effects were recorded for 48 hr postoperatively.
Results and Discussions: The incidence of nausea in group 1 (43%) was significantly higher than in the other groups (group 2; 18%, group 3; 15%, group 4; 18%) (P < 0.05), and vomiting was one in group 1.
Conclusion(s): Continuous ondansetron infusion is effective at preventing PONV, but the effects of additional bolus injections to continuous infusion of ondansetron were not different from continuous infusion only.

A-520

Factors influencing postoperative urinary retention in patients undergoing total knee replacement arthroplasty

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Background and Goal of Study: Postoperative urinary retention is defined as the inability to void with a full bladder during the postoperative period. We investigated the incidence and risk factors of urinary retention following long spinal anesthesia for total knee replacement.
Materials and Methods: We retrospectively studied a number of factors that may be associated with urinary retention in 98 women (68.6 ± 6.6 yrs, 152.0 ± 5.1 cm, 60.9 ± 9.6 kg). The outcome variable of logistic regression models are urinary retention and severe urinary retention. The potential explanatory variables are age, height, weight, history of hypertension, DM and abnormal urology, heavy bupivacaine dose, types of patient-controlled analgesia, time to regression of spinal block to sacral segments (Tregression), amount of fluid and duration of surgery. We constructed a multiple linear regression model of the time from subarachnoid injection to spontaneous voiding (Tvoiding) in relation to above variables.
Results and Discussions: The overall rate of urinary retention and severe retention were 57.1% and 30.6%. Tregression (RR = 1.009) was identified as significant explanator of an increased probability for urinary retention (P = 0.002), Tregression (RR = 1.017) and DM (RR = 6.8) for severe urinary retention (P < 0.001, P = 0.054). In the multiple linear regression model, three variables – Tregression, age, urological history were identified to have significant t-values (3.902, 3.107, 2.284) with Tvoiding (P < 0.001, P = 0.003, P = 0.025).
Conclusion(s): Old age, history of DM, abnormal urological history, delayed recovery of spinal anesthesia are risk factors to urinary retention or delayed spontaneous voiding.
References:
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2 Schnider TW. *Anesthesiology* 1996; 85(3): 502–12.

A-521

Ketamine antagonized propofol-induced yawning

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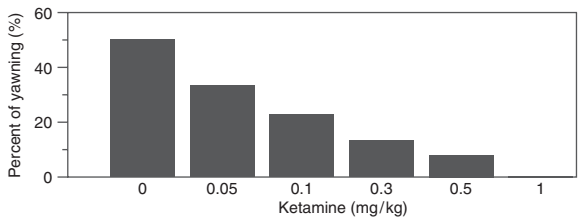
Background and Goal of Study: Yawning could be activated by propofol or thiopental during induction of anesthesia and its mechanism is not clear. Animal study showed drug-induced yawning could be inhibited, not potentiated, by GABA agonists (1). Interestingly, ketamine either induced (0.3 and 0.5 mg/kg, i.p.) or inhibited (15 and 30 mg/kg, i.p.) both apomorphine- and amphetamine-induced stereotyped behaviors in rats (2). This prompted us to investigate whether this NMDA blocker could affect the incidence of propofol-induced yawing during the induction of anesthesia.
Materials and Methods: A prospective, observational study of anesthetics-induced yawning during induction of anesthesia was conducted in a tertiary medical center (2400 beds). Total of 120 adult patients (ASA I) were recruited in a consecutive manner. IRB approval and informed consent were obtained. Auditory evoked potential, SpO_2, $ETCO_2$, ECG and NIBP were applied in the patients receiving routine induction procedure with and without pretreatment of ketamine (0.05, 0.1, 0.3, 0.5 and 1 mg/kg, i.v.). The anesthesia was induced with slow intravenous bolus injection of propofol (1 mg/kg). There were 20 patients in each group. Statistical analysis was carried out using Chi-squared test, SPSS 12.0 (2003).
Results: Under varied concentrations of ketamine (0, 0.05, 0.1, 0.3, 0.5, 1 mg/kg), propofol-induced yawning could be dramatically abolished by ketamine in a dose-dependent manner (50%, 33.3%, 22.7%, 13.3%, 8.3%, and 0%, respectively) and statistically significant p < 0.001 (Fig.1).



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Conclusions: The above results showing that propofol-induced yawning in human beings can be inhibited by ketamine suggest NMDA receptors play an important role in anesthetics-induced yawning.

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2 Morato GS. *Braz J Med Biol Res* 1986; 19: 403–409.

A-522

Preoperative fructose infusion prevents intraoperative hypothermia

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Background and Goal of Study: To reduce the risk of adverse outcomes by perioperative hypothermia, several treatments to prevent hypothermia have been reported including forced-air prewarming, positive end-expiratory pressure (1), and preoperative amino acids infusion (2). Fructose has been reported to elicit a great increase in dietary-induced thermogenesis. Therefore, we investigated whether preoperative fructose infusion could also prevent progressive hypothermia in anesthetized humans.

Materials and Methods: This study was approved by the ethical committee on human experiments of our university hospital and written informed consent was obtained from all patients. Twenty patients were divided into two groups; preoperative fructose infusion group (2 g/kg); and a saline infusion group. Esophageal core temperature and forearm-fingertip skin temperature gradient (an index of peripheral vasoconstriction) were measured (3) for 3 h after induction of anesthesia.

Results and Discussions: There were no significant differences between the two groups in patient characteristics, anesthetic management, or circulatory data during the study. Mean final core temperature 3 h after induction of anesthesia was 35.8 ± 0.3°C (mean ± SD) in the fructose group and 35.1 ± 0.3°C in the saline group ($P < 0.05$). The thermal vasoconstriction threshold, defined as the esophageal temperature that triggered a rapid increase in forearm-fingertip skin temperature gradient, was increased in the fructose group (36.0 ± 0.3°C), compared with that in the saline group (35.6 ± 0.3°C) ($P < 0.05$).

Conclusion(s): Preoperative fructose infusion effectively prevents intraoperative hypothermia by increasing the threshold core temperature for thermal vasoconstriction. Fructose infusion can be an alternative treatment for perioperative hypothermia.

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A-523

Quazepam, not triazolam, the night before general anaesthesia intensifies intraoperative core hypothermia with little effect on preanaesthetic resting energy expenditure

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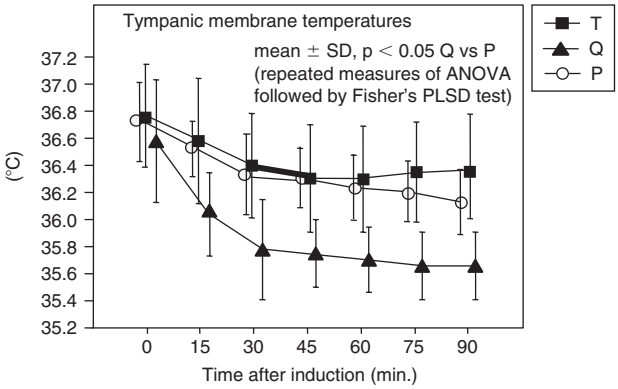
Background and Goals: Preanaesthetic sedatives can affect perioperative body temperatures. We previously reported that quazepam, a long acting benzodiazepine, taken the night before surgery intensified intraoperative core hypothermia (1). We investigated how hypnotics with different durations influence on the perioperative body temperatures and the resting energy expenditures (REE).

Materials and Methods: With IRB approval and informed consent, 15 ASA physical status I or II patients scheduled for head and neck surgery in the morning were randomly assigned to three groups to orally receive triazolam 0.25 mg (T; 3 males (M)/3 females (F), age 44 ± 20 yr (mean ± SD)), quazepam 30 mg (Q; 2M/3F, age 61 ± 5 yr) or placebo (P; 1M/3F, age 59 ± 11 yr) the night before surgery. Preanaesthetic REE was measured using gas mass spectrometer. Tympanic membrane temperature (Tt) was monitored during general anaesthesia with propofol and fentanyl.

Results and Discussions: Intraoperative Tt of patients in group Q, but not in group T, were significantly lower compared with those in group P (Fig.). There were no significant differences in REE among the groups.



Conclusion(s): Quazepam (a long acting benzodiazepine), but not triazolam (a short acting benzodiazepine), taken the night before surgery induces profound intraoperative core hypothermia with little effect on preanaesthetic REE.

Reference:

1 Shido A, Ota J, Nomura T, et al. Eur J Anaesth 2003; 20 (Suppl 30): 92.

A-524

Comparison of the quantitative effect of ketamine on vascular pain associated with intravenous rocuronium injection

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Background and Goal of Study: Rocuronium has a high incidence of pain associated with intravenous injection. In this study, we evaluated the quantitative effect of pretreatment with ketamine on the incidence of pain on injection of rocuronium.

Materials and Methods: Sixty healthy female patients scheduled for general anesthesia were randomly divided into three groups; saline group (n = 20), ketamine 0.2 mg/kg group (n = 20), ketamine 0.5 mg/kg group (n = 20). Each patient received 2 ml of pretreatment solution via 18 G angiocatheter inserted in the dorsal vein of hand. After 30 seconds, 0.6 mg/kg of rocuronium was administered by intravenous route. Anesthesia was induced by 2 mg/kg of propofol. The assessment of pain was made during the injection of rocuronium and the severity of pain was classified as none, mild, severe.

Results: The pretreatment with ketamine 0.5 mg/kg intravenously significantly reduced the pain compared to the saline group and ketamine 0.2 mg/kg group. The patients pretreated with ketamine 0.2 mg/kg were less likely to suffer severe pain compared to the saline group.

Table 1. The incidence of pain during the intravenous administration of rocuronium.

	Severity of Pain		
	None	Mild	Severe
Group 1 (n = 20)	2 (10)	8 (40)	10 (50)
Group 2 (n = 20)	3 (15)	15 (75)	2 (10)
Group 3 (n = 20)*	12 (60)	6 (30)	2 (10)

Group 1: Normal saline, Group 2: Ketamine 0.2 mg/kg, Group 3: Ketamine 0.5 mg/kg.
*$P < 0.05$ compared with Group 1 and Group 2.
Numbers in parenthesis are percentage.

Conclusions: The pretreatment with intravenous ketamine 0.5 mg/kg is more effective than ketamine 0.2 mg/kg in alleviating the incidence and severity of pain on injection of rocuronium without significant side effects.

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A-525

Low dose dexamethasone vs. ondansetron for antiemetic prophylaxis in breast surgery

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Background and Goal of Study: Although postoperative nausea and vomiting (PONV) remain a common problem after breast surgery, few clinical

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trials have compared low dose Dexamethasone with Ondansetron as antiemetic prophylaxis.

Materials and Methods: This is a prospective randomized, double-blind comparative study to asses the efficacy of 4 mg i.v. Dexamethasone vs. 4 mg i.v. Ondansetron during induction of anaesthesia for controlling PONV. 112 women ASA I–II who underwent breast surgery were randomly assigned to Group I-Ondansetron or Group II-Dexamethasone. Diabetic and obese patients were excluded. Numeric variables were compared with parametric or nonparametric tests according to their distributional characteristics. String variables were studied with Chi-square test. $P \leqslant 0.05$ was considered significant.

Results: The 80 cases with a complete chart had a median age of 59 ± 25 years and a mean weight of 65 kg (SD 9.65). The distribution of these variables resulted homogeneous within both groups. Data regarding nausea, vomiting and use of anti-emetic rescue drugs are shown in the Table:

	1st postsurgical hour	2nd–6th postsurgical hours	7th–24th postsurgical hours
Group I – Ondansetron (n = 30)	Nausea = 0 Vomiting = 0 Rescue = 0	Nausea = 2 (6.7%) Vomiting = 0 Rescue = 4 (13.3%)	Nausea = 4 (13.3%) Vomiting = 0 Rescue = 4 (8%)
Group II – Dexamethasone (n = 50)	Nausea = 2 (4%) Vomiting = 2 (4%) Rescue = 8 (16%)	Nausea = 8(16%) Vomiting = 2 (4%) Rescue = 10 (20%)	Nausea = 0 Vomiting = 2 (4%) Rescue = 4 (8%)
*p	Nausea-p = 1.0 Vomiting-p = 1.0 Rescue-p = 0.27	Nausea-p = 0.63 Vomiting-p = 1.0 Rescue-p = 0.69	Nausea-p = 0.13 Vomiting-p = 1.0 Rescue-p = 0.62

Neither side effects nor complications were observed.

Conclusions: 4 mg i.v. Dexamethasone resulted as effective as 4 mg i.v. Ondansetron in preventing PONV during the first 24 hours following breast surgery.

No significant differences were found in the antiemetic rescue therapy requirements with these drugs.

Considering the similarity between them in safety and efficacy, Dexamethasone should be preferred for anti-emetic prophylaxis due to its lower cost.

A-526

Melatonin as a premedication for laparoscopic cholecystectomy

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Background and Goal of Study: There are only a few studies involving the use of melatonin for premedication of anaesthesia. The goal of this study was to compare the effects of melatonin and midazolam, administered as a premedication for laparoscopic cholecystectomy.

Materials and Methods: 45 patients (ASA I/II) undergoing laparoscopic cholecystectomy were divided in three equal groups. Group 1 included the patients receiving 3 mg melatonin the night before and as a premedication, group 2 included the patients which have received 3,7 mg midazolam using the same protocol as for melatonin and, finally, group 3 included patients receiving placebo tablets. In preoperative period the anxiety and sedation scores as well as the quality of preanesthetic sleep have been evaluated. Postoperatively the anxiety and sedation scores and the number of remembered pictures were evaluated at 15 min, 60 min, 6 h, 12 h and 24 h, respectively. The intraanesthetic opioid consumption and the severity of postoperative pain (on VAS) were evaluated also.

Results and Discussions: The anxiety score was lower in the melatonin group compared with midazolam in both preoperative and postoperative period. The score of remembered pictures was constantly better in the melatonin group. The sedation score was significantly lower in melatonin group postoperatively. Also, the severity of postoperative pain and the intraanaesthetic opioid needs were lower in the melatonin group compared with midazolam.

Conclusion(s): Melatonin 3 mg p.o. can be successfully administered as a premedication for laparoscopic cholecystectomy, taking in consideration the analgetic effect and a reduced opioid consumption, together with a better anxiety score and better intellectual performances determined in these patients, in comparison with midazolam.

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A-528

Anxiolytic effects of propofol with nonsedative doses

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Background and Goal of Study: Propofol is a general anaesthetic, which is also used with sedative purposes (1). Other central effects of propofol are still cryptic even though there is a generalized impression that sedative doses of propofol also produce anxiolytic effects. Importantly, it should be remembered that propofol acts putatively on several neurotransmitters systems that mediate anxiety behavior. Taken into account this background, we designed a study in order to investigate the influence of propofol on anxiety using innate anxiogenic situations in rats.

Materials and Methods: Groups of Wistar rats were given intraperitoneal injections of nonsedative (2) doses of propofol (9 mg/Kg, Propofol 1%, Fresenius®), or excipient (10% Intralipid, Fresenius®). Five minutes later animals were behaviourally assessed in an *open field* or an *elevated plus-maze* tests (which evaluate locomotory activity and anxiety behavior, respectively). A second set of animals was examined in the same experimental paradigms following serial injections of propofol (9 mg/Kg, Propofol 1%, Fresenius®) during 5 days.

Results and Discussions: The open field test failed to show any significant differences in locomotion between experimental groups, which ruled out any sedative effects of the treatment. In contrast, performance in the elevated-plus maze was significant altered by propofol; specifically, rats injected with once with propofol spent more time in the open arm and less time in the closed arm than controls and, as a consequence, the open arm/closed arm ratio was statistically different. Repeated exposure to propofol produced similar results but additionally revealed an increased number of entrances and explorations of the open arm.

Conclusion(s): The present results clearly demonstrate that propofol displays anxiolytic properties; importantly, these effects cannot be ascribed to the well-known sedative effects of the drug, as they were observed in animals with preserved locomotory activity.

References:

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A-529

Propofol infusion requirements are lower in hypothermic cardiopulmonary bypass surgery when a cisatracurium infusion is given

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Background and Goal: Infusions of neuromuscular blocking drugs (NMBDs) are commonly used during cardiac surgery. In two consecutive studies, we investigated whether a continuous infusion of cisatracurium reduces the requirements for propofol during hypothermic cardiopulmonary bypass (CPB) surgery (28°C).

Materials and Methods: In the first study[1], 20 patients were randomly assigned either to group 1 ($n = 10$) or group 2 ($n = 10$). Anaesthesia was induced with diazepam 0.15 mg kg^{-1} and sufentanil 2.5 μg kg^{-1} i.v. Those in group 1 were given a bolus dose of cisatracurium at induction and thereafter no more NMBD. Those in group 2 received a continuous infusion of cisatracurium during the entire procedure at a rate of 1 μg kg^{-1} min^{-1} before CPB, 0.75 μg kg^{-1} min^{-1} during CPB, and 1 μg kg^{-1} min^{-1} following CPB. Anaesthesia was maintained with oxygen 40% in air, propofol 1–3 mg kg^{-1} h^{-1} and boluses of sufentanil. Propofol dose requirements were adjusted according to BIS monitoring; the BIS was kept between 45% and 55%.

In the second (present) study, groups 1 and 2 (each $n = 15$) had received a standardised anaesthetic with BIS-guided, propofol target-controlled infusion and a remifentanil infusion steered by haemodynamic changes. Group 1 received a cisatracurium bolus dose at induction; group 2 a continuous infusion. The only methodological difference between the two investigations was thus a remifentanil infusion in the second rather than boluses of sufentanil and diazepam.

Results and Discussion: In the first study, the propofol dose requirements in patients receiving a continuous infusion of cisatracurium during hypothermic CPB surgery were 3.6 ± 0.7 mg kg^{-1} h^{-1} and significantly different from those not receiving a maintenance dose of cisatracurium (4.7 ±

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0.8 mg kg^{-1}h^{-1}) ($P = 0.02$). In the second study, propofol consumption was 5.4 ± 1.7 and 4.4 ± 1.0 mg kg^{-1}h^{-1} in group 1 (bolus) and group 2 (infusion), respectively ($P = 0.07$).

Conclusion: Propofol dose requirements were lower in patients receiving a cisatracurium infusion during hypothermic CPB surgery. Moreover, propofol requirements tended to be higher when remifentanil was administered instead of diazepam and sufentanil.

Reference:

1 Cammu G et al. EJA 2004, in press.

A-530

Sufentanil decreases the consumption of midazolam and propofol versus fentanyl in BIS guided propofol anaesthesia in aesthetic surgery

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Background and Goals: Sufentanil has higher potency and longer duration than fentanyl (1). A lower range opioid supplementation with sufentanil should provide efficacious, smooth and safe analgesia along with cardiovascular stability in aesthetic anaesthesia (2).

Materials and Methods: a total of 150 nonpremedicated patient scheduled for aesthetic surgery were randomly assigned to receive either sufentanil (S) or fentanyl (F) for BIS guided propofol induction and maintenance in the general anaesthesia (S-GA = 64, F-GA = 64) and anaesthetic sedation (S-AS = 11, F-AS = 11)groups. BIS levels were kept in the range 40–60 in group GA and 61–88 in group AS. Consumption of midazolam (mdlm) and propofol (prop) was monitored, intra and postoperative cardiovascular and respiratory data were collected. Pain visual analogue scores, consumption of analgesics and nausea and vomiting (PONV) were recorded.

Results and Discussions: data (Mean ± SD) are shown in the Table.

	S-GA	S-AS	F-GA	F-AS
opioid $_{\mu g/kg}$	0,29 ± 0,1	0,18 ± 0,06	1,39 ± 0,4	0,79 ± 0,2
mdlm $_{\mu g/kg}$	50,6 ± 15*	58,1 ± 14	82,8 ± 24	70,1 ± 26
prop $_{\mu g/kg/h}$	4,5 + 0,6*	1,3 + 0,5**	5,4 + 0,63	2,2 + 0,75
BPdrop$_{ind\ \%}$	12,1 ± 8	8,8 ± 6,2	11,0 ± 7,5	5,7 ± 6,24
BPdrop$_{min\ \%}$	26 ± 7,1*	16 ± 6,8	19,9 ± 9,6	12,9 ± 8,8
BIS $_{extub}$	78 ± 6,6*	–	74,4 ± 5,2	–
$V_{min/kg}$	79,9 ± 14*	80,4 ± 12,5	104 ± 18	79,5 ± 35
RR$_{recov}$/min	13,6 ± 2*	13 ± 3,4**	17 ± 1,5	16,4 ± 0,8
RR$_{< 0,5\,h}$/min	15 ± 1,9	14,4 ± 3	16,9 ± 1,1	16,3 ± 0,9
VAS < 0,5 h	2,7 ± 3,03	0,54 ± 1,5	2,6 ± 2,8	0,1 ± 0,9
tramadol $_{mg}$	62,7 ± 47	~0	72,1 ± 34	20,8 ± 49
diclfenac $_{mg}$	101 ± 43	26,9 ± 56	116 ± 47	29,1 ± 45
PONV	7	0	7	0

*p < 0,05 vs F-GA, **p < 0,05 vs F-AS.

Conclusion(s): (1) Sufentanil decreases the consumption of midazolam and propofol vs fentanyl. In sufentanil group: (2) BP_{min} values are lower, (3) respiratory rate is markedly lower at recovery but has no clinical significance after surgery (4) tolerability of intratracheal tube is better (5) There are no significant difference between VAS, analgesic consumption and PONV.

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1 Lisakowski C *Br J Anaesth*. 2001;86(4):523–7.
2 Friedberg BL *J Clin Anesth*. 1999;11:4–7.

A-531

Volatile induction and maintenance anaesthesia (VIMA) with sevoflurane versus total intravenous anaesthesia (TIVA) with propofol in elderly patients scheduled for laparoscopic cholecystectomy

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Background and Goal of Study: Both methods, TIVA and VIMA, have been successfully used in elderly patients. The purpose of the study was to compare how the two techniques affect time of emergence from anaesthesia, postoperative pain, cognitive functions, and incidence of PONV (postoperative nausea and vomiting).

Material and Methods: 50 patients ASA 2–4 (mean age 77 yrs) were scheduled for laparoscopic cholecystectomy. With approval of a local ethics committee the patients were blindly randomised to have either sevoflurane (group 1; n = 25) or propofol (group 2; n = 25) anaesthesia. VIMA group patients were requested to take a deep breath with a 8vol% of sevoflurane in oxygen (initial flow 8 Lmin^{-1}; then after insertion of laryngeal mask, Pro Seal LMA, decreased to 1–3 vol% with fresh gas flow 4 Lmin^{-1}) whereas the TIVA patients were administered initially 2 mgkg^{-1} i.v. of propofol (flow 50 mg/10 sec, then 8 mg/kg/h following the LMA insertion). All the patients were administered fentanyl and mivacurium i.v. and were ventilated mechanically. After the surgery the following were assessed: time from the moment of discontinuing anaesthesia till the patient opened the eyes, return of cognitive function (MMSE, mini mental status examination 30 points score), incidence of PONV, and pain intensity according to VAS (visual analogue score). Data were analysed using repeated measures of variance (ANOVA test), chi^2 test and Student T-test.

Results and Discussion: All the patients were similar in demographic parameters and ASA.

postoperative:	VIMA	TIVA	p
Eyes opening (min)	8,0 ± 0,5	10 ± 0,8	0,007
Handshake (min)	8,5 ± 0,4	11 ± 0,9	0,011
Removal of LMA (min)	9,0 ± 0,5	11,5 ± 0,5	0,009
MMSE before surgery	26,2 ± 2,4	26,8 ± 2,9	0,45
MMSE 1 hr after surgery	22,4 ± 3,1	21,6 ± 3,1	0,38
MMSE 48 hrs after surgery	26,1 ± 2,5	26,7 ± 2,8	0,12
PONV incidence	42%	28%	0,05
VAS (mm) at 24th hour	45 ± 14	38 ± 10	0,05
VAS (mm) at 48th hour	16 ± 12	15 ± 8	0,14

Conclusions: No serious postoperative morbidity was observed. Time of emergence from anaesthesia was shorter in VIMA group and incidence of nausea was higher in the VIMA patients (p < 0,05).

A-532

Inhibitory effects of sevoflurane on U-wave in ECG

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Background and Goal of Study: The genesis of U wave in ECG is not clear, although several hypotheses have been proposed. Sevoflurane, like other volatile anesthetics, could inhibit transsarcolemmal Ca influx in in-vitro experiments. The present study was therefore to evaluate the possible effects of sevoflurane on U wave in human beings.

Materials and Methods: Perioperative ECG recordings (lead II) were collected and analyzed from 220 gynecologic patients (20 to 70 years old, ASA class I). Anesthesia was induced with thiopental, fentanyl and succinylcholine and maintained with sevoflurane and O_2. U wave amplitude was measured from amplified ECG records manually.

Results: Discernible U waves in variable size could be identified in 75% of the patients. A negative correlation between RR interval and U_{Amp} ($r = -0.72$) supported tachycardia-augmented nature of U wave in the presence of sympathetic stimulation. U_{Amp} was larger in extrasystolic beats (442 ± 151% of the control, n = 5, $p < 0.05$). Sevoflurane (1 to 1.5 MAC) significantly and reversibly suppressed U_{Amp} (a decrease by 55 ± 13 μV, n = 15, $p < 0.05$) (Fig 1).

Conclusions: The inhibitory action of sevoflurane on U_{Amp} suggests a role of afterdepolarizations and intracellular Ca overload on the genesis of U wave in ECG.

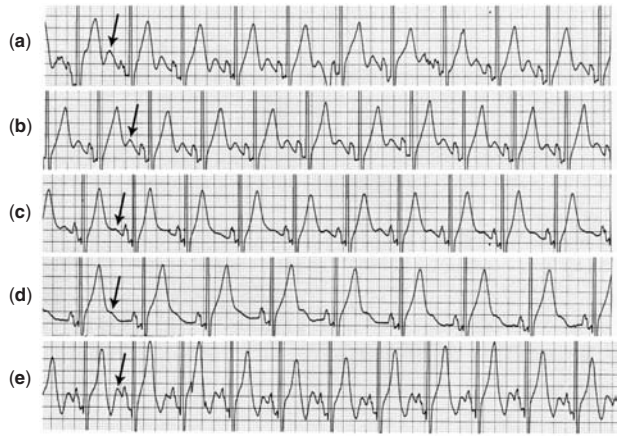

Figure 1. Suppressive effects of sevoflurane on U-waves in ECG. A: pre-induction; B–D: sevoflurane; E: emergence. Example of U-waves in each trace is denoted by arrows.

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A-533

Prognosis value of ECG abnormalities, myocardial specific enzymes and cardiac function in spontaneous subarachnoid hemorrhage

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Background and Goal of Study: Spontaneous subarachnoid hemorrhage (SAH) causes myocardial dysfunction in 9 to 23 p.cent, associated with ECG abnormalities. Prognostic value of myocardial injury is unclear. We studied this changes in term of prognosis (Glasgow outcome scale).

Materials and Methods: We prospectly studied 51 patients the first 24 hours after SAH. Patients with chronic cardiac disease or brain death were excluded. Clinical characteristics (Glasgow scale, heart rate, systolic blood pressure), cardiac enzymes (troponin I, total serum creatine kinase and myocardial isoenzyme, myoglobin), ECG changes (ST-T changes, prolonged QT and corrected QT intervals), echocardiographic assessment of cardiac function (left ventricular ejection fraction, hypokinesia) were studied on the day of the admission.

Results and Discussions: Data are shown in the Table.

	Univariate			Multivariate		
Predictors	OR	p	95% CI	OR	p	95% CI
Glasgow scale < 13	15.11	<0.05	3.1–73.8			
WFNS > 3	10.71	<0.05	2.6–44.4			
Systolic < 100 mmHg	3.47	<0.05	0.8–14-5	7.58	<0.1	1.4–41.3
Heart rate > 95 bpm	11.07	<0.05	2.1–54.2	19.32	<0.1	3.1–119.3
Phenylephrine used	3.6	<0.05	1–13			
QT prolongation	3.75	<0.05	1.0–13.6			

Conclusions: Only systolic blood pressure <100 mmHg and heart rate >95 bpm were found to be independent factors of poor outcome. Measurements of myocardial specific enzymes and echocardiographic assessment of cardiac function have no prognosis impact in this study.

A-535

Deep neuromuscular-block reversal with Org 25969

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Background and Goal of Study: Org 25969 is a novel γ-cyclodextrin developed for the reversal of neuromuscular block which acts by encapsulation of the steroidal neuromuscular blocking agents (1). The aim of this multi-centre, randomised, phase II trial was to explore the dose-response relation of Org 25969 given after a prolonged rocuronium-induced neuromuscular block.

Materials and Methods: Thirty adult patients aged 19–76 years with anticipated duration of anaesthesia of ⩾2.5 h were anaesthetised using an IV anaesthetic technique. Neuromuscular monitoring was carried out using accelerometry in a train-of-four (TOF) mode with TOF-watch SX. Patients received an initial dose of 0.6 mg/kg of rocuronium followed by increments to maintain a deep level of block at post-tetanic count (PTC) of 1–10 assessed every 6 min. At recovery of T2 following 2 h of deep block, 6 patients each were randomly allocated to receive 0.5, 1.0, 2.0, 4.0 or 6.0 mg/kg of Org 25969. Anaesthesia and neuromuscular monitoring were continued for 30 min after reversal. The primary efficacy variable was the time from start of Org 25969 administration to recovery of TOF ratio to 0.9. Data were analysed by weighted nonlinear regression. Heart rate, blood pressure and any adverse effects were recorded and patients followed up for 7 days.

Results and Discussions: There was a dose-related decrease in the time taken to attain a TOF ratio of 0.9 from 6.8 min with the 0.5 mg/kg dose to 1.4 min with the 4.0 mg/kg dose (see Table for mean (SD) values).

0.5 mg/kg	1.0 mg/kg	2.0 mg/kg	4.0 mg/kg	6.0 mg/kg
6.8 (3.1)	2.7 (1.0)	1.8 (0.6)	1.4 (0.6)	2.6 (1.25)

Regression analysis showed the fastest achievable time to TOF ratio of 0.9 to be 1.59 min. Doses of Org 25969 with which the recovery to TOF ratio of 0.9 would occur in a time which would be 4 or 1 min slower were estimated to be 0.74 and 1.39 mg/kg respectively. There were no serious adverse events related to Org 25969 nor was there any evidence of recurarisation.

Conclusion(s): A dose-response effect was seen for the time to recovery of TOF ratio to 0.9. Org 25969 was shown to be efficacious and well tolerated.

Reference:

1 *Bioorg Med Chem.* 2002;10:1819–1827.

Acknowledgements: This study was supported by a grant from Organon NV, The Netherlands.

A-536

Intravenous dexamethasone administered perioperatively does not cause hyperglycaemia – initial report

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Background and Goal of Study: In view of the reports questioning the neuroprotective effect of dexamethasone – due to its rapid hyperglycaemic effect [1] we have performed an initial prospective analysis of blood glucose levels in patients administered i.v. dexamethasone perioperatively during neurosurgical procedures.

Materials and Methods: 46 non-diabetic patients (29 women, 17 men; mean age 52 ± 8 yrs) undergoing extensive cranial base surgery were administered dexamethasone i.v. acc. to the following protocol: 8.00–16 mg i.v.; and then 6 mg i.v. every six hours. Blood glucose levels were checked 30 min. before the initial dose, and every 30 mins for the 2 hours, and then every 2 hours during the day of surgery. No glucose was administered intraoperatively, while after surgery the patients received 2000 ml of 5%.

Glucose/0.9% saline 2:1 solution in a constant infusion.

Results and Discussions: Blood glucose levels remained at a mean value of 82 ± 12 mg% throughout surgery and did not exceed 118 mg% in the postoperative period during the glucose infusion. No significant increases of the blood glucose level were observed in any of the patients.

Conclusion(s): Intravenous dexamethasone appears not to cause rapid hyperglycaemia in non-diabetic neurosurgical patients. This is an initial communication and it launches further research.

Reference:

1 Scott Jellish W, Murdoch J, Leonetti JP *"Perioperative management of complex skull base surgery – the anaesthesiologist's point view";* Neurosurgery Focus 12(5);2002.

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A-537

Risk score to predict postoperative vomiting in children

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Background and Goal of Study: Risk scores to predict the occurrence of postoperative vomiting (PV) or nausea and vomiting (PONV) that were developed for adult patients do not fit for children since several risk factors are difficult to assess or are usually not applicable in pediatric patients (e.g. smoking status) [1]. Thus, the aim of the present study was to develop and to validate a simple to predict *p*ostoperative *v*omiting in *c*hildren (*POVOC*-score).

Materials and Methods: Development and validation of the new score was based on data of 1257 children (0–14 years) from four independent institutions undergoing various types of surgery under general anesthesia without antiemetic prophylaxis. The study was approved by the local ethics committee. Preoperatively, several potential risk factors were recorded. Postoperatively, the occurrence of PV was observed for up to 24 hours. The dataset was randomly split into an evaluation set (n = 657) that was analyzed using a forward logistic regression technique and a validation set (n = 600) that was used to confirm the accuracy of prediction by means of the area under a ROC-curve.

Results and Discussions: Four independent risk factors for PV were identified in the final analysis: duration of surgery ⩾30 minutes), age ⩾3 years, strabismus surgery, and a positive history of PV in the children or PV/PONV

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in relatives (mother, father, or siblings). The incidence of PV was 9%, 10%, 30%, 55%, and 70% for 0, 1, 2, 3, and 4 risk factors observed. Using these incidences as cut-off values in the validation dataset, the AUC under the ROC-curve was 0.72 (95%-confidence interval: 0.68–0.77).

Conclusion: The present data suggest that PV can be predicted with an acceptable accuracy using a 4-item simplified risk score. However, this model must be validated in other institutions before its widespread use can be recommended.

Reference:

1 Eberhart LHJ, Morin AM, Guber D, et al. Applicability of risk scores for postoperative nausea and vomiting for adults in paediatric patients. *Br J Anaesth* 2004; 93: 386–392.

A-538

Meta-analysis of post-operative vomiting in children receiving propofol or sevoflurane for induction or maintenance of anaesthesia

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Background and Goal: In adults, intravenous anaesthesia (IVA) reduces PONV. We used meta-analysis to determine whether similar benefits occur in children.

Materials and Methods: We identified all prospective randomised studies before 2004 comparing PONV after propofol for induction and maintenance of anaesthesia (PP); propofol for induction and sevoflurane for maintenance (PS); sevoflurane for induction and maintenance (SS) or sevoflurane for induction and propofol for maintenance of anaesthesia (SP).

Using S-Plus, odds ratios were calculated using fixed-effects and random-effects meta-analysis. The number-needed-to-treat (the mean number of patients that if induced and maintained with propofol would save one incidence of PONV) was determined.

Results and Discussions: Eleven trials (807 patients) reported vomiting incidence. Seven trials compared PP with SS. 20.2% of the 312 patients anaesthetised with PP and 35.9% of 315 patients receiving SS vomited. The common odds ratio (fixed effects) was 0.409 (95% CI: 0.277, 0.605) i.e. a 2.4-fold reduction in risk of vomiting. The test for heterogeneity was not significant. The common odds ratio (random effects) was 0.409 (95% CI: 0.25,0.669) i.e. a 2.4-fold reduction in risk of vomiting. Two trials compared SS and SP, 7.4% of 54 patients anaesthetised with SS vomited vs 8% of 50 patients receiving SP. The common odds ratio (fixed effects) was 0.938 (95% CI: 0.211, 4.177) i.e. no significant reduction. The test for heterogeneity was not significant. The common odds ratio (random effects) was 0.938 (95% CI: 0.211, 4.177).

One trial compared PP and PS and 1 trial compared PS and SS.

Conclusion: Children receiving a propofol-based anaesthetic had a significantly lower incidence of postoperative vomiting in comparison to children receiving a sevoflurane-based anaesthetic, regardless of the type of surgery and the observation period of PONV. The magnitude of this benefit is smaller than previously reported for adults. Patient numbers for comparisons other than PP vs SS were small and limit the ability to draw clear conclusions.

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A-539

Preincisional i.v. clonidine prevents agitation during recovery from sevoflurane anesthesia in children

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Background and Goal of Study: Clonidine seems to prevent agitation from sevoflurane in children[1]. The aim of this study was to estimate the effect of clonidine on agitation as well as on BIS, cardiovascular changes, postoperative pain and recovery conditions after sevoflurane anesthesia.

Materials and Methods: Fifty four paediatric patients, ASA 1–2, aged 2 months to 12 years, scheduled for elective surgery, were randomly allocated into two groups (A: clonidine $2\,mcg\cdot Kg^{-1}$, B: saline). After induction with sevoflurane and remifentanil and when BIS <30 children were intubated without muscle relaxant. Clonidine or saline was administrated before surgical incision. Anaesthesia was maintained with sevoflurane in a N_2O/O_2 mixture and remifentanil. At the end of surgery, children were extubated when BIS > 80. BIS values, mean arterial pressure (MAP) and heart rate (HR) were recorded before and after administration of clonidine or saline. Children were blindly evaluated for agitation using the modified Aldrete scoring scale and a "score 0–2" scale (0 = no agitation, 1 = cough during extubation, 2 = agitation, cyanosis, cough). Pain was evaluated with VAS (a ten points scale). Statistical analysis was performed with independent-samples t-test or χ^2-test as appropriate.

Results and Discussions: Demographic data were similar in both groups. Changes on BIS, MAP and HR before and after administration of either clonidine or saline were not significantly different in both groups. Pain score, Aldrete score and 0–2 score are shown on the Table.

			Score 0–2 scale		
Group	Pain	Aldrete	0	1	2
A	1.11	8.22	19 (70%)	8 (29%)	0 (0%)
B	2.44	7.88	7 (25%)	9 (33%)	11 (40%)
	$P < 0.05$	NS	$P < 0.05$	NS	$P < 0.001$

Conclusion(s): According to the results of this study, preincisional clonidine prevents agitation from sevoflurane anesthesia in children and decreases postoperative pain, without delaying recovery.

Reference:

1 Bock M., Kunz P, Schreckenberger R. et al., BJA, 88(6):790–6 (2002).

A-540

Perioperative anxiety and postoperative behavioral disturbances in children: comparison between induction techniques

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Background and Goal of Study: Induction with sevoflurane inhalation is associated with distress on emergence from anaesthesia and with postoperative behavioral disturbances (PBD) such as nocturnal enuresis, hightmare, crying during sleep, regression in toilet training etc. (1). This study investigates the influence of amnestic effect of propofol addition to inhalation induction on PBD.

Materials and Methods: Following ethics committee approval and parental informed consent, 120 ASA I–II children (2–10 years), undergoing elective adenoidectomy and tonsillectomy were recruited. Parents were not allowed to accompany their child. Unpremedicated children were randomly allocated as; Group 1($n = 40$): Induction with 8% sevofluran inhalation, Group 2 ($n = 40$): Induction with $2–2,5\,mg\cdot kg^{-1}$ intravenous propofol, Group 3 ($n = 40$): Induction with sevoflurane 8% inhalation followed by subhypnotic dose of propofol ($1.2\,mg\cdot kg^{-1}$). Anaesthesia was maintained with 2–4% sevofluran, 50% O_2 and 50% N_2O. Anxiety on arrival to operating theatre, at anaesthesia induction and 30 min after emergence were assessed. Parents were asked to fill STAI (State Trait Anxiety Inventory) test preoperatively and STAI and Post Hospitalization Behavior Questionnaire test 1 week later to assess children's PBD. Kruskal Wallis test, Wilcoxon test, Bonferroni test, Paired t-test, Student's t-test, Pearson and Spearman correlation test, Chi square test were used for statistics. $P < 0.05$ was considered statistically significant.

Results and Discussions: The anxiety levels were not different at all measurement points ($p > 0.05$). Preoperative parent's anxiety level of all groups was high. Preoperative behavioral disturbances in all groups were same. In Group 1, 15% of children and in Group 3, 20% of children but no children in Group 2 had postoperative nightmare and fear of night ($p < 0.05$). A relation between preoperative anxiety level and PBD was determined ($p < 0.05$). Higher incidence of PBD in the sevoflurane groups were observed but it was not significant.

Conclusion: Addition of subhypnotic dose of propofol to sevoflurane induction doesnot reduce the incidence of PBD seen after inhalation induction. No PBD was seen in intravenous induction group.

Reference:

1 Foesel T, Reisch H.J. Paed Anaesth 2001; 11: 719–23.

A-541

Postopereative nausea and vomiting are independent of oculocardiac reflex during squint surgery in children anesthetized with halothane and nitrous oxide

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Background and Goal of Study: Postoperative nausea and vomiting (PONV) appear during squint surgery. The data are still controversial about

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interdependence of PONV and oculocardiac reflex (OCR). As was proved in a recent study, rocuronium attenuates OCR. If these two occurrences are dependent, rocuronium is expected to diminish PONV. The goal of this study was to test the possibility of diminishing PONV with 0.4 mg kg^{-1} of rocuronium and prove their interdependence.

Materials and Methods: ASA 1 children, 3 through 10 years old (6, 3–10; median, range), undergoing surgery of the medial rectus muscle, were randomly assigned to two groups. In the R group (n = 59), 0.4 mg kg^{-1} of rocuronium was administered i.v. before intubation. In the C group (n = 60), no muscle relaxant was used. The anesthesia was induced and maintained with halothane and N_2O/O_2 (50/50%). We registered nausea, vomiting and emetic episodes during 0–6, 7–12 and 13–24 h, postoperatively. Nausea was defined as unpleasant sensation with urge to vomit, and vomiting as forceful expulsion of gastric content. Chi-square, and t-test were used for statistical analysis; $p < 0.05$ was considered significant.

Results and Discussion: There was no difference between groups regarding gender ($p = 0.77$), age ($p = 0.17$), body mass ($p = 0.77$), ET halothane ($p = 0.72$), or duration of surgery ($p = 0.75$), and anesthesia ($p = 0.67$). There was significant difference between groups regarding occurrence of OCR ($p = 0.03$). Despite rocuronium attenuation of OCR, the occurrence of PONV was not diminished. There were no differences regarding PONV periods among the children in two groups.

		PONV		
Group	OCR	No	Yes	Total
R	No	23	20	43
	Yes	9	7	16
C	No	18	14	32
	Yes	14	14	28
Total		64	55	119
p		0.963		

Conclusions: Rocuronium (0.4 mg kg^{-1}) does not diminish the appearance of PONV. We could not find association between OCR and PONV during squint surgery in children anesthetized with halothane and nitrous oxide.

A-542

Transcutaneous electrical acupoint stimulation versus ondansetron in the prevention of postoperative vomiting following pediatric tonsillectomy

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Background and Goals: We aimed to evaluate the efficacy and side effects of either transcutaneous electrical accupoint stimulation (TEAS) or ondansetron compared to a control group receiving no treatment in the prevention of postoperative vomiting.

Material and Methods: This study (randomized, controlled, prospective) was carried out for 90 children, aged between 4 and 12 who went through tonsillectomy under general anesthesia. In the acupuncture group, electrical stimulation on acupoints (Neiguan and Shangwan) was performed. The second group received a single dose of ondansetron (0.15 mg · kg^{-1}). No treatment was given to a control group. The frequency of vomiting attacks and side effects were noted on the day of surgery (in the Postanesthesia Care Unit, in the Day Surgery Care Unit and after discharge) and on the first day after surgery.

Results: There was a significant difference between the treatment groups when compared with the control group in the incidence of emetic episodes occurring in the Day Surgery Care Unit and on the day of surgery after discharge ($p < 0.001$). In the ondansetron group, side effects were seen in more patients than in the other groups ($p < 0.001$).

Conclusion: The application of TEAS on sedated children could be an easy, painless (1), reliable and effective method (2) for the prophylaxis of PONV in pediatric tonsillectomy.

References:

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A-544

Role of postoperative hyperglycaemia after paediatric heart surgery

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Background and Goal of Study: Hyperglycaemia is an often encountered stress response reflecting the severity of acute illness. Prognostic relevance of this phenomenon in paediatric critical care is poorly understood. Our objective was to determine the association between hyperglycaemia and morbidity after paediatric heart surgery.

Materials and Methods: A cohort of 389 consecutive patients were reviewed, who were admitted between January 2003–December 2003 to our postoperative intensive care unit (PICU). Logistic regressions were performed to analyze the role perioperative variables, particularly the one of hyperglycaemia in prolonged (>72 h) PICU stay, cardiac failure and serious infection.

Results and Discussions: Univariate analysis showed strong relationship between hyperglycaemia and each outcome variable. Multivariate model revealed that intraoperative transfusion (ml/kg; OR: 1,04; 95% CI: 1,01–1,06), intraoperative cumulative inotropic index (OR: 1,65; 95% CI: 1,21–2,24), glucocorticoids on the day of surgery (OR: 0,16; 95% CI: 1,21–2,24) and maximum blood glucose level >144 mg/dl on the first postoperative day (10 mg/dl; OR: 1,11 95% CI: 1,01–1,21) were independent predictors of prolonged PICU stay (Hosmer–Lemeshow test: 8,13; p:0,42). Hyperglycaemia remained also determinant of cardiac failure in the final multiple model.

Conclusion(s): Postoperative hyperglycaemia is associated with longer ICU stay and cardiac complications in patients underwent paediatric cardiac surgery.

A-545

Premedication with oral midazolam with or without parental presence

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Background and Goal of Study: Most children prefer to stay with their parents even premedicated with oral midazolam and it is not easy to control anxiety on separation from parents at the entrance to the operating room (1, 2). The aim of this study was to determine if parental presence with oral midazolam premedication is effective than midazolam alone.

Materials and Methods: Sixty ASA I–II children undergoing surgery were enrolled in the study. Children were randomized to receive either 0.5 mg · kg^{-1} midazolam (Group M) or 0.25 mg · kg^{-1} midazolam with parental presence (Group MP) or parental presence alone (Group P). The child's anxiety, sedation and separation score was evaluated by 1–4 points of anxiety score (AS), 0–4 of University of Michigan Sedation Score (UMSS) and 1–4 point of parental separation score (PSS) at the entrance to the operating room and tolerance to the face mask. Heart rate (HR), mean blood pressure (MBP) and O_2 saturation (%) were assessed by repeated intervals before and after induction. At the end of surgery the child's modified Aldrete and Kroulik recovery score, AS, PSS, UMSS, FLACC and objective pain scale (OPS) were also assessed.

Results and Discussions: There were no difference between groups in age, sex, weight, and duration of surgery and anesthesia. MBP changes were similar between groups but HR was high in Group M before and after induction of anesthesia ($p < 0.05$). UMSS was greater both in Group M and PM in the preoperative period ($p < 0.05$). Success rates for anxiolysis and separation were higher in Group M and PM than Group P ($p < 0.05$). During recovery, the AS and UMSS was higher and FLACC and OPS was lower in Group M and PM than Group P.

Conclusion(s): Premedication with midazolam results in significantly better anxiolysis and parental separation tolerance, but midazolam with parental presence provides the best condition for children in the operating room.

References:

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2 Kain NZ, Mayes CL, Wang S et al. Anesthesiology 1998; 89(5): 1147–56.

A-546

Is dexamethasone is a good alternative to ondansetron in preventing postoperative vomiting after paediatric tonsillectomy

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Background and Goal: Postoperative vomiting (POV) is a frequent complication in children after tonsillectomy (1). The aim of this study was to compare the effects of a single dose of dexamethazone versus ondansetron on the incidence of early and late POV and oral intake in children undergoing tonsillectomy.

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Material and Methods: Written informed consent was obtained from the parents of children ages 3–14 years, ASA physical status I or II 100 children schedulated to undergo ambulatory tonsillectomy in this prospective randomized trial. All children premedicated with oral midazolam 0.5–0.6 mg/kg. General anesthesia was induced by inhalation with sevoflurane. Endotracheal intubation was facilitated with atracurium 0.5 mg/kg. Children were randomized in to two study medication groups: group I, ondansetron 0.15 mg/kg, maximum 4 mg and group II, dexamethazone 150 μg/kg, maximum 8 mg. Anesthesia was maintained with sevoflurane in nitrous oxide and oxygen. Each patient received an acetaminophen 30 mg/kg suppository via rectum before the start of surgery. Muscle relaxant antagonists were not used.

The incidence of early (0–6 h) and late (6–24 h) vomiting, the time to first oral intake (FOI), the quality of early (on the ward) and late (after discharge) oral intake (OI;1 = excellent, 4 = poor), parental satisfaction (PS;1 = excellent, 4 = poor) and pain scores in PACU (1 = no pain, 5 = highest pain score) were compared in groups. Chi-square and Student's t-tests were used in statistical analysis with significative $p < 0.05$.

Results and Discussion: The demographic data, the duration of surgery and anaesthesia were comparable between groups. Early POV was seen lower in group I ($p = 0.046$), but late POV was lower in group II ($p = 0.025$).

	Group I	Group II	p
Pain (1,2)	27 (40%)	40 (80%)	0.030*
FOI (min)§	224.94 ± 74.66	149.00 ± 81.31	0.000*
EarlyOI (1,2)	18 (36%)	21 (42%)	0.046*
Late OI (1,2)	31 (62%)	47 (94%)	0.000*
PS (1,2)	41 (82%)	45 (90%)	0.077

§Values reported as mean ± SD; *$p < 0.05$.

Conclusion: We concluded that single dose of dexamethasone 150 $\mu g \cdot kg^{-1}$ is as effective as ondansetron 0.15 mg $\cdot kg^{-1}$ for the prevention of POV. Besides, for quality of oral intake dexamethasone was better than ondansetron.

Reference:

1 Litman RS et al. Anesth Analg 1994;78:478–81.

A-547

Pain on propofol injection in 160 preschool children: are a new formulation and lidocaine useful?

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Background and Goal of Study: Pain on injection prevents propofol (PPF) anesthesia in children. Mixing lidocaine to PPF is widely used to reduce pain (1). A new solvent (MCT/LCT) has been advocated to be less painful than standard (LCT) PPF (2). No information is available in preschool children, in whom painful injection is especially unsuitable. We designed a prospective, randomized, double-blinded, placebo-controlled study to assess injection pain with two different PPF emulsions with or without lidocaine in children <7 years.

Methods: 160 ASA I–III children undergoing elective surgery were randomly assigned to receive in 30 s for induction of anesthesia: PPF-LCT or PPF-MCT/LCT, 5 mg/kg, with lidocaïne 0.5 mg/kg or saline. Age, weight, SpO_2, NIBP, HR, site and size of venous cannulation were recorded in each patient. From spontaneous verbal and motor reaction during injection, each graded 0 to 3, was derived a pain score graded 0 to 6. Results are presented as median and *[range]*. Kruskall-Wallis and Mann and Whitney tests were used for statistical analysis.

Results: All groups were comparable with regard to all data except pain score descriptive data:

Group	n	Pain score	Pain score <3 (%)
1: ppf-lct-*saline*	39	3 *[0–6]*	41.0
2: ppf-lct-*lidocaine*	41	1 *[0–5]*	77.5
3: ppf-mct/lct-*saline*	39	1 *[0–5]*	76.3
4: ppf-lct/mct-*lidocaine*	41	0 *[0–4]*	92.5

Pain decreased significantly in all groups *vs* 1, in 4 *vs* 3 & 2 but not between 3 & 2. Unsuitable pain (score ⩾ 3) virtually disappeared in group 4.

Conclusion: Induction of anesthesia in preschool children with PPF-MCT/LCT caused significantly less pain on injection than with PPF-LCT. Mixing lidocaïne to PPF resulted in a further significant reduction of injection pain with both PPF emulsions. Premixing lidocaïne to PPF-MCT/LCT resulted in median pain score = 0.

References:

1 Anaesthesia, 1998; 53: 468–476.
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A-548

Lidocaine pretreatment before repeated propofol-based sedation in children undergoing hematologic procedures

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Background and Goal of Study: In this study we examined the effect of lidocaine pretreatment prior to propofol administration in children undergoing hematologic procedures (bone marrow aspiration, bone biopsy or lumbar puncture).

Materials and Methods: A total of 386 patients undergoing, over a period of 12 months, to 560 hematologic procedures were randomly assigned to receive 2% lidocaine (2.0 mg/kg) or an equivalent volume of saline solution 0.9%, 1 minute before the administration of 3 mg/kg of propofol. Patients who refused the "milky solution" underwent inhalation induction with sevoflurane. A blinded observer measured the presence of pain at site of injection, the incidence of dizziness and vestibular ataxic-like symptoms and patient satisfaction. Awakening time and postoperative nausea and vomiting were also recorded.

Results and Discussions: Lidocaine pretreatment significantly reduced pain at site of injection compared to placebo (48% vs 12%; $p < 0.05$). The incidence of neurologic symptoms was significantly reduced with lidocaine pretreatment compared to placebo (38% vs 2%; $p < 0.05$). In patients who undergone inhalation induction awakening time longer and PONV was significantly more frequent than in patients who undergone propofol-based anesthesia induction. Lidocaine bolus injection was more frequently associated to bouts of cough compared to placebo and improve patient parents acceptance. Parents interview report a lower percentage of dysphoria and agitation in children receiving lidocaine than those receiving placebo before propofol infusion (28% vs. 52%; $p < 0.05$).

Conclusions: The use of lidocaine pretreatment prior to propofol has been shown to reduce propofol induced pain at the site of injection.The sevoflurane-based induction is associated to higher incidence of postoperative nausea and vomiting and longer time to discharge. We also demonstrate that for short duration sedation-anesthesia in children undergoing repeated hematologic procedures the administration of lidocaine 2 mg/kg 1 minute before the infusion of propofol reduces dizziness and vestibular ataxic-like symptoms. Bouts of cough associated to lidocaine administration can have a protective role on airway.

A-549

Propofol versus sevoflurane: differences in laryngeal reflex responses in anesthetised children

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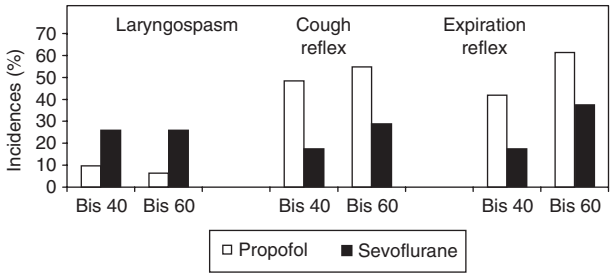
Background and Goal of Study: Exaggerated upper airway reflexes are a frequent cause for harm in particular during light levels of anesthesia, especially in children[1]. The aim of the study was to determine the role of two most commonly used anesthetic agents in pediatric anesthesia, propofol (P) and sevoflurane (S), in depressing upper airway reflexes depending on the level of hypnosis.

Materials and Methods: 70 children, 2–6 years, scheduled for surgical or dental procedures, were randomly allocated to undergo P or S anesthesia. Premedication was midazolam 0.3 mg/kg and induction of anesthesia with either P or S under spontaneous breathing. Insertion of LMA. The tip of a bronchoscope was placed above the glottic opening. The larynx was stimulated at BIS 40 ± 5 and 60 ± 5 by spraying the vocal cords with 0.2 ml of distilled water. The evoked responses were classified into 3 categories[2]: a) apnea with laryngospasm (complete closure of the glottis >10), b) expiration reflex (forceful inspiration, no preceding inspiration), c) cough reflex.

Results and Discussions: Demographic data did not differ between the groups. In group S 35 patients and in group P 31 patients were analyzed.



p = 0.006	p = 0.002	p = 0.002	Group
p = 0.79	p = 0.18	p = 0.016	Level of Hypnosis
p = 0.79	p = 0.71	p = 0.97	Group*Level

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Conclusion(s): While apnea/laryngospasm were more frequent in group S, the incidence of the cough and expiration reflex was greater in group P. The incidence of apnea/laryngospasm and the cough reflex was independent of the level of hypnosis. These results clearly demonstrate clinically relevant differences of laryngeal reactivity between S and P.

References:

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2 Tagaito Y, Anesthesiology 1998; 88:1459.

A-550

Cardiac arrhythmias during general anesthesia with fentanyl or sevoflurane for cardiac surgery in children

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Background and Goal of Study: We conducted this randomized controlled trial to compare the incidence of arrhythmias during general anesthesia with fentanyl and that with sevoflurane in children undergoing cardiac surgery for atrial or ventricular septal defect (ASD, VSD).

Materials and Methods: 58 patients, aged 1 mo to 12 yr, who were undergoing ASD or VSD repair were enrolled. Holter-ECG recording was started at least 1 hr before the induction of anesthesia and stopped after sternotomy was done. Patients who had preoperative arrhythmias or electrolyte imbalance were ruled out from the study. Without premedication, patients were randomly assigned to sevoflurane (n = 31) or fentanyl (n = 27) group. The sevoflurane group was induced with sevoflurane and vecuronium and the fentanyl group was induced with fentanyl, midazolam, and vecuronium. Each group was maintained with the same agents used in induction of anesthesia under 50% O_2 with air. Blood pressure was maintained within 20% of preoperative values in all patients. Chi square test and linear logistic regression analysis are used for statistical analysis and $P < 0.05$ was considered significant.

Results: The incidence of atrial arrhythmias was not different according to agents used but the incidence of ventricular arrhythmias was significantly higher in sevoflurane group (odds ratio 3.05, 95% confidence interval 1.04–8.92).

	Fentanyl (%, n)	Sevoflurane (%, n)
Atrial	40.7 (11/27)	48.3 (15/31)
Ventricular	40.7 (11/27)	67.7 (21/31)*
Both	11.1 (3/27)	32.2 (10/31)*

*$P < 0.05$ vs. fentanyl group.

Conclusion(s): The overall incidence of cardiac arrhythmias during general anesthesia with fentanyl or sevoflurane was very high in patients with VSD or ASD. The incidence of ventricular arrhythmias was significantly higher in sevoflurane group compared to fentanyl group.

A-551

Pharmacokinetics and pharmacodynamics of propofol in critically ill children

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Background and Goal of Study: We have shown that propofol pharmacokinetics are altered in children after cardiac surgery[1], but drug action in this age group remains unpredictable. We report on a new study to construct a pharmacokinetic-pharmacodynamic (PK-PD) model of propofol in this setting with the aim of improving predictability. The collection of further PK data also allowed validation of our previously constructed PK model.

Materials and Methods: This was a prospective study of 10 children (0.4 to 7.7 years, 6.4 to 22.6 kg) emerging from propofol anaesthesia following cardiac surgery. We collected blood samples (for propofol analysis) and electroencephalography (EEG) data during a stepped wake-up, where the propofol infusion rate was reduced from 4 mg kg^{-1} hr^{-1} in 1 mg kg^{-1} hr^{-1} steps at 30 minute intervals. A sequential population PK-PD analysis was performed using NONMEM software. Age, weight, height, BSA, gender and propofol infusion duration were investigated as model covariates.

Results and Discussions: The pharmacokinetics of propofol were 3-compartmental and weight-proportional. Simulations of propofol infusions using this and our previous model were in good agreement. Initial attempts to model using more traditional EEG variables (spectral edge frequency, % power in 0.5–2Hz band) were unsuccessful, hence a summation of high to low frequency ratios was used[2]. A sigmoid E_{max} model with an effect compartment best described the PD response, with age as a model covariate.

Conclusion(s): Although substantial inter-patient variability remained, age was a significant covariate affecting C_{50} and indicated an increased sensitivity to propofol in younger children. The values for K_{e0} (typically 0.3 min^{-1}) and propofol concentrations at arousal (median effect site concentration 0.9 μg mL^{-1}) were similar to those observed in adults.

References:

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A-552

Ketamine reduce pain score and morphine requirement in children after tonsillectomy

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Background and Goal of Study: Tonsillectomy by dissection is painful during postoperative period and responsible for postoperative complications for paediatric patients. Low dose ketamine was efficient to reduce postoperative pain in adult. The goal of this study was to evaluate the effects of low dose ketamine on postoperative pain in children scheduled for tonsillectomy by dissection.

Materials and Methods: After approval by the regional institutional human studies committee and parental consent, 60 ASA physical status I–II pediatric patients undergoing tonsillectomy by dissection were included in a prospective, double blinded, randomised, multicenter study. Children receiving non-steroid anti-inflammatory were excluded. Anesthesia was conducted with sevoflurane and sufentanil (0.2 mcg · kg^{-1}). Sufentanil was only given one time before tracheal intubation. Ketamine (0.3 mg · kg^{-1}) or placebo (P) (saline solution) was administered at incision. Patients, medical staff and nurses were blinded of the treatement during and after surgery. All children were extubated in the operating room and transferred in recovery room. They received morphine (50 mcg · kg^{-1}) if Objective Pain Score (OPS) [1] was higher than 3 after administration of paracetamol (15 mg · kg^{-1}). Primary outcome measurement was OPS after surgery. Morphine requirement was noted. Wilcoxon and Khi square tests were used for statistical analysis.

Results and Discussions: Thirty children received K and 30 P. OPS after surgery were shown in table 1. Forty percent patients in the K group have no postoperative morphine requirement (10% in the P group; $p < 0.0001$). Ketamine reduce significatively OPS and morphine requirement after tonsillectomy in children compared with placebo.

Table 1. OPS (median; min–max), *$p < 0.05$.

Time	15′	30′	60′	4 h	8 h	12 h	16 h
K	0 (0–5)*	0 (0–6)*	0 (0–3)	0 (0–3)	0 (0–4)*	0,3 (0–2)*	0 (0–2)*
P	3 (0–8)	1.5 (0–6)	0 (0–4)	0 (0–7)	1 (0–5)	1.2 (0–5)	0.3 (0–3)

Conclusion(s): Ketamine can be used to improve pain management of tonsillectomy in children.

Reference:

1 Marcus et al, Br J Anaesth 2000; 84: 739–42.

A-553

Comparison of morphine and tramadol by patient controlled analgesia (PCA) for postoperative analgesia after tonsillectomy in children

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Background: Tramadol is an alternative to opioids for postoperative pain management (1). This prospective, randomized, double blind study was designed to compare the analgesic efficacy of patient-controlled tramadol with patient-controlled morphine on postoperative pain after tonsillectomy in children.

Methods: Sixty patients were allocated randomly to receive a PCA with either tramadol (T) or morphine (M), in a double-blind randomized study. When surgery was completed and haemostasis achieved, a standardised loading dose (0.1 mg · kg^{-1} in group M, or 1 mg · kg^{-1} in group T) was given. Patients were allowed to use bolus doses of the study solution every 10 minutes without a time limit. Scores for pain, sedation, nausea, and the bolus and total PCA doses, haemodynamic parameters and side effects were recorded at 5, 15, 30 minutes and 1, 2, 4, 6 and 24 hours after PCA administration.

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Results: Pain scores decreased significantly with time in both groups ($p < 0.05$), but were lower in group M than in group T at 1, 2 and 4 hours ($p < 0.05$). Sedation scores increased with time in both groups ($p < 0.05$). However there were no significant differences in sedation scores between two groups at any study period, but nausea scores were higher in M group at 4, 6 and 24 hours ($p < 0.05$).
Conclusion: Intravenous patient controlled tramadol is an alternative to patient controlled morphine for postoperative pain relief in children after tonsillectomy. Morphine gave better postoperative pain relief, but was associated with higher incidence of nausea than tramadol.
Reference:
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A-554

Age dependent EEG effect in response to weight normalised propofol dosage in children

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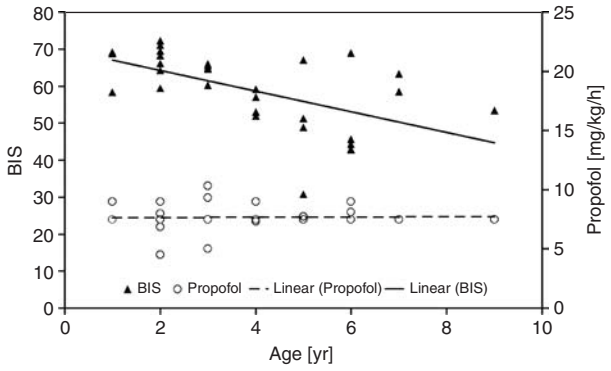
Background and Goal of Study: Intravenous anaesthesia with propofol becomes clinical practice in paediatric anaesthesia.[1] Commonly, drug dosage is body weight normalised ($mg \cdot kg^{-1}$).[2] This study investigates whether similar weight normalised propofol dosage during surgical maintenance of anaesthesia produces the same EEG effect in children of different ages.
Materials and Methods: We reanalysed EEG data from 31 children aged 1 to 9 yr (10 to 25 kg) scheduled for elective minor abdominal surgery.[3] Propofol was administered with weight normalised constant infusion rates of $7.68 \pm 1.09\ mg \cdot kg^{-1}h^{-1}$ supplemented by remifentanil ($0.38 \pm 0.08\ \mu g\, kg^{-1}h^{-1}$). The EEG effect was assessed by the BIS® recorded with an A1000-monitor. The association between age and weight was investigated by the Pearson r product-moment correlation.
Results and Discussions: Age and weight were linearly correlated ($r = 0.92$). BIS increased with decreasing age for similar weight normalised infusion ($R^2 = 0.30$, Figure).



Conclusion(s): Weight normalised dosage produces different EEG effects in children of different ages. Possible explanations for this finding are: 1) age dependent alterations of propofol pharmacokinetics and – dynamics; 2) age dependent pharmacodynamic interaction of propofol and remifentanil. In addition, changes of the EEG morphology with age cannot yet be ruled out.
References:
1 Strauss JM, Giest J: Anaesthesist 2003; 52: 763–77.
2 Anderson BJ, Meakin GH: Paediatr Anaesth 2002; 12: 205–19.
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A-555

Serum S100B in paediatric head trauma: our experience

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Background and Goals: Physical examination, Glasgow Coma Scale score (GCS) and Cranial computed tomography (CT) are the current gold standards for diagnosing traumatic brain injury (TBI), but they have a low sensitivity. Aim of this study is to determine the role of S100B as possible diagnostic test in pediatric TBI.
Material and Methods: We prospectively studied 15 children (age 8,06 ± 2,84 yrs) with head injury. Exclusion criteria were age upper 15 yrs and history of neurological disease. S100B was evaluated on admission and after 48 hours using a immunoradiometric assay. We've considered a serum S100B levels ⩾0.2 μg/L indicative of cellular injury. CT findings were evaluated using the Marshall classification. Outcome was evaluated after 6 months according Glasgow Outcome Scale extendend (GOSe).
Results: Data are shown in Table 1.

Pat. No	GCS t_0	S100B t_0	S100B t_1	CT t_0	GOSe
1	7	2.88	0.67	I	8
2	15	0.27	0.32	I	8
3	13	0.32	*	I	8
4	13	0.21	0.18	I	8
5	15	0.16	0.18	I	8
6	14	0.22	0.28	I	8
7	14	0.33	0.19	I	8
8	5	1.74	1.06	I	8
9	15	0.16	*	I	8
10	11	0.23	0.17	I	8
11	12	0.15	1.34	I	8
12	14	0.19	0.19	I	8
13	14	0.28	*	I	8
14	8	0.46	0.2	I	8
15	3	4.15	1.53	I	8

*The patients were dismissed
P > 0,05 vs GCS; P < 0,05 vs CT and GOSe.

Conclusions: Despite the restricted number of cases monitored S100B seems to be a promitting tool of early detection of TBI when imaging assessment might still be silent. However our results donot suggest a predictive or prognostic value of S100B for long lasting neurocognitive abnormalities after TBI.
References:
1 Woertgen C. *J. Trauma* 1999; 47(6): 1126–30.
2 Petzold A. *Crit. Care Med.* 2002; 30(12): 2705–10.
3 Berger R. P. *J of Neurotrauma* 2002; 19 (11): 1405–9.

A-556

Evaluation of an anaesthetic protocol associating propofol and alfentanil for paediatric fiberoptic bronchoscopy

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Background and Goal of Study: Anaesthesia with sevoflurane for paediatric bronchoscopy is used routinely. However, in severe bronchopulmonary disease, because of impaired sevoflurane alveolar diffusion, anaesthesia can be difficult to manage (airway reactivity, obstruction and hypoventilation). The aim of this study was to evaluate if anaesthesia with propofol and alfentanil can prevent the respiratory problems occuring with sevoflurane.
Materials and Methods: This prospective study included children older than one month over a three-month period. Induction was performed with bolus of propofol (less than 3 years: $5\ mg \cdot kg^{-1}$; 3–8 years: $4\ mg \cdot kg^{-1}$; over 8 years: $2.5\ mg \cdot kg^{-1}$) and bolus of alfentanil ($10\ mcg \cdot kg^{-1}$). Maintenance was performed by a propofol infusion (respectively 18, 15 and $10\ mg \cdot kg^{-1} \cdot h^{-1}$). Local anaesthesia was performed by the endoscopist. Children were oxygenated by mask during the procedure and ventilated if necessary. If coughing, stridor, or laryngospasm occurred, $0.5\ mg \cdot kg^{-1}$ bolus of propofol was injected. After two boluses, the infusion rate was increased. In addition of standard monitoring, $FeCO_2$ was monitored (sidestream microstream nasal and oral capnograph). The satisfaction of the endoscopist was recorded (1–10 scale). Data collected were sex, age, weight, ASA status, pulmonary disease and treatments, complications occuring during the procedure and in the recovery room and inflammatory status of the lower airway.
Results and Discussions: 30 children were included (16 boys, 14 girls, 3.2 ± 3.8 years old, mean weight 14.2 kg). Only 2 children were ASA 1. 26 children had bronchial hyper-reactivity. There was a significant relation between additional boluses and the level of inflammation. Respiratory complications (2 laryngospasms, 6 bronchospasms and 19 coughing) were managed by deepening anaesthesia. Spontaneous ventilation was maintained but $FeCO_2$ was over 50 mmHg. The mean satisfaction rate was good (7.8/10). Calculated plasma concentration (Kataria model) was less than $5\ mcg \cdot ml^{-1}$. Mean spontaneous eye opening delay was 33.8 min.
Conclusion: Propofol associated with alfentanil provides a satisfactory anaesthesia for fiberoptic bronchoscopy with few side effects.
Reference:
1 Jones R. *Br J Anaesth* 1990; 65: 661–667.

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A-557

Is there white blood?

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Background and Goal of Study: A case report of an unusually severe presentation of a diabetic ketoacidosis.
Materials and Methods: A five years old child was transferred to the Critical Care Unit of our tertiary referral teaching hospital with severe diabetic ketoacidosis complicated by hypertriglyceridaemia.

The presenting complains at the referring hospital were: vague history of lethargy and tiredness lasting for about a week. The first blood glucose test was 29 mmol/l. On transfer the child was stable, self-ventilating, normotensive, Glasgow Coma Scale 15/15, capillary refill of 4 sec, acidotic (metabolic acidosis with slight compensatory respiratory alkalosis).

On admission of note were the hyperlipidaemia (in excess of 100 mmol/l) and hypercholesterolaemia (more than 30 mmol/l)! On insertion of the invasive monitoring lines the blood was macroscopically white, dense and with high viscosity. Immediate treatment with insulin and fluids according to the protocols of the institution were initiated. Plasmapheresis was considered, but dropped for a later stage of the clinical management. A deep venous thrombosis in the right leg developed as a result of the hyperviscosity.

With time the patient improved and in 48 hours all results went back to normal.
Results and Discussion: This is an unusual presentation of a diabetic ketoacidosis where the biggest clinical problem was the excess in triglicerides secondary to insulin deficiency. The suggesting mechanism is by maximal secretion of lipoprotein lipase enzyme which is known to occur with the katabolic effects of the diabetic ketoacidosis. It is the blood levels of this katabolic end-products and their effects on the circulation as well as the possibility of ways of management (heparin, plasmapheresis, etc.) that make this case unusual, difficult and clinically significant.
Conclusion: Diabetic ketoacidosis remains a clinical challenge to critical care physicians who are the ones dealing with the patients when in extremes. The complexity of the problem and its multi-system effects are of paramount importance for the recovery of the patient. As our case shows, despite a respiratory and cardiovascularly stable, the patient can demonstrate untypical and subtle effects of the hyperglycaemia and ketoacidosis.

A-558

The efficacy of IV and peritonsillar infiltration of ketamine for postoperative pain relief in children following adenotonsillectomy

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Background and Goal of Study: Establishment of good analgesia is a major concern in the postoperative period following adenotonsillectomy (1). Our aim is to compare the effects of low dose i.v. and peritonsillar infiltration of ketamine on postoperative pain in children undergoing adenotonsillectomy.
Materials and Methods: Prospective, double-blind placebo controlled study. ASA I–II, 90 children were randomized three goups of each 30. GroupI recieved i.v. 2 ml of saline, GroupII received i.v. ketamine ($0.5\,mg \cdot kg^{-1}$) and Group III received a local peritonsillar infiltration of 2 ml of ketamine ($0.5\,mg \cdot kg^{-1}$), 1 ml per tonsil 3 minutes prior to tonsillectomy. Peritonsillar abscess, allergy of the study drugs and analgesic usage within 24 hours prior to surgery were excluded. Anaesthesia and surgical technique were standardized. Modified Hannallah pain scale (OPS) (1), nausea, vomiting, bleeding, rescue analgesia sedation and Aldrete scores were recorded at first, 15th, 30th and 60th minutes postoperatively. Patients were interviewed on the day after surgery to assess the postoperative pain, nightmares, hallusinations, vomiting and bleeding. Repeated measures variance analysis, chi-square and Kruskall-Wallis were performed. $p < 0.05$ was considered significant.
Results and Discussions: 28 female and 62 male patients with a mean age of 5.88 years (±2.20), a mean weihgt of 20.65 kg (±6.36), and a mean height of 109.75 cm (±15.64) were included.GII had higher sedation score at 15th minute ($p = 0.015$). GI had higher OPS scores ($p = 0.000$ at first minute, $p = 0.05$ at 15th minute, $p = 0.16$ at 30th minute, $p = 0.03$ at 60th minute) than GII and GIII. GII and GIII had similar scores which are not statistically significant ($p > 0.05$). 32 children, 19 of whom were in Group I had rescue analgesia in PACU ($p < 0.05$) and the time to reach rescue analgesia was shorter in GI ($p = 0.006$).GII and GIII also had less pain than GI ($p = 0.023$). There were no differences between the groups regarding the incidence of adverse reactions.
Conclusions: Low dose ketamine given i.v or by peritonsiller infiltration perioperatively provides efficient pain relief without side effects in children undergoing adenotonsillectomy.
Referance:
1 O'Flaherty J.E. and Lin C.X Paed. Anaesth. 2003 13:413–421.

A-559

Intraocular pressure measurement in children under general anaesthesia with sevoflurane

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Background and Goal of Study: To identify normal values of intraocular pressure (IOP) in children, is required for congenital glaucoma diagnosis and treatment. Sevoflurane is a potent and low-irritant volatile agent, so it can be used for anaesthetic induction and maintenance in children. The aim of this study is to develop a feasible procedure of general anaesthesia for the measurement of the IOP in children and to determinate the sevoflurane effect on the IOP, using sevoflurane end-tidal and bispectral index as reference.
Material and Methods: 30 children undergoing botulinic toxine inyection for strabismus correction, under general anaesthesia with sevoflurane, were analysed. Induction was performed with sevoflurane inhalation with tidal volume technique at 8% concentration. IOP was measured once anaesthesia was induced and subsequent to botulinic toxine administration, sevoflurane was stopped up and IOP was measured minutely until the child's recovery.
Results and Discussion: Figure 1 shows IOP values all along the procedure. All of them were into normal range. The lowest IOP values were obtained just before awareness, when bispectral index showed light sedation scores.

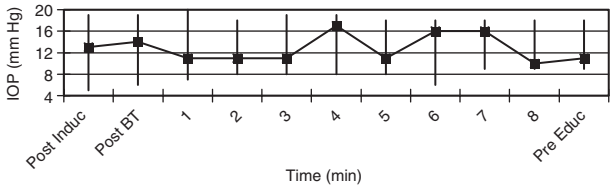

Figure 1. IOP variations during procedure ($n = 60$).

A linear regression analysis revealed a statistically significant correlation between IOP and end-tidal sevoflurane (Pearson coefficient = 0,40; $p = 0,0009$) and between IOP and bispectral index (Pearson coefficient = 0,51; $p = 0,0008$).
Conclusions: Sevoflurane inhalation with tidal volume technique at 8% concentration has been useful for IOP measurement in children. IOP drop due to sevoflurane was 10%. In our study, we have showed a significant correlation between IOP values and bispectral index and end-tidal sevoflurane values.
References:
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2 Sator-Katzenschlager S. Br J Anaesth 2002;89: 764–766.

A-560

Comparison of caudal ketamine with lidocaine or tramadol administration for postoperative analgesia of hypospadias surgery in children

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Background and Goal of Study: This study was designed to investigate whether the addition of tramadol or lidocaine to caudal ketamine would enhance the quality of intra and postoperative analgesia and reduce the sevoflurane requirement for hypospadias surgery in children.
Material and Methods: Sixty two ASA I or II children, between 1 and 10 years of age, scheduled for hypospadias surgery were recruited. Anaesthesia was induced with 6–8% sevoflurane and maintained with 0.5–2.5% sevoflurane-50% N_2O in oxygen. Children were allocated randomly to receive one of two study drugs. Children in group KL received caudal ketamine ($0.25\,mg \cdot kg^{-1}$) plus lidocaine ($2\,mg \cdot kg^{-1}$) and in group KT received caudal ketamine ($0.25\,mg \cdot kg^{-1}$) plus tramadol ($1\,mg \cdot kg^{-1}$). Sevoflurane requirement, systemic blood pressure, heart rate, peripheral O_2 saturation, sedation and pain scores (CHEOPS) were recorded at 1st, 5th, 10th, 15th, 30th , 45th min and 1st, 2nd, 3rd h following recovery from anaesthesia.
Results and Discussion: Duration of analgesia was similar between two groups ($p > 0.05$). CHEOPS scores were found to be lower in KL group than

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in KT group throughout the study period, except at the first 15 minutes. Sevoflurane requirement was significantly lower in group KL than in group KT perioperatively ($p = 0.000$). Sedation scores were significantly higher in group KL than in group KT at the first 10 minutes ($p < 0.05$). Incidence of postoperative nausea and vomiting was similar between two groups ($p > 0.05$).

Conclusions: Caudal ketamine (0.25 mg · kg^{-1}) plus lidocaine (2 mg · kg^{-1}) significantly reduced sevoflurane requirement and provided better analgesia quality in postoperative period compared with ketamine (0.25 mg · kg^{-1}) plus tramadol (1 mg · kg^{-1}).

A-561

Ultrasound guidance reduces the amount of local anaestethic for ilioinguinal blocks in children

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Background and Goal of Study: Regional anaesthesia is a cornerstone in paediatric anaesthesia today. Successful regional anaesthesia provides conditions for light and haemodynamic stable General Anaesthesia and is an essential part of postoperative pain management. The so called Ilioinguinal block is one opportunity to achieve adequate analgesia in inguinal hernia or hydrocele repair. In a recently submitted paper, our group demonstrated, the big advantage of Ultrasound guidance in Ilioinguinal Blocks (1). This study was designed to evaluate, if US guidance in Ilioinguinal blocks reduces the amount of local anaesthetic.

Materials and Methods: After ethic committee approval and parental consent, 40 children, aged between 1–8 years, were included in the study, designed as a step down approach to find the correct dose. Due to prior findings the starting dose of the trail was 0.2 ml/kg 0.25% L-Bupivacaine. In all patients the Ilioinguinal block was performed under US guidance using a portable Sonosite 180 plus US machine and a 10 MHz high resolution linear US probe. Intra and postoperative quality of the block was assessed by a staff anaesthetist, who was blinded to the amount of local anaesthetic. An increase in HR and/or blood pressure of 15% from baseline was assessed as lack of analgesia and treated with 1 μg/kg Fentanyl. Postoperative an OPS Score more than 11 was treated with 30 mg/kg Paracetamol rectal.

Results and Discussions: A success rate of 100% (10 out 10) was achieved with 0.2 ml/kg and 0.1 ml/kg. With a dose of 0.05 ml/kg 0.25% L-Bupivacaine in 3 out of 10 children additional analgesia was necessary at skin incision performed 15 min after block performance. Therefore the dose was increased to 0,075 ml/k g. In this group the success rate was again 100%.

Conclusion(s): Concordant with previous studies in that field (2) we showed that ultrasonographic guidance offers the advantage for a significant reduction of local anaesthetics for ilioinguinal nerve blocks.

References:

1 Ultrasonographic guidance for ilioinguinal and iliohyogastric nerve block in children Willschke et al. submitted for publication.
2 Ultrasonographic guidance reduces the amount of local anaesthetic for 3-in-1 blocks. Marhofer et al. RAPM 1998.

A-562

Is cerebral autoregulation preserved in children anesthetised by sevoflurane?

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Background and Goal of Study: The transient hyperemic response (THR) test is a simple non invasive technique to measure cerebral autoregulation using transcranial Doppler. The THR ratio (THRR) provides an index of cerebral autoregulation in healthy adults (1). We aim to evaluate this response in children undergoing general anesthesia.

Materials and Methods: ASA 1 children undergoing elective urological surgery were recruited, each receiving sevoflurane at 0.5, 1.0 and 1.5 MAC in random order. Analgesia was provided by caudal anesthesia using 0.25% bupivacaine without epinephrine. The middle cerebral artery flow velocities before (F1), during (F2) and after (F3) ipsilateral carotid artery compression were recorded. THRR is calculated by dividing F3 by F1.

Results and Discussions: To date 10 male children aged between 1.4 to 3.2 yrs (1.5 ± 0.7) have been recruited. Results are presented as means (SD) in the following Table.

	0.5 MAC	1.0 MAC	1.5 MAC
F1 cm/s	120 (20)	126 (19)	125 (26)
F3 cm/s	153 (26)	147 (25)	147 (30)
THRR	1.28 (0.11)	1.18 (0.1)	1.16 (0.07)
Range	1.12 to 1.52	1.05 to 1.38	1.04 to 1.28

THRR greater than 1.10 have previously been adopted as a lower limit of a normal response (2). The THRR is statistically different between 0.5 MAC versus 1.0 & 1.5 MAC respectively. However, no difference was detected between 1.0 and 1.5 MAC.

Conclusion(s): Preliminary results in this study suggest that THR is present and is maintained under general anesthesia at up to 1.5 MAC of sevoflurane. More patients are presently being studied to further elucidate this response in children.

References:

1 Smielewski P *et al*. *J Neurosurg* 1997; 86: 773–778.
2 Smielewski P *et al*. *Stroke* 1996; 27: 2197–2203.

A-563

Comparison of recovery after desflurane and sevoflurane anaesthesia in children premedicated with midazolam

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Background and Goal of Study: Oral premedication with midazolam delays early recovery but not discharge after ambulatory sevoflurane anaesthesia (1,2). Because of low solubility characteristic of desflurane, it gives the anaesthesiologist tighter control over anaesthetic level (3). In this study we aimed to determine if anaesthesia maintenance with desflurane also prolongs recovery as sevoflurane.

Materials and Methods: After the approval by the Medical Ethics Committee of our Hospital and written informed consent from the parents, 40 children (2–6 yr of age, ASA physical status I–II) undergoing tonsillectomy with or without adenoidectomy, received oral midazolam 0.5 mg · kg^{-1} 30 min before induction of anaesthesia. Anaesthesia was induced with thiopentone (5 mg · kg^{-1}), fentanyl (1 microg · kg^{-1}), atracurium (0.5 mg · kg^{-1}) and maintained with nitrous oxide/oxygen (50%/50%) and with sevoflurane (2–3%) in Group S or desflurane (4–6%) in Group D. Emergence (times to spontaneous ventilation, extubation, response to verbal command) and recovery times (achieving ⩾9 points on the modified Aldrete scale, duration of PACU stay), side effects were recorded. ANOVA and chi square tests used for statistical analyses. $P < 0.05$ was considered significant.

Results and Discussion: Demographic data of the patients and duration of operation were similar between the groups. Emergence times were shorter in Group D compared with Group S but the difference was not significant statistically. Recovery times were longer in Group S than Group D ($p < 0.05$). Side effects did not differ between the two groups.

Conclusion: After oral premedication with midazolam, recovery was later with sevoflurane anaesthesia than desflurane anaesthesia. We conclude desflurane was superior to sevoflurane as an inhalational anaesthetic agent in children undergoing short surgical procedures after midazolam premedication.

References:

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A-564

Does hypocapnia prevent modification in cerebral blood flow velocity in children when changing from sevoflurane to desflurane anesthesia?

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Background and Goal of Study: The effect on cerebral blood flow velocity (CBFV) when sevoflurane (Sev) is changed to desflurane (Des) anesthesia has been reported. (1) This study was designed to determine if mild hypocapnia can prevent this change in CBFV in children.

Materials and Methods: With REB approval 10 healthy children scheduled for urological surgery were enrolled. Each patient randomly received Sev 1 MAC at either 30 or 40 mmHg end-tidal CO_2 ($ETCO_2$) followed by Des 1 MAC at the same $ETCO_2$. The same sequence was repeated at the other $ETCO_2$. CBFV was measured at steady-state for each agent and $ETCO_2$. Heart rate, mean arterial blood pressure and temperature were recorded.

Results and Discussions: The age and weight were 36.6 ± 23.8 mo and 14.3 ± 5.2 kg, respectively. CBFV was higher at $ETCO_2$ 40 when compared

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to $ETCO_2$ 30 regardless of the anesthetic agent. ($P < 0.001$, Table) The blood pressure decreased when sevoflurane was switched to desflurane at 30 mmHg $ETCO_2$ and HR remained unchanged ($P < 0.01$, Table).

	$ETCO_2$ 30		**$ETCO_2$ 40**	
Agent:	Sev	Des	Sev	Des
CBFV (cm/sec)	34.0 (4.6)	43.2 (6.5)	62.5 (8.7)	65.5 (10.4)
BP (mmHg)	60.6 (13.9)	58.4 (8.8)	58.4 (8.7)	54.9 (5.9)
HR	102.2 (14.8)	104.9 (15.5)	104.0 (6.4)	107.9 12.2)

Values are mean (SD).

Conclusion(s): Replacing sevoflurane with desflurane anesthesia in children might lead to an increase in CBFV if proper control of $ETCO_2$ is not ensured. This might have important considerations in patients with decreased intracerebral compliance.

Reference:

1 Bedforth N, Hardman J, Nathanson M. *Anesth Analg* 2000;91:152–5.

A-565

The effect of hypocapnia and its ability to modify the changes in cerebral blood flow velocity when substituting propofol with desflurane in children

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Background and Goal of Study: Facilitating rapid anesthetic emergence by changing from propofol (Prop) to desflurane (Des) anesthesia affects cerebral blood flow velocity (CBFV) (1). This study was designed to determine if mild hypocapnia can prevent this change in CBFV in children.

Materials and Methods: With REB approval 10 healthy children scheduled for urological surgery were enrolled. Each patient randomly received Prop at either 30 or 40 mmHg end-tidal CO_2 ($ETCO_2$) followed by Des 1 MAC at the same $ETCO_2$. The same sequence was repeated with the other $ETCO_2$. CBFV was measured at steady-state for each agent and $ETCO_2$. Heart rate, mean arterial blood pressure and temperature were recorded simultaneously.

Results and Discussions: The age and weight were 34.5 ± 19.4 mo and 14.1 ± 3.4 kg, respectively. Heart rate increased and blood pressure decreased with Des compared to Prop, at both $ETCO_2$ levels ($P < 0.001$). CBFV was higher with Des as compared to Prop, regardless of the $ETCO_2$ ($P < 0.001$, Table).

	$ETCO_2$ 30		$ETCO_2$ 40	
Agent:	Sev	Des	Sev	Des
CBFV	25.3 (6.9)	42.3 (9.1)	33.7 (8.8)	62.5 (9.1)
BP	60.6 (13.9)	54.2 (8.8)	67.0 (8.0)	57.6 (5.2)
HR	95.0 (10.3)	109.0 (11.8)	98.0 (10.1)	108.8 (13.2)

Values are mean (SD).

Conclusion(s): Substituting propofol for desflurane anesthesia in children causes an increase in CBFV that could not be prevented by mild hypocapnia. This should be taken into consideration in patients with decreased intracranial compliance.

Reference:

1 Barlow R, Karsli C, Luginbuehl I, et al. *Can J Anesth* 2004; 51: 824–8.

A-566

Does mild hypocapnia prevent modification in cerebral blood flow velocity when changing from isoflurane to desflurane anaesthesia in children?

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Background and Goal of Study: Although desflurane (Des) may provide for faster anesthetic emergence than isoflurane (Iso) (1), it may be associated with an increase in cerebral blood flow velocity (CBFV) (2). This study assesses whether mild hypocapnia can prevent changes in CBFV when switching from Iso to Des in children.

Materials and Methods: With REB approval 10 healthy children scheduled for urological surgery were enrolled. Each patient randomly received Iso 1 MAC at either 30 or 40 mmHg end-tidal CO_2 ($ETCO_2$) followed by Des 1 MAC at the same $ETCO_2$. The same sequence was repeated at the other $ETCO_2$. CBFV was measured at steady-state for each agent and $ETCO_2$. Heart rate, blood pressure and temperature were recorded simultaneously.

Results and Discussions: The age and weight were 45.6 ± 15.7 mo and 15.4 ± 2.6 kg, respectively. There were no changes in CBFV or BP when Iso was switched to Des, at either $ETCO_2$ (Table). There was an increase in HR when Iso was substituted with Des at 30 mmHg $ETCO_2$ ($P < 0.05$).

	$ETCO_2$ 30		$ETCO_2$ 40	
Agent:	Sev	Des	Sev	Des
CBFV	41.6 (9.2)	48.3 (8.4)	69.9 (13.7)	68.9 (11.6)
BP	60.2 (6.2)	57.2 (7.3)	60.9 (8.1)	57.5 (5.1)
HR	102.8 (10.1)	108.7 (12.5)	103.4 (9.8)	108.3 (11.6)

Values are mean (SD).

Conclusion(s): Switching from Iso to Des anesthesia in order to facilitate rapid emergence appears not to have an effect on CBFV in healthy children.

References:

1 Wolf A, Lawson R, Dryden C et al. *Br J Anaesth* 1996; 76: 362–4.
2 Sponheim S, Skraastad O, Helseth E et al. *Acta Anaesthesiol Scand* 2003; 47: 932–8.

A-567

Functional residual capacity (FRC) and ventilation homogeneity in anaesthetised children following neuromuscular blockade

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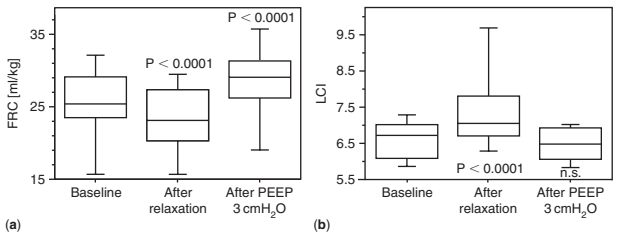
Background and Goal of Study: Children under general anaesthesia have a reduced FRC. FRC provides us important information on gas exchange, which is of special importance in children as they are particularly vulnerable for hypoxaemia. However, most studies assessed the overall effect of anaesthesia on the FRC in comparison with the pre-anaesthetic status without regarding the magnitude of contribution of e.g. induction, relaxation, PEEP on their own.

Materials and Methods: We studied 25 children (mean [range] age = 60 [26–77] months, weight = 11.8 [11.2–26.3] kg) without cardio-pulmonary disease, scheduled for elective surgery. Anaesthesia was standardised. FRC was measured using a SF6 multi-breath washout technique. Measurements were taken after 1. intubation, 2. muscle relaxation with rocuronium i.v. and 3. the additional application of PEEP (3 cmH_2O). FRC and lung clearance index (LCI) were calculated.

Results and Discussions: FRC significantly decreased following muscle relaxation by 10.1% compared with the FRC measurement following induction while at the same time the LCI increased by 14.3%. FRC values increased by 11.1% after the application of PEEP (3 cmH_20) compared with baseline, whereas the LCI dropped slightly below baseline values (−0.7%).



Conclusions: Neuromuscular blockade leads to a significant decrease of FRC while consistently increasing ventilation inhomogeneity. In contrast, the application of PEEP (3 cmH_20) leads to an increase of FRC simultaneously restores ventilation homogeneity towards baseline values. Therefore the use of "pysiologic" PEEP seems rationale in paralyzed children to restore FRC and ventilation homogeneity.

Acknowledgements: The Centiva/5 critical care ventilator used in this study was kindly provided by Anandic.

A-568

Elongation of the trachea during neck extension in children: implication in the safety of endotracheal tube

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Background and Goal of Study: The uncuffed endotracheal tube (ETT) displacement has been described as changes of the distance between the ETT tip and carina in children. However, the change of the distance between the ETT tip and carina during neck extension may not be equal to the changes of the distance between vocal cords and the ETT tip, which is directly related with the ETT extubation, because of the tracheal elongation.
Materials and Methods: Twenty-five children (2–8 years) were enrolled. Using fiberoptic bronchoscope, distance from ETT tip to carina was measured in the neutral position, after full flexion and full extension of the neck. Then, the distance between carina and vocal cords was measured in the neutral position and after full extension. The distance from vocal cords to ETT tip was calculated as the distance between carina and vocal cords minus the distance from ETT tip to carina.
Results and Discussions:

	Mean ± SD (cm)	Range (cm)
(Tp-Ca) with full flexion	−1.0 ± 0.5	−0.2–−2.1
(Tp-Ca) with full extension	2.0 ± 0.6*	0.8–3.6
VC-Ca in neutral position	8.0 ± 0.9	6.5–10.0
VC-Ca with full extension	8.9 ± 0.9	7.2–11.0
(VC-Ca) with full extension	1.0 ± 0.4	0.4–1.9
(VC-Tp) with full extension	−1.1 ± 0.5	−0.3– −2.1

*$p < 0.05$ compared with (Tp-Ca) with full flexion.
Abbreviations: (Tp-Ca), change of the distance between carina and endotracheal tube tip, VC-Ca, distance between vocal cords and carina; (VC-Ca), change of the VC-Ca; (VC-Tp), change of the distance between vocal cords and endotracheal tube tip.

After full extension, the Tp-Ca increased by 2.0 cm. However, VC-Tp decreased only by 1.1 cm.
Conclusions: The tracheal elongation may have an effect of decreasing the risk of ETT extubation during neck extension in older children.

A-569

Effects of modified ultrafiltration on extravascular lung water and intrathoracic blood volume in pediatric patients after cardiopulmonary bypass

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Background and Goal of Study: Modified ultrafiltration (MUF) [1] improves haemodynamics and reduces total body water significantly after cardiopulmonary bypass (CPB) in pediatric patients undergoing open heart surgery [2]. In this study we want to determine the effects of MUF on the extravascular lung water (EVLWI) as a parameter of pulmonary edema and the changes in intrathoracic blood volume (ITBI) and stroke volume variation (SVV) as parameters for sufficient cardic filling.
Materials and Methods: After parents writen informed consent, 19 patients with minor congenital cardiac defects (ASD n = 12; VSD n = 7) were included in this study. Patients were monitored using the paediatric 3 Fr. PiCCO-System introduced via a femoral artery. Haemodynamics were evaluated after discontinuation of CPB and after twenty minutes of MUF. Students-t-test was used, $p < 0.05$ was considered statistically significant, all data are expressed as mean ± SEM.
Results and Discussions: Beside the previously described increase in mean arterial pressure and cardiac index and a reduction of inotropic support after MUF, we found the following changes:

	Before MUF	After MUF	p-value
EVLWI	12.7 ± 1.1	11.4 ± 0.9	$p < 0.01$
ITBI	531 ± 40	558 ± 51	p n.s
SVV	15.5 ± 1.4	10.4 ± 1.0	$p < 0.01$

Conclusion: In our preliminary results leads MUF to a not yet significant increase in ITBI, but to a highly significant decrease in SVV and EVLWI. MUF therefore improves cardiac filling and haemodynamic stability and reduces pulmonary edema and postoperative heart failure.
References:
1 Naik SK, Knight A, Elliot MJ; Perfusion 1991(6): 41–50.
2 Chew MS; Perfusion 2004(19): 57–60.

A-570

Tube tip displacement in children during laparoscopy

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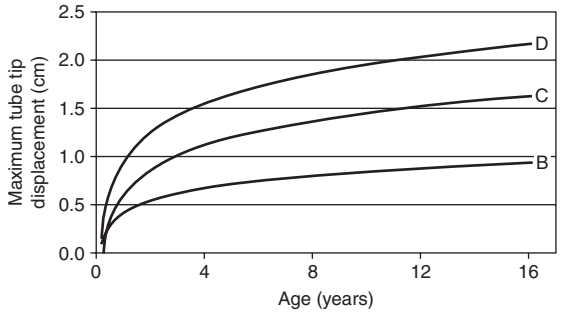
Background and Goal of Study: Tracheal tube tip displacement during laparoscopy in adults is a well known and studied problem (1). Children have a shorter trachea and are at higher risk for endobronchial intubation during capnoperitoneum and head tilt position. The aim of this study was to investigate tube tip displacement during laparoscopy in children aged from birth to adolescence.
Materials and Methods: With ERB approval and written parental consent 28 children undergoing laparoscopy, were prospectively studied. The patient's tracheas were orally intubated and the tubes (Microcuff PET) positioned with the depth mark at the level of the vocal cords. The carina – tube tip distance was fibreoptically measured with the patient in (A) 0° position, (B) 20° head tilt, (C) 0° position with capnoperitoneum and (D) 20° head tilt with capnoperitoneum (pressure 10 mmHg). Percentual tube displacement towards the carina was calculated. Maximum tube tip displacements were plotted against age.
Results and Discussions: 28 children aged from 2 months to 16.5 years (median 7.4 years) were studied. Tube tip displacement ranged from 0–25% (14%) for 20° head tilt, 2–41% (18%) for capnoperitoneum and 11–70% (30%) for capnoperitoneum with 20° head tilt.



Conclusion(s): Based on our data, caudal tube tip displacement during laparoscopy is similar to tube tip displacement during head/neck flexion in children. In all patients intubation depth marks were appropriate to avoid inadvertent endobronchial intubation during laparoscopy.
Reference:
1 Mackenzie M. Br J Anaesth 2003; 91: 297–8.

A-571

The optimal length of internal jugular venous catheters in children confirmed by TEE

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Background and Goal of Study: Incorrect positioning of central venous catheter (CVC) leads to serious complications. There have been several studies with regard to the optimal depth of CVC tip position to prevent serious complication in pediatric patients. However, the limitation of these study was that they used chest radiograph to determine the CVC tip position. The assessment of catheter tip position using chest radiograph is inaccurate. In contrast, transesophageal echocardiography (TEE) has been shown to accurately monitor the placement of catheter tip at superior vena cava-right atrial (SVC-RA) junction. We examined the distance from skin puncture

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site to SVC-RA junction, after positioning the CVC tip at SVC-RA junction using TEE.
Materials and Methods: We studied 60 right internal jugular vein (IJV) catheterizations in infants and children undergoing surgery for congenital heart disease for 6 months. The position of CVC tip was confirmed that it is in SVC-RA junction by TEE. The distance from skin puncture site to SVC-RA junction, height, weight and age were recorded.
Results and Discussions: The measured distance highly correlated with the patient height. Based on these data, following guideline could predicted that a CVC would be positioned above the RA 97.5% of the time with 95% accuracy. Optimal depth of insertion (cm) = 1.7 + (0.07 × height).
Conclusion(s): We suggest that using our simple practical guideline in the first attempt to insert the CVC could prevent malposition of CVC.

A-572

Filling cuff pressures in paediatric laryngeal mask airways

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Background of Study: Initial cuff volume at the time of LMA insertion may vary and considerable unknown high cuff pressure may result after inflation of maximum recommended cuff volumes increasing the risk of airway morbidity (1).
Materials and Methods: In an in vitro set up, maximum recommended cuff filling volumes for size 1/1.5/2/2.5/3 disposable LMAs from different manufacturers (Softseal LMA (Portex); Unique LMA (Intavent); Marshall LMA, LaryngoSeal (Tyco)) and reusable Classic and ProSeal LMAs (Intavent) were inflated into completely emptied LMA-cuffs and into LMA-cuffs at residual volume (volume with cuff set to ambient pressure). Cuff pressures were measured using a cuff manometer. Experiments were performed two times using two exemplars of each brand/size (4 measurements each).
Results and Discussion: (Data are mean ± SD)

LMA cuff pressures (cmH_2O) after filling the completely emptied cuff with recommended volume of air

LMA/Size	1	1.5	2	2.5	3
Classic	71 ± 2	>120	>120	85 ± 5	97 ± 5
Unique	83 ± 1	>120	>120	>120	>120
ProSeal	NA	78 ± 3	70 ± 3	42 ± 2	18 ± 2
SoftSeal	62 ± 1	53 ± 3	34 ± 3	70 ± 2	55 ± 2
Marshall	48 ± 1	91 ± 5	107 ± 2	97 ± 2	>120
LaryngoSeal	>120	>120	>120	>120	>120

Maximum recommended cuff filling volumes for paediatric LMAs inflated into fully emptied cuffs resulted in hyperinflation (cuff pressure >60 cmH_2O (2)) in almost all LMAs. When maximum recommended cuff filling volumes were inflated into LMAs at residual cuff volume, cuff pressures of > 120 cmH_2O resulted in all LMAs and sizes except in the ProSeal size 3 (101 ± 1 cmH_2O).
Conclusions: Maximum recommended cuff filling volumes in paediatric LMAs lead to cuff hyperinflation in almost all LMA brands and sizes. The cuffs should be inflated with the minimum volume of air required to form an effective seal with the respiratory and gastrointestinal tracts and cuff pressure should be controlled using a manometer to avoid cuff hyperinflation and associated airway morbidity.
References:
1 Marjot R. Br J Anaesth 1993; 70: 25–9.
2 LMA Instruction Manual 2004: 26.

A-573

Tube tip displacement in children during head-neck movement – a radiological assessment

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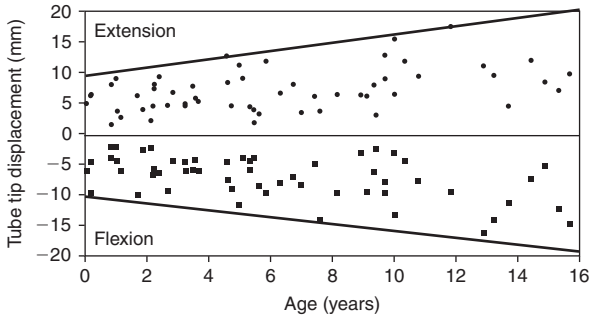
Background and Goal of Study: Because of their short trachea appropriate tracheal tube insertion depth is mandatory in children to avoid inadvertent extubation or endobronchial intubation during head-neck movement. Aim of this study was to investigate appropriateness of insertion depth marks of the Microcuff paediatric tracheal tube (1) in children during head-neck movement.
Materials and Methods: With ERB approval and written parental consent we included children aged from birth to 16 years undergoing cardiac catheterisation. The patient's tracheas were orally intubated and the tubes positioned with the depth mark at the level of the vocal cords. The carina to tube tip distances were radiologically assessed with the patient supine and the head-neck in 30° flexion, 0° position and 30° extension. Percentual upward displacement of the tube tip related to tracheal tube insertion depth (depth mark distance) and down-ward movement related to carina – tube tip distance was calculated. Absolute tracheal tube tip displacements were plotted against age.
Results and Discussion: 60 children aged from 3 weeks to 15.7 years (median 5.4 years) were studied. Tube tip down-ward movement after head-neck flexion ranged from 5 to 58% (21%) of initial distance to carina and upward displacement after head-neck extension ranged from 5 to 38% (18%) of tube insertion depth.



Conclusion: The insertion depth marks were appropriate to avoid inadvertent tracheal extubation and endobronchial intubation during head neck movement in all patients.
Reference:
1 Weiss M. Br J Anaesth 2005; 94: 80–7.

A-574

Effect of four mixtures on withdrawal movement during intravenous injection of rocuronium in pediatric patients

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Background and Goal of Study: The purpose of this study was to evaluate the incidence and severity of withdrawal movement during injection of rocuronium mixed with saline, lidocaine, sodium bicarbonate ($NaHCO_3$), lidocaine-$NaHCO_3$ in pediatric patients.
Materials and Methods: Sixty-seven patients (5–15 years old) were randomly assigned to four groups in a double blinded, prospective study; Group S (0.9% normal saline 5 ml mixed with rocuronium 50 mg), Group L (2% lidocaine 5 ml mixed with rocuronium 50 mg), group B (8.4% $NaHCO_3$ 5 ml mixed with rocuronium 50 mg) and Group LB (4% lidocaine 2.5 ml and 8.4% $NaHCO_3$ 2.5 ml mixed with rocuronium 50 mg). All patients received intubating dose (0.6 mg/kg) of premixed rocuronium over 5 seconds after loss of consciousness with sevoflurane inhalation. We investigated the incidence and severity of withdrawal movement.
Results and Discussions:

Table 1. Incidence and Severity of Withdrawal Movement.

	Group S (n = 19)	Group L (n = 18)	Group B (n = 14)	Group LB (n = 16)
None	9 (47.4%)	8(44.4%)	12 (85.7%)	13 (81.3%)
Wrist	0 (0.0%)	1 (5.6%)	1 (7.1%)	2 (12.5%)
Arm only	2 (10.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Generalized	8 (42.1%)	9 (50.0%)	1 (7.1%)*?	1 (6.3%)*?
Overall Movement (18.7%)*?	10 (52.6%)	10 (55.6%)	2 (14.3%)*?	3

*$p < 0.05$ vs Group S; ?$p < 0.05$ vs Group L.

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Conclusion(s): We conclude that premixed $NaHCO_3$ with rocuronium is effective in reducing the withdrawal movement whereas addition of lidocaine is little effective in pediatric patients.

References:
1 Shevachenko Y. *Anesth Analg* 1999; 88: 746–8.
2 Chiarella AB. Br J Anaesth 2003; 90: 377–9.

A-575

Caudal block reduces demand of sevoflurane for adequate depth of anesthesia in children

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Background and Goal: It is generally known that neuraxial anesthesia for adults reduces the demand for hypnotics needed for adequate sedation. Therefore, this study examined the effect of a preoperative caudal block to the general anesthetic requirement on adequate depth of anesthesia in children.

Materials and Methods: Twenty children aged 3–5 in good health who were to undergo inguinal herniorrhaphy were divided into 2 groups of 10 children each, the control and caudal block groups. Under the condition of no premedication, tracheal intubation was performed after induction with thiopental 5 mg/kg, rocuronium 0.6 mg/kg, and sevoflurane 3.0 vol%. Subsequently, anesthesia was maintained with 100% O_2 and sevoflurane.

After setting up the Bispectral Index (BIS) monitor, a caudal block was performed to both groups differently, normal saline 0.7 ml/kg was administered to the control group and 1.5% lidocaine 0.7 ml/kg was administered to caudal block group. A predetermined end-tidal concentration of sevoflurane was maintained for 10 minutes, and the BIS value, which measured 6 times every 10 seconds, was subsequently averaged.

Afterwards, the end-tidal concentration of sevoflurane was increased by 0.2 vol% in the next patient if the BIS average of the precedent patient was >50, and was decreased 0.2 vol% if the BIS average was 50.

The MAC_{BIS50} in both groups was calculated using probit analysis. The relative median potency analysis was applied to compare the results in both groups.

Results and Discussions: The MAC_{BIS50} of sevoflurane was significantly lower with the 1.5% lidocaine caudal block (1.40 vol% [1.25–1.55 vol%]) compared to the control group (1.77 vol% [CL, 1.61–2.00 vol%]).

Conclusion(s): A preoperative caudal block reduces the demand of sevoflurane needed for the adequate depth of anesthesia, as measured by BIS in children.

References:
1 Tverskoy M, Shifrin V, Finger J, et al *Reg Anesth* 1996; 21(3): 209–213.
2 Gentili M, Chau Huu P, Enel D, et al *Br J Anaesth* 1998; 81: 970–971.

A-576

Usefullness of carina as a radiographic landmark of central venous catheter tip position in pediatric patients

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Background and Goal of Study: Several reports have proposed radiographic landmark of central venous catheter tip position. Carina is one of the proposed landmarks in adult. We evaluate the possibility of using the carina as a radiographic landmark for identifying the proper positioning of central catheter tip position in pediatric patients.

Materials and Methods: We studied 57 right internal jugular vein catheterizations in infants and children undergoing surgery for congenital heart disease. After placing the central venous catheter (CVC) tip at the junction of the superior vena cava and the right atrium (SVC-RA junction) using intraoperative transesophageal echocardiography and taking postoperative anterior-posterior chest radiography, we measured the longitudinal distance from the carina to SVC-RA junction by using Picture Archiving and Communicating System (PACS).

Results and Discussions: We found that carina was 1.5 cm (95% confidence interval 1.3 cm–1.8 cm) above the SVC-RA junction. There was no catheter tip cephalad to carina. The distance is not correlated statistically with the patient age, height and weight.

Conclusion: The carina can be used as a landmark for the upper margin of the SVC in pediatric patients.

References:
1 Aslamy Z. *Chest* 1998; 114: 820–826.
2 Schuster M. *Br J Anesth* 2000; 85: 192–194.

Obstetric Anaesthesia

A-577

Determination of the dose response relationship of spinal ropivacaine and levobupivacaine, combined with sufentanil, for labour analgesia

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Background and Goal: Using the MLAC methodology, the relative potency of ropivacaine (R) and levobupivacaine (L) during labour analgesia is controversial (1,2,3,4,5). Full dose response curves of R and L during labour analgesia have not been constructed. The goal of the present study is to determine the full dose response curves of spinal R and L for labour analgesia.

Material and Methods: Following ethical committee approval and written patient informed consent, 300 term, vertex presenting pregnant patients in labour were included in this blinded, randomised trial. Combined spinal epidural analgesia was performed and R or L were intrathecally administered in a dose of 1.0, 1.5, 2.0, 2.5, 3.0 or 3.5 mg. In each group R or L were combined with 1.5 μg sufentanil. Patients were considered responders if the visual analogue scale score for pain was less then 25 mm within 15 minutes after initiation of analgesia and if analgesia persisted for at least 45 min. Patient demographics, obstetrical data, side effects and foetal and neonatal well being were noted. Group specific dose response curves were constructed using a probit regression model. ED50 and ED95 doses were calculated for each group. A likelihood-ratio test has been used to compare the dose response curves of R and L.

Results and Discussion: No statistically significant differences in dose response relationship between R and L were observed ($p = 0.91$). The ED50 of spinal R and L respectively was 2.213 mg (95% CI, 1.834–2.583) and 2.320 mg (95% CI, 1.954–2.717). The ED95 of spinal R and L respectively was 4.791 mg (95% CI, 3.988–6.661) and 4.961 mg (95% CI, 4.106–6.985).

Conclusion: Based on the present full dose response study, intrathecal R and L combined with sufentanil, are of similar potency when used for labour analgesia. This is in line with more recent MLAC data by Polley et al and Benhamou et al. in which no ED50 differences between epidural R and L were reported (4,5). These results contrast with previous findings based on direct MLAC comparisons of epidural R or L with bupivacaine (1,2,3).

References:
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2 Polley et al. Anesthesiology 1999; 90, 944–950.
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4 Polley et al. Anesthesiology 2003; 99, 1354–1358.
5 Benhamou et al. Anesthesiology; 99, 1383–1386.

A-578

Incidence of neurological complications following regional anaesthesia in obstetrics

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Background and Goal of Study: For both parturients and anaesthetist one of the most feared complications of regional anaesthesia is a neurological deficit. The incidence has been reported as 0–30 per 10,000 blocks after epidural and 35 per 10,000 after spinal anaesthesia (1). The purpose of this retrospective study was to estimate the incidence of neurological complications following regional blockade in our unit.

Materials and Methods: All women who delivered from 1994 to 2003 had their postnatal anaesthetic/medical/clinic follow-up records retrospectively audited for lumbo-sacral spine and lower extremity nerve injury. Factors associated with documented nerve injury were noted: difficulty in insertion of regional block, pain or paraesthesia on insertion or injection, duration of second stage of labour, maternal position (i.e. lithotomy), instrumental delivery, fetal presentation and fetal compression of pelvic nerves.

Results and Discussions: 50,242 women delivered over the ten-year period (1994–2003). 23,029 (41.7%) received regional block. Total neurological

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complications reported in association with pregnancy and delivery was 146. Detailed examination of the notes revealed only 43 of these women had a significant neurological complication and had a regional block. 12 women had spinal, 24 had epidural and 7 had combined spinal-epidural anaesthetic. Insertion was difficult in 3 and 2 patients had pain on injection of local anaesthetic. Other factors found to be associated with neurological injury were instrumental delivery, prolonged second stage of labour and time spent pushing in lithotomy position. Duration of symptoms was less than three months in 32.2%, more than three in 34.8% and unknown in 37.2% (reasons were referral to other specialty clinics or patients not attending follow up clinic).
Conclusion: The estimated incidence of postpartum neurological complications associated with regional block in our unit is 0–20 per 10,000, but its definite relationship is yet to be proved.
Reference:
1 Brooks H, May A. BJA CEPD Reviews. Aug 2003, 4: 111–114.

A-579

Epidural continuous infusion of sufentanil and neostigmine for labor analgesia

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Background and Goal: During labor, motor impairment resulting from neuraxial local anesthetics leads to higher instrumentation delivery rate and lower parturients' satisfaction (1). Epidural neostigmine (N) 500 μg, a cholinesterase inhibitor, combined with sufentanil (S) initiates labor analgesia without motor block or side effects (2). The study compares the efficacy (analgesia, ropivacaine (R) consumption, instrumentation) of an epidural continuous infusion (CI) combining sufentanil with either ropivacaine or neostigmine during labor.
Materials and Methods: After informed consent, at the beginning of labor, a lumbar epidural catheter was inserted in healthy parturients. When VAS was ⩾30/100, after a test dose, all patients receive epidural N 500 μg and S 10 μg in a total volume of 12 mL, then, were randomly allocated to receive epidural CI with S 2 μg/h and R 10 mg/h (group SR; n = 15) or S 2 μg/h and N 100 μg/h (group SN; n = 15) during 5 hours. After what R 0.1% was used until delivery. During CI, rescues doses of epidural R were available as needed. Pain scores, time before the 1st rescue dose (rescue 1) as well as number of rescues doses (n), labor duration, instrumentation rate and total R consumption were noticed. Maternal and fetal vital parameters and side effects were recorded.
Results: Parturients did not differ concerning demographic data. Analgesia efficiency (= % parturients with VAS < 30/100) differed after 5 hours: SR 50% versus SN 17% (*) for similar cervical dilatation (6.75 vs 6 cm). Other results are expressed in the Table. Data are presented as mean ± SD and (95% CI). No particular side effects were observed.

	SR	SN
Rescue 1 (min)	155 ± 74	140 ± 75
n rescues	1.1 ± 1	1.3 ± 1
L duration (min)	321 ± 164	299 ± 115
R use (mg/h)	13.2 (10–15)	6 (4.4–7.7)*
Instrumentation (%)	6.6	0

Statistical analysis used ANOVA; *p ⩽ 0.05 significant.

Discussion and Conclusions: Until cervical dilatation 6 cm, SN infusion provides similar analgesia to classical SR and allows R sparing effect. No impact on instrumentation rate was noticed.
References:
1 Wilson MJ et al Anesthesiology 2002; 97: 1567–75.
2 Roelants F et al Anesthesiology 2004; 101: 439–44.

A-580

Effect of different types of anaesthesia on fetal immunity

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Background and Goal of Study: There have been reports about the effects of anesthetic techniques on fetal and maternal immunity. To determine the effects, interleukin-6 (IL-6), cortisol and natural killer (NK) cell activity were investigated.
Materials and Methods: 29 elective caesarean (C/S) cases were studied to find out the difference between effects of general (GA) and spinal anesthesia (SA) on fetal immunity by means of a randomized prospective study. In SA group (n = 14), anesthesia was achieved by 10 mg hyperbaric marcain and 15 μgr fentanyl. In GA group (n = 15), after oxygenation, induction was achieved by thiopenthal and succinyl choline, intubation and maintenance by sevoflurane, N_2O and O_2. Maternal blood was collected before and after C/S from the antecubital vein, fetal blood from fetal side of umbilical vein after clamping. IL-6 levels were detected by ELISA technique, NK cell activity by K562 cell line. Mann-Whitney U, t tests and Spearman's correlation analysis were used for statistical analysis. $P < 0.05$ considered as statistically significant.
Results and Discussions: The time interval from the beginning of anesthesia to umbilical cord clamping was longer in SA group than GA group (median = 13.5 and 8 minutes, p = 0.003). As the discussed time interval increased in SA group, fetal IL-6 levels was decreased (rho = −0.573, p = 0.041). In both groups, there was no statistically significant correlation between fetal and maternal IL-6 levels. Fetal cortisol level in GA group was significantly higher than SA group (median = 5.22 and 3.95, p = 0.008). NK activity was found to be similar in both groups. In GA group, there was a negative correlation between NK activity and fetal IL-6 level (rho = −0.580, p = 0.023).
Conclusions: Increased length of C/S in SA group, high cortisol levels in GA group, NK activity and its correlation with IL-6 levels were important findings. Non of the anesthetic techniques affected the IL-6 placental transmission from mother to fetus. Due to inhibitory effect of regional anesthesia on stress response, SA should be preferred to GA as far as immune system concerned.
Reference:
1 Salo M. Acta Anaesthesiol Scand 1992; 36: 201–220.

A-581

Ultrasound imaging of epidural anaesthesia for morbidly obese parturients

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Background and Objective: Using ultrasound for the identification of the epidural space in obstetric patients has been reported*1,*2. With an increase in number of morbidly obese parturients (BMI > 40), we report our experience of the use of ultrasound for help in identification of the epidural space for epidural analgesia for labour pain control.
Method: All patients were given an explanation of the use of ultrasound and gave verbal consent. Patients (BMI > 40) lying in the left decubitus position were scanned with a 3.75-MHz curved array probe (Tosbee, TOSHIBA) placed in longitudinal plane immediately next to the midline of the back. The level of intervertebral space, L4/5,was confirmed and the distance measured from skin to the ligamentum flavum. The epidural needle was inserted, paramedian approach, from the marked place identified by the ultrasound and confirmed by loss of resistance to saline. 20 ml of 0.1% bupivacaine with fentanyl was given directly through the Tuohy needle with the epidural catheter inserted for the subsequent top-ups.
Result:

			Distance**		
Case	BMI	Palpitation*	Ultrasound	Tuohy needle	Visibility***
1	45	Poor	8.1	8	Average
2	40	Slight	7.4	6.5	Good
3	43	Slight	6.1	6.5	Average
4	41	Slight	6.2	7	Average
5	41	Poor	6.8	7.5	Good

* Idendification of intervertebral space.
** Distance from skin to epidural space (cm).
*** Visibility of ligamentum flavum.

There were no dural puncture and none of them took more than 5 min to scan for the epidural space.
Conclusion: Epidural analgesia was safely instituted for the morbidly obese patients using ultrasound guidance. There was reasonable agreement between depth of epidural space as predicted by ultrasound and that actually identified.
References:
*1 Grau T, J Clin Anesth. 2002; 14(3).
*2 Grau T, B J Anaesth. 2001; 86(6).

A-582

Intravenous remifentanil versus epidural levobupivacaine with fentanyl for pain relief in early labour: a randomised, controlled, double blind study

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Background and Goal of Study: Individually titrated intravenous patient controlled analgesia with remifentanil (RE) has been noted to provide

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effective pain relief during labour (1). We hypothesized that it could provide as satisfactory analgesia as epidural analgesia (EPID).

Material and Methods: After permission by ethics committee 52 healthy parturients with singleton uncomplicated pregnancies were randomised to receive either EPID with 20 ML levobubivacaine 0,625 mg/ML and fentanyl 2 μg/ML in saline or RE in a prospective, double blind-study. The PCA dose for RE was given over 1 min with a lockout time of 1 min. The dose was increased after every other uterine contraction starting from the bolus of 0.1 μg/kg up until individual effective dose was reached, until a maximum dose of 0.9 μg/kg was reached, or 60 minutes had elapsed. The parturient's assessment of contraction pain (verbal numerical score 0–10), pain relief (rank categorical score 0–4), sedation and nausea (rank categorical scores 0–3) were recorded at 10 minutes intervals. Averages of the scores were calculated for each patient. Mann-Whitney and chi square tests were used for statistical analyses. $P < 0.05$ was considered significant. Data are median with 25th and 75th percentiles.

Results: 46 parturients were included in the analysis. Mean age was 28 years. Cervical opening was 4 cm (3–5) before the study and 7 cm (5–9) after the study. The pain scores were 7.3 (5.6–8.2) and 5.6 (2.2–6.7) during RE and EPID, respectively ($p = 0.009$). The pain relief scores were 2.5 (2.2–2.9) and 2.8 (2.0–3.5) for RE and EPID, respectively ($p = 0.17$). Sedation scores were 2.3 (1.3–2.6) and 0 (0–0.8) with RE and EPID, respectively ($p < 0.001$). All parturients remained responsive and able to discuss throughout the study. Already before RE, 9 parturients had nausea. This continued during the study period albeit milder. 2 parturients started to have mild nausea during EPID.

Conclusions: In terms of pain scores EPID is superior to RE. However, there was little difference in the pain relief scores between the treatments. With RE, sedation was an obvious side effect. RE did not increase the number of parturients who had nausea.

Reference:

1 Volmanen P, Akural E, Raudaskoski T, et al. Anesth Analg 2002; 94: 913–7.

A-583

Ephedrine and phenylephrine for maternal hypotension in a chronic sheep model with increased placental vascular resistance

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Background and Goal of Study: We studied the effects of ephedrine and phenylephrine on uterine and placental circulations and fetal acid-base status and lactate levels in a chronic sheep model with increased placental vascular resistance (R_{UA}) induced by placental embolization.

Materials and Methods: At 115–136 days' gestation, chronically instrumented, anesthetized ewes with placental embolization were randomized to receive boluses of ephedrine or phenylephrine for maternal epidural-induced hypotension. Uterine (Q_{UtA}) and placental (Q_{UA}) volume blood flows were measured with perivascular transit-time ultrasonic flow probes, and uterine vascular resistance (R_{UtA}) and R_{UA} were computed from volume blood flows and maternal and fetal mean arterial pressures (MAPs). Statistical analysis: ANOVA, followed by paired t-test.

Results and Discussion: During hypotension, maternal MAP and HR, Q_{UtA}, Q_{UA}, and fetal pH and pO_2 decreased and R_{UtA}, R_{UA}, and fetal lactate increased. Following treatment, fetal pH did not further decrease in either group, but fetal lactate increased in the phenylephrine group (mean difference 1.5, 95% confidence interval 0.7 to 2.3 mmol l^{-1}; $P = 0.004$).

Table 1.

	Ephedrine ($n = 7$)		Phenylephrine ($n = 6$)		
	Baseline	Vasopressor	Baseline	Vasopressor	*P*
MAP_{ewe}	92 ± 10	88 ± 10	95 ± 9	90 ± 17	0.9
HR_{ewe}	130 ± 17	152 ± 20*	127 ± 9	73 ± 7*	<0.001
Q_{UtA}	576 ± 221	532 ± 199	448 ± 189	251 ± 106*	0.014
R_{UtA}	0.18 ± 0.06	0.19 ± 0.10	0.27 ± 0.18	0.44 ± 0.25*	0.003
MAP_{fetus}	49 ± 7	53 ± 9	50 ± 6	50 ± 9	0.4
HR_{fetus}	182 ± 24	169 ± 44	169 ± 22	150 ± 20	0.8
Q_{UA}	195 ± 107	204 ± 96	182 ± 61	134 ± 100	0.031
R_{UA}	0.31 ± 0.14	0.32 ± 0.18	0.29 ± 0.07	0.51 ± 0.27*	0.031
pH	7.30 ± 0.05	7.27 ± 0.10	7.34 ± 0.05	7.26 ± 0.11*	0.2
pCO2	7.5 ± 0.6	7.3 ± 1.4	7.2 ± 0.5	7.5 ± 1.2	0.3
pO2	2.1 ± 0.5	2.4 ± 0.5*	2.0 ± 0.8	1.8 ± 0.6	0.099
Lactate	2.5 ± 0.8	4.5 ± 2.2*	2.7 ± 0.6	6.7 ± 2.3*	0.082

Values are mean ± SD. *$P \leq 0.05$ compared with baseline.

Conclusions: Despite the more favorable effects on uterine and placental circulations of ephedrine over phenylephrine, we observed no significant differences in fetal acid-base status. Fetal lactate, however, increased further from hypotensive values with phenylephrine but not with ephedrine.

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The relative motor blocking potencies of intrathecal bupivacaine, ropivacaine and levobupivacaine

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Introduction: We determined the ED50 motor block for intrathecal bupivacaine (B), ropivacaine (R) and levobupivacaine (L).

Method: After local ethic committee approval and informed consent, 99 women, at term, undergoing elective Caesarean section under combined spinal-epidural anaesthesia were randomised to receive spinal 0,5% B, R or L. The starting dose was 4 mg and the testing interval 1mg. Subsequent doses were determined by the response of the previous parturient according to the up-down sequential allocation. The end point was the occurrence of any motor block (Bromage and hip motor function scale) within 5 minutes. The sequences were analysed using up-down and probit regression to estimate ED50 with 95% confidence interval (CI) and then compared using one-way ANOVA with Tukey post-tests. Significance was defined at $P < 0,05$ (two-sided).

Results: The ED50s for motor block are reported in the Table (ANOVA: $P < 0,0007$). The potency ratios were: R:B 0,59, L:B 0,71 and R:L 0,83.

	ED50 (mg)	95%CI
Ropivacaine	5,79	4,62; 6,96
Levobupivacaine	4,83	4,35; 5,32
Bupivacaine	3,44	2,55; 4,34

Discussion: In a previous study[1] we demonstrated an analgesic potency hierarchy of intrathecal bupivacaine > levobupivacaine > ropivacaine. The results of our study suggest the parallel nature of the analgesic and motor responses of intrathecal pipecolexylidines.

Reference:

1 Camorcia M et al. Anesthesiology 2005, in press.

A-585

The influence of intravenous PCA remifentanil infusion and PCA continuous epidural analgesia on cortisol and Il-6 levels in primaparas anaesthetised for delivery

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Background and Goal of Study: Delivery is a stressful and painful event which can modify IL-6 and Cortisol levels. Although various kinds of anaesthesia techniques for delivery were tested, so far, only epidural PCA has become "golden standard". Patient controlled intravenous infusion of Remifentanil, a new short acting opioid, seems to be a valuable alternative treatment for the future. We estimated the influence of both kinds of PCA for delivery on IL6 and Cortisol concentrations.

Materials and Methods: After obtaining written consent we divided 18 healthy, ASA I/II primiparas into two equal groups. Group Rf parturients were anaesthetized with PCA remifentanil intravenous infusion (concentration 10 μg/ml, PCA bolus 0.2 μg/kg, lockout time 2 minutes, no base flow). Group E – patients received epiduraly bolus of 8 ml 0.125% bupivacaine with 0.1 mg Fentanyl. Anaesthesia was continued with 0.125% bupivacaine (PCA bolus 4 ml, lockout time 15 min, base flow 1 ml/hour). We recorded:

1. duration of first and second delivery stage,
2. mean VAS score,
3. IL-6 level before anaesthesia (IL6 I) and after delivery (IL6 II),
4. mean maternal blood cortisol levels.

The data was analysed with U-Mann-Whitney test.

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Results: There was no difference between both groups in VAS score and the first stage of delivery duration. The second stage of delivery was significantly longer in the E group.

Data of IL-6 and Cortisol are shown as mean ± SD in the Table.

	IL6 I (μg/dl)	IL6 II (μg/dl)	Cortisol (pg/ml)
E	6.98 ± 7.22	39.70 ± 19.80	45.14 ± 12.93
Rf	8.48 ± 5.14	60.97 ± 103.79	49.39 ± 20.70

Conclusion: Intravenous PCA Remifentanil infusion and PCA continuous epidural analgesia do not create differences in Il-6 and Cortisol concentrations in primaparas anaesthetised for delivery.

A-586

Impact of artificial rupture of membranes on provision of anaesthetic services – could the bubble burst?

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Background and Goal of Study: Much obstetric workload is unplanned. However, one area of practice which can be controlled is the induction of labour in general and artificial rupture of membranes (ARM) in particular. Given the paucity of data regarding the impact of ARM on anaesthetic workload a retrospective study was undertaken to investigate the frequency as well as timing of ARM and to correlate these aspects with the provision of epidural anaesthesia.

Materials and Methods: A retrospective audit of 1131 patients admitted to a city maternity hospital over a 3 month period was undertaken. Elective Caesarean sections were not included. Data were analysed using descriptive statistics (Chi-squared test).

Results and Discussions: The number of women requiring ARM was 157 (14%). Only 10% of women who had ARM delivered between 0900 h and 1300 h with the peak delivery times of 1900 h and 0100 h. 76% of patients received an epidural within 5 h of ARM. 94% delivered within 12 h of ARM; 83% of women having an ARM after 1500 h delivered between midnight and 0800 h. 20% with an ARM presented for emergency Caesarean section and of these patients 77% underwent delivery between 1900 h and 0800 h. The percentage of daily ARMs undertaken between 1500 h and 2400 h ranged from 38–53% over a week. Patients having ARM after 1500 h are statistically more likely to deliver between midnight and 0900 ($p < 0.001$).

Conclusion(s): ARM influences the timing and mode of delivery. This in turn has an impact on out-of-hours obstetric and anaesthetic workload, irrespective of the weekday. Because of the European Working Time Directive and the increasing out-of-hours workload which is now placed on the consultant workforce, morning ARM should be considered to minimise disruption of subsequent elective work.

A-587

Maternal and neonatal effects and placental transfer of remifentanil given at induction of general anaesthesia for Caesarean section: a randomized double-blinded controlled trial

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Background and Goal of Study: Although case reports have described the use of remifentanil to improve haemodynamic stability during general anaesthesia for Caesarean section (CS) in patients with coexisting disease,[1] there has been no controlled study of its use. Our aim was to compare the maternal and neonatal effects of a single bolus of remifentanil 1 mcg/kg given at induction and to quantify the placental transfer of remifentanil.

Materials and Methods: With Ethics approval and written consent, in a double-blinded study, we randomized patients having general anaesthesia for CS to receive i.v remifentanil 1 mcg/kg (Gp 1, $n = 20$) or saline (Gp 0, $n = 20$) over 30s before thiopental/succinylcholine. Maintenance was with isoflurane in N_2O/O_2. We compared maternal haemodynamic changes and neonatal condition at birth. We measured maternal and umbilical plasma levels of remifentanil using liquid chromatography-tandem mass spectrometry. Data were analyzed with t-test, Mann-Whitney, Chi-square and ANOVA-RM.

Results and Discussions: Serial changes in maternal blood pressure (BP) and heart rate (HR) until delivery were lower in Gp 1 vs Gp 0 ($P < 0.001$). Maximum values (mean ± SD) were lower in Gp 1 vs Gp 0 for systolic BP (127 ± 12.6 vs 165 ± 23.0, $P < 0.0001$), mean BP (98 ± 8.6 vs 123 ± 15.9, $P < 0.0001$) and HR (112 ± 8.4 vs 126 ± 15.4, $P = 0.0008$). Apgar scores, cord gases and time to sustained respiration were similar between groups. However, two neonates in Gp 1 were considered clinically depressed and received naloxone. Remifentanil crossed the placenta with umbilical venous/maternal arterial ratio 0.73 ± 0.17 and umbilical arterial/umbilical venous ratio 0.60 ± 0.23.

Conclusion(s): Single bolus i.v. remifentanil 1 μg/kg effectively attenuated haemodynamic changes after induction and tracheal intubation. However, remifentanil crosses the placenta and may cause neonatal depression and should be reserved for clear maternal indications when adequate facilities for neonatal resuscitation are available.

Reference:

1 Orme RM et al. *Int J Obstet Anesth* 2004;13:183–7.

A-588

Levobupivacaine versus racemic bupivacaine in spinal anesthesia for Cesarean section

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Background and Goal of Study: Racemic bupivacaine is the most common local anesthetic used intrathecally. This study aimed to detect if intrathecal (i.t.) levobupivacaine and bupivacaine provided anesthesia (satisfactory analgesia and muscle relaxation) and postoperative analgesia in patients undergoing Cesarean section.

Materials and Methods: Sixty parturients were enrolled. Patients were assigned to receive one of the following i.t. solutions: levobupivacaine 0.5% 15 mg ($n = 30$) and bupivacaine 0.5% 15 mg ($n = 30$) at L3–4. Anesthesia was considered effective if an upper sensory level of T4 (verified with pinprick test) was achieved; motor blockade was documented by using modified Bromage score. Hemodynamic variables (e.g. blood pressure, heart rate, pulse oxymetry) were recorded every minute for the first 10 min. after the i.t. injection; then – every five minutes.

Results and Discussions: Intergroup differences between levobupivacaine and bupivacaine were insignificant both with regard to the onset of time and duration of sensory and motor blockade (10 ± 3 versus 12 ± 4 min; 9 ± 3 versus 11 ± 3; 238 ± 67 versus 247 ± 75; 290 ± 78 versus 295 ± 82). Both groups showed slight reduction in heart rate and mean arterial pressure, but there were no intergroup differences in hemodynamics. Patient satisfaction was good in all cases.

Conclusions: Levobupivacaine, the pure S(−)-enantiomer of racemic bupivacaine, is an equally effective local anesthetic for spinal anesthesia for Cesarean section, compared with racemic bupivacaine.

A-589

Thromboelastography to predict the safe removal of epidural catheters following elective Caesarean section

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Background and Goal of Study: The use of heparin thromboprophylaxis following elective Caesarean section (CS) is becoming increasingly common (1). It is also common practice to administer rectal diclofenac at the end of surgery. Both of these agents will tend towards reduced coagulability (2), raising the question of the optimum time for safe removal of epidural catheters when CS is performed under a regional anaesthetic technique. Thromboelastography (TEG) has proved useful in assessment of perioperative coagulation following major surgery (3).

Materials and Methods: We studied 24 pregnant women, of moderate thromboembolic risk, presenting for elective CS. Citrated blood was collected at (i) before regional block (ii) at termination of surgery, but before unfractionated heparin (5000 units subcutaneously) and rectal diclofenac (100 mg) and (iii) at 4 hours post-operatively. The samples were studied using TEG, with reference to time to a specific clot strength (R) and maximum clot strength (MA).

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Results and Discussions:

	Mean (SD)	
	R value (min)	**MA** value (mm)
Time (i)	3.71 (0.48)	66.44 (2.74)
Time (ii)	3.20 (0.28)	67.86 (3.11)
Time (iii)	3.53 (0.45)	67.93 (2.80)

ANOVA analysis showed that mean R value decreased significantly between times (i) and (ii) $p = 0.0008$, but increased significantly between times (ii) and (iii) $p = 0.009$. There were no significant changes between times (i) and (iii) or in any of the MA values, p all >0.05.

Conclusion(s): It would appear that immediately following elective CS women are hypercoagulable, returning to pre-operative values 4 hours following operation and drug administration. This would imply that the epidural catheter can therefore be removed safely at this point.

References:

1 Gidiri M, Sant M, Philips K et al. *J Obstet Gynaecol* 2004; 24: 392–394.
2 Goucke CR. *Anaesth Intensive Care* 1989; 17: 458–465.
3 Mahla E, Lang T, Vicenzi MN. *Anesth Anlag* 2001; 92: 572–577.

A-590

UK vs US partner anxiety prior to elective Caesarean section under regional anaesthesia

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Background and Goal of Study: We compared and contrasted measured anxiety levels in partners of women undergoing elective Caesarean section with regional anaesthesia. Our aim was to discover an international variation in partner anxiety response. Over 90% of elective Caesarean sections at the Princess Margaret Hospital, Swindon, UK [1] and the University of Michigan Hospital, US [2] are performed under regional anaesthesia.

Materials and Methods: 91 UK and 100 US partners of women undergoing an elective Caesarean section with regional anaesthesia were recruited. The questionnaire used in the UK and US, comprised 4 parts: (1) Demographic data i.e. age, gender, occupation, education, previous attendance at Caesarean sections, attendance at anaesthetic clinics and relationship to patient; (2) Leeds Self Assessment of Anxiety (SAA) scale [3]; (3) Specific questions about source of anxiety; 4) Specific questions about relieving factors of anxiety. Additional comments were invited from the partners for the final 2 sections. The Leeds SAA scale has 4 possible responses to each question with associated points: not at all (0), not much (1), sometimes (2), definitely (3). Scores range from a maximum score of 18 to 0. A score $\geqslant$**7** is consistent with a pathological state. The studies used Chi Square tests and Fisher's Exact tests to determine differences between demographic variables and level of anxiety among partners. A Student's t-test was used to determine differences in partner age in the anxious and non-anxious partner.

Results: Twenty eight percent of partners in both the UK and US study demonstrated anxiety scores compatible with a pathological state.

Conclusion: These UK/US partner anxiety findings warrant further investigation into how we may alleviate stress in this silent population. Interestingly, the US study co-incided with the 9/11 terrorist attacks which may have indirectly affected the level of US partner anxiety.

References:

1 Taylor IR. *Anaesthesia,* 57: 600–605, 2002.
2 Bullough AS. *Abstract IARS 77th Congress* 2003.
3 Snaith RP. *BJ of Psychiatry*, 128: 156–165, 1976.

A-591

Comparison of ephedrine-phenylephrine vs ephedrine to treat hypotension during elective cesarean section after spinal anesthesia

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Background and Goal of Study: Recent studies suggest that preventive administration of phenylephrine (P) combined with ephedrine (E) halved the incidence of hypotension during cesarean section (CS) under spinal anesthesia (SA)[1]. This study assesses the effectiveness of curative administration of E + P mixture by comparison with E alone to treat hypotension during SA for CS.

Materials and Methods: After informed consent, 40 healthy parturients scheduled for elective CS received a crystalloid preload of 15 ml/kg. SA (8 mg hyperbaric bupivacaine, 2 μg sufentanil) was performed in the sitting position. Hypotension (SBP $<$ 100 mmHg or decrease $<$80% baseline) was treated with 1 mL incremental bolus doses of vasopressor (V) solutions. Parturients were randomly allocated into 2 groups and receive either E-P mixture containing E 3 mg/mL with P 15 μg/mL (group E–P; n = 20) or E with a concentration of 3 mg/mL (group E; n = 20). Maternal blood pressure and heart rate at different time points after spinal injection as well as V administration needed to avoid hypotension were recorded. Data are expressed as mean ± SD. Statistical analysis used ANOVA; $p < 0.05$ was considered significant.

Results and Discussions: Patients did not differ concerning demographic data, sensory level, time before baby delivery and Apgar scores. % patients needing vasopressors at different time (T in min post SA) and total vasopressors (V) consumption are expressed in the Table. No atropine was required.

	E	E–P	*p*
T 3 (%)	25	15	n.s.
T 5 (%)	45	35	n.s.
T 7 (%)	55	15	0.008
T 10 (%)	15	20	n.s.
T 20 (%)	15	20	n.s.
T 30 (%)	10	5	n.s.
Total V (mL)	6.85 ± 4.8	4 ± 2.5	0.006

Conclusion(s): E + P combination reduces total amount of vasopressors needed and seems to be more effective to treat hypotension after SA for CS.

Reference:

1 Mercier FJ, Riley ET, Frederickson WL, et al. Anesthesiology 2004; 95: 668–74.

A-592

Prophylaxis of perioperative nausea and vomiting with subhypnotic dose of propofol and dexamethasone during intradural anesthesia in cesarean section

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Background and Goal of Study: To determine the preventive and therapeutic effect of subhypnotic dose of propofol and dexamethasone administered after delivery on the incidence of nausea and vomiting during intradural anesthesia for cesarean delivery.

Materials and Methods: Controlled, randomized double blind study of 60 women (ASA I–II) receiving intradural anesthesia for elective cesarean section. Group D received dexamethasone 8 mg i.v followed by continuous infusion of Intralipid® 0.5 mL/kg/h as placebo, Group P received 2 mL saline followed by propofol infusion of 1 mg/kg/h and placebo group (Group C) received equal volumes of saline and Intralipid® after fetal extraction. Emetic episodes and safety assessment were performed during anesthetic management. Nausea and vomiting on a 3-point ordinal scale (0 = none, 1 = mild nausea, 2 = severe nausea and retching, 3 = vomiting) and need for rescue antiemetic treatment were evaluated.

Results and Discussions: Groups were comparable with respect to demographic data, anesthetic and operative managements. The amount of ephedrine used for the treatment of hypotension was similar between groups. In an intraoperative, post-delivery period, an emesis free episode occurred in 2 of 20 patients (10%), 7 patients (35%) who received dexamethasone and propofol respectively, compared with 3 of 20 (15%) those who received placebo. No patients presented vomiting in Groups D and P compared with 4 patients in Group C. The proportion of patients who required antiemetic rescue was higher (80%) in Group C compared to 35% in Group D ($p < 0.05$) and 20% in Group P ($p < 0.05$). The severity of nausea was greater in patients receiving placebo than in those receiving propofol and dexamethasone ($p < 0.05$). No clinically important side effects related to the use of study drugs were found.

Conclusion: A subhypnotic dose (1 mg/kg/h) of propofol was effective than dexamethasone for the prevention of nausea and vomiting in parturients undergoing cesarean section under spinal anesthesia. Propofol and dexamethasone reduced the severity of nausea, vomiting and the need for rescue antiemetics.

Reference:

1 Numazaki M, Fujii Y. *Anesth Intensive Care* 2000; 28: 262–265.

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A-593

Intrathecal ropivacaine for caesarean section – a dose-finding study

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Background and Goal of Study: Ropivacaine, a relatively new amino-amide local anaesthetic, has recently been licensed for intrathecal application for various indications. There is however no official recommendation of any dosage regimen to be used in women undergoing caesarean section. We reviewed all caesarean sections done in our department using ropivacaine in different dosages.

Materials and Methods: 40 women undergoing elective caesarean section received the following doses of spinal ropivacaine: 10 mg + 0.1 mg morphine, 12.5 + 0.1 mg morphine, 12.5 mg or 15 mg of spinal ropivacaine.

Patients did not receive any fluid preload. The level and duration of sensory block, intensity and duration of motor block using a modified Bromage score, time to mobilize and changes in mean arterial pressure were recorded at timed intervals.

Results and Discussions: 10 mg + 0.1 mg morphine was only used in two patients since it provided insufficient sensory and motor block. 15 mg of spinal ropivacaine produced sensory block at T3/4 level; 12.5 mg produced sufficient sensory block at T6/7 level but with a short duration of 72 ± 7 min until complete void of the block.

12.5 mg ± 0.1 mg morphine provided sufficient sensory block at T6/7 level with a duration of 91 ± 17 min.

Conclusion(s): Low-dose ropivacaine is safe and easy to use in women undergoing caesarean section since it provides sufficient analgesia and motor block and haemodynamic depression is rare. Some dose-finding studies could not see any advantages of ropivacaine over other local anaesthetics but doses of ropivacaine used in those studies were much higher. Comparative studies between low-dose ropivacaine and other local anaesthetics used in women undergoing caesarean section are necessary.

Reference:

1 Khaw KS, Ngan Kee WD, Wong ELY, Liu JYW, Chung R Spinal Ropivacaine for Ceasarean Section – A Dose-finding Study. Anesthesiology 2001; **95**:1346–50.

A-594

Serum leptin, cortisol and malondialdehyde levels for evaluation of surgical stress response in general and spinal anesthesia

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Introduction and Objective: The importance of stress hormones for evaluation of surgical stress response was well known. In this study, we aimed to investigate the effects of general and spinal anesthesia on stress response in vaginal hysterectomy operations.

Materials and Methods: After approval of faculty ethics committee, 40 patients (ASA I–II) scheduled for vaginal hysterectomy were included in the study. They were divided into two groups randomly. Group I patients (n = 20) were operated under general anesthesia and spinal anesthesia was used for group II patients (n = 20). Anesthesia was induced with tiopental sodium (5 mg kg, I.V.) and vecuronium bromur (0.1 mg kg, I.V.) and maintained with 50% N_2O + 50% O_2 and 2% sevoflurane in Group I. Group II patients received bupivacaine and fentanyl via a 22 gauge spinal neddle placed between L3–4 level. Blood samples were collected for preoperative (1), Perioperative (2) and postoperative (3) analysis of serum leptin, cortisol and malondialdehyde levels. The results were compared by using t-test and repeated measures analysis.

Results: Serum leptin and MDA levels showed no difference between two groups for all sampling periods. However, serum cortisol levels of 3rd period were detected higher in group I (711 ± 206) than group II (481 ± 186).

No difference was determined between two groups with respect to serum levels of leptin in all sampling periods.

MDA levels increased postoperatively (1.66 ± 0.6) compared to preoperative values (1.33 ± 0.5) in group I, whereas no difference was observed in Group II.

Cortisol levels remained unchanged in group II for all sampling periods, however they increased postoperatively (711 ± 206) when compared with 1st (442 ± 180) and 2nd (502 ± 123) periods in group I.

Conclusion: We beleive that differences between two groups with respect to serum cortisol and MDA levels show that spinal anesthesia is more useful than general anesthesia to prevent surgical stress response.

Intensive Care Medicine

A-596

Percutaneous dilatational tracheostomy in 139 critically ill patients: evaluation of our experience

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Background and Goal of Study: A number of percutaneous procedures for tracheostomy (PDT) have been estabilished within the last few years. Three techniques for percutaneous tracheostomy – the estabilished Translaringeal Fantoni technique (TLT), a variant to TLT and the new Percutwist were prospectly studied for perioperative and postoperative complications in 139 critically ill patients.

Materials and Methods: During an eight years period we performed 139 PDT (age 74 ± 8 yrs), 27 classic TLT, 9 percutwist and 103 TLT modified (without rigid tracheoscopy): infection of the tracheostomy site and severe coagulopaty were considered contraindications for tracheostomy. In all cases tracheostomy was performed at the bedside in the ICU. The procedure time (min) was 20,3 ± 7 for TLT modified, 32 ± 12 for classic TLT and 22.7 ± 8 for Percutwist. Regardless of the technique every procedure was terminated by one final broncoscopy.

Results and Discussions: Data are shown in the Table:

		Postoperatory	
Complications	Intraoperatory	Early	Late
Desaturation	15 (10.7%)		
Mild Bleeding	3 (2.15%)		
Severe Bleeding	1 (0.71%)	2 (1.43%)	
Subcut. Emphysema		1 (0.71%)	
Difficult of cannula placement	15 (10.7%)		
Infection of Tracheostoma		1 (0.71%)	
Decannulation	4 (2.8%)		
Difficult of cannula replacement		5 (3.59%)	

Conclusion(s): According to our data PDT are safe procedures and unlikely to result in major complications.

Reference:

1 Westphal K. *Anesth. Analg.* 1999; 89: 938–43.

A-597

Is ideal body weight related to the lung dimension or weight?

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Background and Goal of Study: The most common way to set the tidal volume during mechanical ventilation in ALI/ARDS patients is based on the estimation of the ideal body weight (1). The "rationale" should be a good correlation between the ideal body weight of the patient and the volume–weight of the lung. Thus by maintaining a tidal volume between 6–8 ml/Kg should reduce the lung stress–strain and ventilator induce lung injury.

We aimed to evaluate the relationship between the ideal body weight and the degree of lung inflation during controlled mechanical ventilation.

Materials and Methods: 34 intubated, sedated and paralyzed ALI/ARDS patients (mean age 56 ± 18 years, body mass index 23.7 ± 3.6 Kg/m^2, PaO_2/FiO_2 194 ± 79 mmHg, PEEP 11.1 ± 2.7 cmH_2O, tidal volume 575 ± 148 ml resulting in a tidal volume per body weight of 8.5 ± 1.6 ml/Kg) were studied. A lung CT scan was performed in static conditions during an end expiratory pause at 5 cmH_2O of PEEP (140 mA, 120 Kv). The lung was manually drawn and the quantitative analysis to asses the volume–weight of the lung was made using dedicated software (Softefilm, University of Milan, Italy).

Results and Discussions: There was no relationship between the ideal body weight and the inflated lung volume ($p = 0.085$, $r = 0.033$). Identical results were obtained also considering the lung weight.

We did not find any relationship between the ideal body weight and the inflated lung volumes, thus when setting the tidal volume based on body weight it does not reflect the "real" lung inflation.

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Conclusion(s): This might explain the contradictory results obtained by the most recently clinical trials which evaluated possible benefits of a low tidal volume ventilation strategy.

Reference:

1 Acute Respiratory Distress Syndrome Network. N Engl J Med 2000; 342: 1301–1308.

A-598

The effect of midazolam on the oleic acid induced acute lung injury in rats

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Background and Goal of Study: Although some of the other commonly used intravenous anaesthetics have been shown to be protective in acute lung injury (1), the effects of midazolam on the acute lung injury is not known. We aimed to investigate the effects of midazolam in oleic acid-induced acute lung injury in rats.

Materials and Methods: 30 male Wistar rats were randomly allocated into 5 groups. Control group (n = 6),Vehicle group (n = 5) (the dissolving chemicals of midazolam in its pharmaceutical formula), Midazolam group (n = 7):midazolam (50 mg/kg i.p.), Oleic acid group (n = 6) (50 μl Oleic acid i.v.), Oleic acid + midazolam group (n = 6): (50 μl Oleic acid i.v. + midazolam (50 mg/kg) i.p.). A histologist who was blinded to the animals' group assignment assessed the acute lung injury (interstitial oedema, alveolar haemorrhage, intraalveolar neutrophils, intraalveolar macrophages and intraalveolar pneumocytes, total lung injury). Kruskal Wallis and Mann-Whitney-U tests were used. $p < 0.001$ was considered as significant for pairwise comparisons.

Results and Discussions: Midazolam increased the interstitial oedema (median [95%CI] score: 2[0–3]) compared to the control group (0[0–0]) and to the vehicle group (0[0–1]. Oleic acid caused significant total lung injury (9.5[4–12]) compared to the control group (1[0–3]) and to the vehicle group (1[0–2]). There were no differences between the oleic acid group (9.5[4–12]) and the oleic acid + midazolam group (8[3–13]) regarding the severity of the acute lung injury.

Conclusion(s): We found that oleic acid caused significant acute lung injury and midazolam failed to attenuate this damage. The potential clinical implication of this study is the safety of using midazolam for induction in patients with acute lung injury, although it is not protective.

Reference:

1 Gao J, Zeng BX, Zhoub LJ, Yuan SY. Protective effects of early treatment with propofol on endotoxin induced acute lung injury in rats. British Journal Anaesthesia 2004; 92: 277–9.

A-600

Broncho-alveolar lavage in criticaly ill patients in the intensive care unit

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Background and Goal of Study: Respiratory infections and the development of resistant strains are one of the major problems in the ICU. The objective of the study was to identify the bacteria most frequently isolated by broncho-alveolar aspiration and the kind of antibiotics they were resistant to.

Materials and Methods: Prospective study included 128 patients, aged from 23–61 years. Group I consisted of polytraumatized cases, while group II included operated patients (ileus, pancreatitis, perforations, peritonitis, etc.). On day 3rd and 10th from the admission to the ICU, bronchoalveolar aspirates were collected from all patients and analyzed in microbiological laboratory with appropriate drug susceptibility test for prescription of target antibiotic therapy. All patients were scored according to APACHE II scoring system.

Results and Discussions: The results obtained by the first and the second bronchoalveolar lavage are as follows. The analysis of the first result reveals that the highest percentage of Staphylococcus aureus and Xanthomonas was found in group I of patients, while Staph. aureus, Xanthomonas and Acinobacter spp. were most prevalent in group II. The increased proportion of Pseudomonas spp. in the second sample was reported in both groups of patients, what could be explained by development of resistant strains to potent antibiotics: Imipenem, Meropenem. In case of use of these antibiotics sensitivity, intermediate sensitivity and resistance were similar: 89.9%, 2%, 9.1%, and 91.9%, 0.9%, and 7.2% respectively. Sensitivity to Vancomycin was 100% in case of Staphy. aureus infection.

	First lavage (%)	Second lavage (%)
Staphylococcus aureus	43	24
Proteus spp.	7	9
Klepsiella spp.	6	10
Pseudomonas spp.	11	16
Acinetobacter spp.	8	7
Xanthomonas	20	12

Conclusion(s): Therefore, it is necessary to take a critical view of antibiotic application, because the resistance to potent antibiotics might seriously question the control of infection.

A-601

Aquired tracheoesophageal fistulas in critically ill patients

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Background and Goal of Study: Acquired tracheoesophageal fistula (TEF) represents the life-treating complication of prolonged mechanical ventilation in critically ill patients. The management of patients with acquired TEF is controversial.

Materials and Methods: Between January 2001 and July 2004, a total of 1450 patients were admitted to surgical ICU requiring mechanical ventilation. Study population comprised trauma patients with multiple injuries and surgical patients with severe complications. Seven patients (0.48%), two women and five men with median age of 37 (21–54) years had tracheoesophageal fistula resulting from median 51 (range 22–98) days of tracheal intubations. Six were cuff related decubital tracheal injuries, and one appeared accidentally during inserting the tracheostomy tube. Diagnosis was made by oesophagography. The median TEF length was 2.5 ± 1.2 cm and defects were associated with tracheal stenosis.

Results and Discussions: Immediate treatment was supportive, adequate nutrition was facilitated by inserting jejunostomy. Three patients were weaned from mechanical ventilation. Two of them had recurrent sepsis episodes and persistent pulmonary infection. In one patient, after establishing spontaneous breathing, radical surgical repair oh the trachea was performed. The patient successfully recovered. In the second case, the airway defect was closed using extrathoracic muscle flap. This patient died in early postoperative period. There was no spontaneous closure of the fistula. All other patients died.

Conclusion(s): Our experience suggests that TEF is still the life-treatening complication of prolonged mechanical ventilation in critically ill patients. Surgical correction is required because spontaneous closure of the fistula is rare.

A-602

Experimental comparison of Ciaglia and Griggs PCT techniques with biomechanical method

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Background and Goal of Study: To create a method for biomechanical experimental evaluation of percutaneous tracheostomy (PCT). Nowadays two techniques of PCT (Ciaglia and Griggs) are employed. Every technique is based on gradual tearing of the hole in the cervical trachea by specially designed dilators. Biomechanical study of the different stages of PCT will help to compare the course of these two procedures.

Materials and Methods: PCT by Ciaglia technique (n = 10) and by Griggs technique (n = 10) were performed on fresh dead pigs with mass of the body 115 ± 3 kg. Portex set of instruments was used for Griggs technique and Cook set of instruments – for Ciaglia technique. During different stages of PCT (piercing, penetrating, pulling, and pushing) special measurements of forces applied on different instruments were performed with the help of electronic dynamometer (MRC). Calculations of energy spent for these stages of PCT were done. At the end of experiments evaluation of the cervical trachea was performed to receive objective parameters of each tracheotomy.

Results and Discussions: Application of Ciaglia dilator requested more energy (1.54 times) than Griggs dilating forceps ($p < 0.05$). Formation of tracheotomy by Ciaglia dilator was more exact than by Griggs forceps due to special markings on the dilator. The work with Griggs dilating forceps requested additionally experience due to absence of any markings on the dilator. Laceration of the cervical trachea could be easily happened in the time of work with dilating forceps in Griggs technique and during insertion of tracheostomy tube loaded on dilator in Ciaglia technique. Macroscopic appearance and parameters of each tracheostomy type were the same ($p < 0.05$).

Conclusion(s): PCT by these two techniques has almost similar biomechanical characteristics. In spite of difference in the design of dilators the final result of the two techniques is the same. Both techniques have some

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dangerous moments. In order to prevent them several improvements must be done in instrumentation.

A-603

Effectiveness of continuous positive airway pressure (CPAP) face mask Boussignac-Vygon as a treatment of acute respiratory failure

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Background and Goal of Study: Among different types of non-invasive mechanical ventilation, in recent years a face CPAP mask (Boussignac-Vygon) has been developed and used in a mode of CPAP ventilation. An O_2 supply is used to create through a special valve mechanism continuos positive pressure in the airways; the aim of our study was to evaluate the effectiveness of CPAP Boussignac system as treatment of acute respiratory failure in ICU patients.
Material and Methods: We have studied all patients with acute respiratory failure treated with CPAP Boussignac during a four years period. In all patients CPAP was applied at a setting of 5–7 cms H_2O. Main variables were demographic data, SAPS value, etiology of respiratory failure, length of treatment and its complications, changes in arterial blood gases and clinical data.
Results and Discussion: 20 patients were enrolled; 17 patients (85%) were men and 3 (15%) were women. Mean age was 54.8 yr (± 24.35) with a range from 22 to 85 yr; 9 patients were postoperative ones and 11 were traumatic. Etiology of acute respiratory failure was: 7 pacients (35%) with atelectasis, 2 (10%) with pleural effusion, 2 (10%) with pneumonia, 1 (5%) with acute cardiogenic pulmonary edema and 8 patients (40%) with thoracic trauma. Mean SAPS was 29 (±11); mean CPAP treatment length was 32.95 hours (±24.35) with a range from 3 to 101 hours. Intubation was necessary in 3 cases (15%).

Blood arterial gases results and clinic evolution

	Before CPAP	After CPAP
pH	7.4 ± 0.06	7.41 ± 0.03
pCO_2 (mmHg)	43 ± 7.1	43 ± 5.0
pO_2/FiO_2	196 ± 68	258 ± 80*
Sat O_2(%)	95 ± 2.9	98 ± 1.8*
Respiratory rate	21 ± 4	19 ± 3
Heart rate	92 ± 28	87 ± 21

Mean ± SD; *$p < 0.05$ t-student.

Conclusions: CPAP-Boussignac system is a respiratory support that is easy to use, it is well tolerated and has a low cost and it could avoid intubation in certain conditions. In our study it has been useful in 85% of patients with and improvement of FiO_2/pO_2 and $SatO_2$ parameters after treatment.

A-604

Weaning from mechanical ventilation in patients with intra-abdominal hypertension

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Background and Goals: Intra-abdominal hypertension (IAH) is frequent in ICU [1] and it may adversely affect respiratory function. The aim of our study was to assess the correlation between intra-abdominal pressure (IAP) and P0.1, as a conditioning factor of successful weaning.
Materials and Methods: 5 patients with IAH (IAP > 15 cmH_2O) and 5 patients with no IAH, during weaning from mechanical ventilation, were studied. IAP was measured by the bladder pressure method; Pes and P0.1 were recorded by Bicore CP-100 Pulmonary monitor.
Results: Data are shown in table 1:

Table 1.

Pz	IAP*	P0.1*	Pes*	f/Vt	PaO_2/FiO_2	Weaning
1	4,08	4	6	40	220	Failed
2	4,08	4	9	13	258	**
3	6,8	4	10	16	140	**
4	2,72	7	8	34	180	Failed
5	4,08	6	9	64	223	Failed
6	16,88	3	14	80	200	Successed
7	15,88	2	9	42	150	**
8	21,4	3	12	40	212	Failed
9	21,4	3	10	55	380	Successed
10	77,52	2	17	110	203	**

*IAP, P0.1 and Pes are expressed in cmH_2O.
**patients not extubated because of complications.

3 out of 5 patients with no IAH, and 1 out of 5 patients with IAH, failed the weaning and it was necessary to re-intubate them within 24 hours; 2 out of 5 patients with IAH successed the weaning.

Conclusions: In these series there is no correlation between IAP and P0.1 values.

P0.1 < 4, f/Vt < 100 and PaO_2/FiO_2 > 200 were prognostic for successful weaning.

Reference:
1 Malbrain MLNG et al. Intensive Care Med 2004; 30:822–829.

A-605

CT scan assessment of malpositioned chest tube in intensive care patients

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Background and Goal of Study: Percutaneous chest tube placement for pleural effusion or pneumothorax is a frequent procedure in intensive care unit. Severe complications due to malpositioned chest tubes such as lung lacerations and fatal bronchopleural fistula have been reported (1). However, the incidence of malpositioned chest tube in critically ill patients has never been prospectively studied. The aim of the study was to assess its incidence.
Materials and Methods: We underwent a one year prospective descriptive study in our surgical intensive care unit. During this period, all patients with a percutaneous chest tube were screened. Patients with such a tube in place in whom a thoracic computed tomographic scan (TCT) was acquired for clinical reasons (sepsis, acute respiratory distress syndrome, ineffective thoracic drainage, etc) were included for the analysis. Based on the TCT findings, chest tube position was classified as pleural, extrathoracic, intrafissural or intraparenchymatous.
Results and Discussions: Among 122 chest tubes placed in 75 adult patients (age = 51 ± 19, SAPS II = 38 ± 16) during the study, 106 chest tubes in 63 patients (age = 49 ± 19, SAPS II = 39 ± 16) were visualized on TCT. The mean delay between tube placement and TCT was 3.5 ± 2.9 days (from 1 to 13 days). Chest tubes were placed for sterile pleural effusion (50%), and/or for pneumothorax (40%), and/or for hemothorax (20%), and/or for pleural empyema (2%). Thirty-two chest tubes (30%) were malpositioned: (extrathoracic tube = 0, intrafissural tubes = 22, intraparenchymal tubes = 10).

Using clinical and standard chest X Ray, less than 1% malpositioned chest tube has been reported in large retrospective studies (2).
Conclusion(s): Chest tube malposition is an underestimated complication in critically ill patients. A reassessment of the indications as well as the technique for placement of this routinely used procedure is necessary to reduce its potentially deleterious side effects.
References:
1 Stark DD. Am J Roentgenol 1983; 141: 253–258.
2 Millikan JS. Am J Surg 1980; 140: 738–741.

A-606

Incidence of ventilator associated pneumonia (VAP) according to different enteral feeding techniques

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Background and Goals of Study: VAP is the most frequent nosocomial infection in intensive care units[1]. Colonization by gastropulmonary route plays a basic role in VAP pathogenesis[2]. Enteral feeding that is related to gastric contents alkalization, gastroesophageal reflux stimulation and colonization of upper respiratory tract increases the risk of VAP. The aim of the study was to assess the incidence of VAP according to use of intermittent (IEF) or continuous (CEF) enteral feeding techniques.
Materials and Methods: Prospective randomized study included 30 patients with an expected mechanical ventilation period of at least 6 days. They were divided into two groups: A (n = 15) fed by IEF technique, and B (n = 15) fed by CEF technique. The patients with history of alimentary tract disorders, gastrostomy, and H2-receptor antagonists or proton pump inhibitors treatment were excluded from the study. pH of gastric contents taken by gastric tube was examined by CP-315 pH-meter. The changes of pH were evaluated by nonparametric Wilcoxon test. The diagnosis of VAP was based on clinical, radiological and bacteriological criteria (tracheobronchial aspirate and protected specimen brush). Significance of differences in VAP incidence was assessed by Fisher exact test.
Results and Discussion: The study included 30 patients –7 females and 23 males aged 15–70 years. A statistically significant decrease of pH during night feeding break was stated in patients from group A ($p < 0,01$). This made a prevention of gastric colonization and VAP development in this

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group and incidence of VAP was 20%. In group B the pH changes were not statistically significant and incidence of VAP was 33%. The difference between incidence of VAP in both groups was not statistically significant (p = 0,34).

Conclusion: IEF technique can be used to obtain a temporary increase of gastric contents acidity that inhibits gastric colonization, however, this not cause a statistically significant decrease in incidence of VAP.

References:

1 Combes A, Figliolini C, Troillet JL et al. *Chest* 2002; 121: 1618–1623.
2 Alcon A, Fa'bregas N, Torres A, *Infect Dis Clin N Am* 2003; 17: 679–695.

A-607

Evaluation of perioperative and late complications after the percutaneous tracheostomy

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Background and Goal of Study: In patients with long-lasting mechanical ventilation it is recommended to perform an early tracheostomy. In the last years the development of the percutaneous dilatational tracheostomy (PDT) technique is observed. Perioperative complications rate of the PDT is lower then the morbidity of the conventional open surgical tracheostomy (ST).

Materials and Methods: In the previous two years in 111 patients treated in the Intensive Care Unit with mechanical ventilation longer than 8 days, who were older than 18 years, without observed anomalies in the neck and without diagnosed coagulopathy the elective PDT procedure was performed using the Griggs technique. In 111 patients perioperative morbidity was evaluated, that occurred in the first 24 hours after the procedure. Additionally in 50 patients who survived more than 6 months after the discharge from the ICU the late complication rate was evaluated.

Results: Rate and type of complications is presented in the table:

Perioperative complications.

Complication	Number	(%)
Bleeding	2	1.8
Pneumothorax	1	0.9
Subcutaneous emphysema	2	1.8
Infection	1	0.9
Revision of the fistula	1	0.9

Late complications: In one patient symptomatic tracheal stricture was observed, what gives 0.9% of performed procedures. Complications were observed in 8 patients (7.2% of the performed procedures).

Conclusion(s):

1. No life-threatening complications and no deaths were observed as the complication of the procedure.
2. The only observed late complication was symptomatic stricture, that required surgical treatment.
3. Proper selection of the patients and surgeon's experience result in a complication rate after PDT that is not higher than after ST.

References:

1 SP Ambesh, et al., Anesth. Analg 2002, 95: 1739–45.
2 DD Massick, et al., The Laryngoscope 2000, 110: 222–8.

A-608

Minimally invasive percutaneous dilational tracheostomy: our experience

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Background and Goal: To present our experience with Percutaneous Dilational Tracheostomy (PDT).

Material and Methods: We performed 97 consecutive PDT by Percutwist technique (Rush, Kernen, Germany).

The indications for tracheostomy included prolonged mechanical ventilation and/or difficult weaning.

The procedure is performed, through a small incision of the skin, using a Seldinger technique for inserting the tracheal cannula, while the dilation is obtained by the rotation of a twist. This technique allows the tracheal lumen to held open during the dilation process by elevation of the anterior tracheal wall and avoid the damage to the posterior wall. Once the end of the thread twist can be seen endoscopically, the greatest degree of dilation and penetration has been achieved(1).

In our experience tracheostomy was defined "early" if performed within the 10th day of mechanical ventilation and "late" if performed thereafter.

Discussion and Results: 97 patients (M = 56; F = 41) were admitted in ICU for different diseases: patients with severe trauma: 23; COPD: 19; cerebrovascular diseases: 29; other causes: 26. Early tracheostomy was performed in 45 patients while 52 received late tracheostomy.

Completion of the procedure consumed 7–20 minutes (mean, 14 minutes). The procedure caused complications in only one patient: a subcutaneous bleeding few hours after the procedure in a patient who was already treated with low molecular weight heparin.

In our experience late complications did not arise. The follow up was performed using a simple questionnaire by phone on the third and on the sixth month.

Conclusions: In our experience, according to the international literature, the PDT seems to be the elective procedure for prolonged airway management in high-risk intensive care patients and for weaning from mechanical ventilation.

The procedure is safe, simple, fast, cost-effective, with low incidence of perioperative or postoperative complications, so we feel this technique as preferential for routine in ICU patients.

Reference:

1 Frova G, Quintel M. "Un nuovo metodo semplice per la tracheostomia percutanea: dilatazione con rotazione controllata. Dati preliminari". Int Care Med (2002) 2:132–136, ed. Italiana.

A-609

Routine chest radiography following percutaneous dilatational tracheostomy

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Background and Goal of Study: The role of routine chest radiography (CXR) following percutaneous dilatational tracheostomy (PDT) has recently been questioned.[1]

Materials and Methods: We have performed a prospective observational study on 106 patients undergoing PDT under bronchoscopic guidance to assess the utility of routine postoperative chest radiography. Data was collected on all patients undergoing PDT from 1/11/03–1/12/04. Two post procedure CXRs were reviewed and compared with those taken prior to PDT. Significant findings were barotrauma (pneumothorax, pneumomediastinum) and consolidation not noted on the pre procedure film. Post procedural films reviewed were those taken immediately after PDT and, to exclude the possibility of overlooking evidence of minor barotrauma, one further film taken between 24–96 hours.

Results and Discussions: 106 patients underwent PDT. 80 (75%) were uncomplicated. Complications were recorded in 26 (25%). 91(86%) patients had 2 post procedural CXRs reviewed. 14 (13%) patients had at least 1 CXR reviewed after PDT. 1 patient had no CXR after PDT. New complications were noted on 3 (3%) post procedure CXRs. No new pneumothoraces were seen. Patients having uncomplicated PDTs had no new CXR changes.

Table 1.

PDT Complicated?	No. CXRs reviewed	New Abnormality on CXR n (%)
No n = 68 (64%)	2	0 (0%)
Yes n = 23 (22%)	2	3 (13%)
No n = 11 (10%)	1	0 (0%)
Yes n = 3 (3%)	1	0 (0%)

Conclusion(s): Routine CXR following uncomplicated PDT is not warranted. The role of CXR following PDT appears to be restricted to those patients undergoing complicated procedures. This will lead to reductions in both medical costs[2] and exposure of staff and patients to ionising radiation.

References:

1 Datta D, Onyirimba F, McNamee MJ. *Chest* 2003; **123**: 1603–1606.
2 Tarnoff M, Moncure M, Jones F, et al. *Chest* 1998; **113**: 1647–1649.

A-610

Influence of perioperative fluid infusion on pulmonary complications after oesophagectomy

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Background and Goal of Study: Pulmonary complications (PC) are frequent after oesophagectomy reaching 20 to 40% of the operated patients.

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In case of thoracic surgery, intraoperative excessive fluid infusion has been identified as a risk factor for PC [1]. To our knowledge, no study has ever specifically studied the influence of perioperative fluid administration on the emergence of PC in patients operated for oesophagectomy.

Materials and Methods: We reviewed retrospectively 196 patients undergoing oesophagectomy with (n = 190) or without (n = 6) thoracotomy over a 5-year period (1999 to 2004). Patients were divided into 2 groups according to the presence or not of PC. PC was defined as presence of pneumonia with lung infiltrate and purulent sputum and/or acute lung injury (ALI) and/or acute respiratory distress syndrome (ARDS). Age, surgery time, intraoperative fluid infusion (IFI), intraoperative amount of colloïd and cristalloïd, fluid infusion (FI) during the first 24 H, cumulated intra- and postoperative FI (CFI), intensive care unit (ICU) and hospital length of stay and 28-day mortality were registered.

Results and Discussions: Data are mean ± SD.

	PC (−) (n = 135)	PC (+) (n = 61)
Age (year)	59 ± 9	56 ± 10
Surgery time (min)	370 ± 76	368 ± 92
IFI (ml · kg^{-1} · h^{-1})	11.4 ± 4.0	12.0 ± 4.0
Colloids (L)	1.9 ± 0.6	2.0 ± 0.7
Cristalloids (L)	2.9 ± 0.8	2.9 ± 0.8
FI at 24H (L)	7.1 ± 1.2	7.6 ± 1.6*
CFI (ml · kg^{-1})	102 ± 25	115 ± 33*
ICU stay (D)	3.2 ± 1.43	14.2 ± 16.7*
Hospital stay (D)	11.4 ± 1.8	26.1 ± 17.1*
Death [n(%)]	1 (0.7%)	5 (8%)*

PC (+) vs PC (−), Wilcoxon test or Fisher's test. *$p < 0.05$.

Conclusion(s): Even if intraoperative fluid infusion was not different between the two groups, early postoperative fluid intake might influence pulmonary morbidity after oesophagectomy.

Reference:

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A-611

Effects of liquid vs. vaporized perfluorocarbons on the antioxidative system and the surface proteins of type I pneumocytes in oil acid induced lung injury

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Background and Goal of Study: In the present study we compared the effects of liquid and vaporized perfluorocarbons on the antioxidative system, lipid peroxides and different histochemical parameters in a porcine model of acute lung injury.

Material and Methods: Lung injury was induced in 30 piglets by means of central venous infusion of oleic acid. Thereafter animals were randomized to one of the following groups (n = 6): control group treated with conventional gas ventilation (GV), therapy with 2.5%, 5% and 10% PFH vapor or PLV with perfluorooctane (30 ml/kg). After an observation period of up to 6h animals were killed and tissue samples were taken from gravity dependent and non-dependent lung regions. As markers of apical type I pneumocytes tomato lectin, caveolin-1 and aquaporin-5 were determined histochemically. The amount of lipid peroxidation products and the ratio of reduced to oxidized glutathione (GSH/GSSG) were measured biochemically in lung parenchyma.

Results and Discussion: The animals treated with PFH vapor showed a trend towards elevated GSH/GSSG ratio, but statistical significance was achieved only in the PFH 5% group. Similarly, a tendency was observed for the amount of lipid peroxidation products to be reduced in animals treated with perfluorocarbons, as compared to GV. The histochemical analysis showed no differences among groups.

Conclusion: Surface proteins of type I pneumocytes were not affected by injury or therapy, which is most likely explained by the relatively short observation period. Treatment with PFH 5% vapor was associated with a protective antioxidative effect in this model.

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A-612

Development of a pig model of neurogenic pulmonary edema

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Background and Goal of Study: The inflammatory reaction following brain death (BD) in the heart-beating donor may rapidly result in neurogenic pulmonary edema (NPE) contributing to the critical organ shortage in lung transplantation. Further study of the pathophysiological changes in a large animal model may direct strategies to increase donor lung availability in humans. Currently, no large animal model of NPE following acute increase of intracranial pressure (ICP) exists.

Materials and Methods: Pigs were divided in two groups (n = 6/group). In group I [BRAIN DEATH = BD] brain death was induced by increasing ICP to 200 mmHg with an epidural balloon catheter. In group II [CONTROL = C] the balloon was not inflated. Functional parameters and catecholamine levels were measured during 1 hour. After explantation Wet-to-Dry weight ratio was calculated.

Results and Discussion: A clear cushing response was observed in BD. Adrenaline and Noradrenaline levels in BD peaked at 1 min and 5 min, respectively and were significantly ($p < 0.05$) higher compared to C (5.23 ± 1.50 μg/L and 4.11 ± 2.50 μg/L versus 0.20 ± 0.09 μg/L and 0.08 ± 0.02 μg/L, respectively).

Functional parameters (mean ± SEM) are listed in Table:

Time		30′	60′
PAP (mmHg)	BD	19.4 ± 4.0	21.0 ± 2.6
	C	19.2 ± 3.8	20.1 ± 3.9
COMPL (ml/cmH_2O)	BD	30.8 ± 2.6	35.0 ± 3.5
	C	27.4 ± 1.9	42.3 ± 3.8
PO_2/FiO_2 (mmHg)	BD	549.6 ± 26.2	519.6 ± 26.2
	C	550.6 ± 5.0	561.2 ± 15.2
W/D	BD		4.99 ± 0.20
	C		4.95 ± 0.23

*$p < 0.05$. No significant differences were observed in BD versus C and at 30′ versus 60′. (Mann-Whitney U test).

Conclusions: (1) Though not significant, lung function slightly deteriorated within the first hour in BD compared to C. (2) In contrast to other animal models, this is the first evidence that a longer evaluation after increased ICP is needed in pigs to develop NPE.

A-613

Immunomonitoring in severe sepsis: which anti-inflammatory cytokines to measure?

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Background and Goal of Study: Severe sepsis is the major source of morbidity and mortality despite the rapid development of intensive therapy. Studies have indicated that there are marked alterations in immune response in patients with severe sepsis including altered pro- and anti-inflammatory mediator/cytokine release (1). Aim of this study was to assess the prognostic value of anti-inflammatory cytokines: interleukin (IL)-1 receptor antagonist (IL-1ra), IL-4, IL-10 and transforming growth factor (TGF)-beta 1 regarding severity and outcome in patients with severe sepsis.

Materials and Methods: Thirty five patients with well-documented sepsis were enrolled in this study. Sepsis severity score (Elebute and Stoner, revised by Grundman, 1988) was from 3 do 36. Twenty eight patients developed MODS and 21 died. Blood was drown on the first, third and fifth day of onset of sepsis. Concentrations of IL-1ra, IL-4, IL-10 and TGF-beta 1 were determined in plasma using ELISA assays.

Results and Discussions: When compared MODS group with group without MODS, we found statistically highly significant difference ($p < 0.01$) in IL-1ra and IL-10 concentrations; mean values of IL-1ra were 6-fold higher and IL-10 70-fold higher in patients with MODS; IL-4 and TGF-beta 1 were not statistically different ($p > 0.05$) between two groups. When compared non-survivors with survivors, we found statistically highly significant difference ($p < 0.01$) in IL-1ra and IL-10 concentrations; mean values of IL-1ra were 2.7-fold higher and IL-10 1.4-fold higher in non-survivors; IL-4 and TGF-beta 1 were not statistically different ($p > 0.05$) between two groups.

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Conclusion(s): Our study shows that IL-1ra and IL-10 are excellent predictors of severity and outcome of severe sepsis; higher concentrations were found in group with more severe clinical status (MODS) and in non-survivors. IL-4 and TGF-beta 1 had no significance as predictors of severity and outcome what so ever.

Reference:

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A-614

Correlation between pro-inflammatory response and severity and outcome of trauma

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Background and Goal of Study: The cytokine cascade activated in response to injury consists of a complex biochemical network with diverse effects on the injured host. Studies have indicated that there are significant alterations in pro-inflammatory response in patients exposed to major trauma or prolonged surgical procedures (1). Aim of this study was to assess pro-inflammatory response to trauma.

Materials and Methods: Twenty five patients with severe trauma who developed MODS and 10 patients with less severe trauma (without MODS) were enrolled in this study. In the trauma + MODS group 14 died. In trauma group 2 died. Blood was drown on the first, third and fifth day of trauma. Concentrations of IL-8, IL-12, tumor necrosis factor (TNF)-alpha and interferon (IFN)-gamma were determined in plasma using ELISA assays.

Results and Discussions: When compared trauma + MODS group with trauma group we found that mean values of IL-8 were 230-fold higher ($p < 0.01$), IFN-gamma 360-fold higher ($p < 0.01$) and TNF-alpha 17-fold higher ($p < 0.05$) in patients with trauma + MODS; IL-12 was not statistically different ($p > 0.05$) between two groups. When compared non-survivors with survivors, we found that mean values of IL-8 were 2.3-fold higher in non-survivors ($p < 0.01$), mean values of TNF-alpha were 2.2-fold higher in survivors ($p < 0.01$), IL-12 was also higher in survivors ($p < 0.05$). IFN-gamma was not statistically different ($p > 0.05$) between two groups.

Conclusion(s): There is augmented pro-inflammatory response after trauma. High concentrations of IL-8 and TNF-alpha indicated higher severity (MODS). But, fatal outcome was predicted with high concentrations of IL-8 only; survivors had higher concentrations of TNF-alpha and IL-12.

Reference:

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A-616

What are the causes of increased procalcitonin values in brain-dead organ donors?

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Background and Goal of Study: Procalcitonin (PCT) is a polypeptide whose concentration is very low/undetectable in healthy patients. Its increase above 2 ng/ml is predictive of severe bacterial or fungal infections but non-infectious causes of increased PCT values have been reported. Several recent reports have documented an association between increased PCT values in brain-dead organ donors (BDOD) and altered graft function in the receiver but the causes of increased PCT values in BDOD are not known. The aim of this study was to investigate possible causes of increased PCT in BDOD.

Materials and Methods: We retrospectively analysed 100 consecutive BDOD and investigated the initial causes that lead to BD, several demographic and clinical parameters, results of bacterial cultures (blood, urine, tracheal suction samples), prescriptions of antibiotics and the plasma values of PCT measured before organ harvesting. We designated as infection either a positive bacterial culture and/or prescriptions of antibiotics.

Results and Discussions: The median values of PCT were of 1.5 (25–75 percentiles: 0.4–6.9) ng/ml. A value of PCT above 2 ng/ml was observed in 38 patients. The increase in PCT values was not associated with any of the definitions of infection. The only predictive factor of PCT increase was cerebral anoxia (e.g. strangulation, cardiac arrest) as the initiating event that lead to BD.

Conclusion: Our results confirm that PCT is increased in BDOD and bring suggestive evidence that this is not related to an infectious cause although diagnostic difficulties of infection should render the interpretation of these observations cautious. We suggest that brain anoxia could be one of the factors that explains increased PCT values in BDOD.

A-617

Role of 3-nitrotynosine in Escherichia coli LPS-induce vascular hyporeactivity in rats

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Background and Goals: To observe the pathological role of 3-nitrotynosine (3-NT) on Escherichia coli LPS-induced vascular hypoveactivity in rats and the therapeutic effect of antioxidants.

Material and Methods: Forty male SD rats with weight from 200 g to 250 g were randomly divided into four groups: the control group ($n = 10$); Escherichia coli LPS-induced septic shock group ($n = 10$); uric acid treated group ($n = 10$) melatonin treated group ($n = 10$). 6 h after LPS shock, apply phenylephrine ($0.5 \sim 2.5\ \mu kg^{-1}$) intravenously to all groups and record the percentage increased in MAP, respectively. The concentration-response curve of aorta rings from all groups rats were obtained by cumulative addition of phenylephrine PE and calculated PE Emax, EC_{50}. The concentrations of plasma malondialdehyde (MDA), nitrate/nitrite and 3-NT were assayed in all groups after 6 h LPS shock.

Results: The MAP level induced by PE significantly decreased to 54.6% in LPS shock rats compared with the controls ($P < 0.05$). However, PE induced MAP level increased 37.7% and 43.05% in uric acid and melatonin treated rats respectively comparing with the LPS shock rats ($P < 0.05$). The maximum response and EC_{50} to PE were significant reduced in LPS shock rats compared with control group ($P < 0.05$); but the reactivity of aorta to PE was improved obviously in uric acid and melatonin treated groups ($P < 0.05$). The plasma concentration of MDA, nitrate/nitrite and 3-NT were much lower in uric acid and melatonin groups compared with the LPS shock group ($P < 0.05$).

Conclusions: 3-NT is an important pathological factor on vascular hyporeactivity in Escherichia coli LPS-induced septic shock. Antioxidants effectively improve α-adrenergic receptor mediated vascular reactivity in LPS shock rats partially by removing lipid peroxidative production, reducing nitric oxide and 3-NT biosynthesis.

A-618

Nitric oxide down-regulate alpha1-adrenergic receptors gene express in rat vascular smooth muscle cells

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Background and Goal of Study: The heightening of safety and efficiency of regional anaesthesia for the patients of elderly age is an actual problem. We study efficiency and safety of an epidural anaesthesia in a combination with Diazepamum for patients in elderly age.

Materials and Methods: The study was prospective. 44 patients who have transferred traumatological operations were inspected out. All patients separated into 2 groups. In I group ($n = 21$) was performed *epidural ataralgesia/anaesthesia* by Lidocainum in a combination with Diazepamum (5–10 mg). In II group ($n = 23$) to local anesthetic added morphine (3–5 mg). The chosen groups had no essential differences on age. Learning of intraoperation anesthesia efficiency and rating of postoperative pain intensity were carried out by the different experts. The patients previously gave the written approval to carrying out of an anaesthesia and operation.

Results and Discussions: In 16–20 minutes after epidural introduction of Diazepamum the patients covered, the level of sedation was $4{,}3 \pm 0{,}2$ numbers (M.A. Ramsay et al., 1974). The level of sensor block reached Th_{4-5}, the pain sensitivity disappeared in 14–18 min. The duration of operation was $105{,}7 \pm 15{,}6$ min, to the end of the operation the patients have woken up. Complications, bound with carrying out epidural ataralgesia/anaesthesia, in I group was not observed. In II group patients were in a status of surface dream, thus the sedation level made $1{,}4 \pm 0{,}1$ numbers ($p < 0{,}05$). The duration of operations was $128{,}0 \pm 25{,}8$ min. At the same time, for a part of the patients of II group after the operation the following complications – depression of breath for 1 patient, expressed dermal itch for 4 patients were

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observed. The matching of postoperative pain intensity in the chosen groups has not detected an essential variance. The multiplicity of NSAID deriving nor differed. Therefore, efficiency of an epidural ataralgesia/ anaesthesia by way of preventive measures of postoperative pain not differ from an epidural analgesia by morphine.
Conclusion(s): The absence of depressive influence on respiratory center at epidural introduction of ataractics alongside with effective preventive measures of postoperative pain makes to perspective usage of epidural ataralgesia/anaesthesia in a gerontological anesthesiology.

A-619

Neostigmine does not attenuate organ injury in murine endotoxaemia: there are still missing points about the cholinergic anti-inflammatory pathway

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Background and Goal of Study: Stimulation of the efferent cholinergic antiinflammatory pathway suppress the systemic inflammatory response and can prevent endotoxaemia. Our aim was to investigate the effects of neostigmine- a cholinergic agent that has not been tested for this purpose- on histopathological organ injury in endotoxaemia.
Materials and Methods: 54 male albino mice (20–40 g) were included in a double blind, randomised, placebo controlled study. Group I (n = 12): Control group, Group II (n = 10): Endotoxin (Etx), Group III (n = 12): Neostigmine (Neo) 0.1 mg/kg, Group IV (n = 12): Etx + Neo 0.1 mg/kg, Group V (n = 4): Neo 0.3 mg/kg, Group VI (n = 4): Etx + Neo 0.3 mg/kg. Endotoxin was derived from *Escherichia* coli (O55:B5) All drugs were injected intraperitoneally at equal volumes and repeated every 6 hours for 3 days. On the 3rd day, all mice were killed by cervical dislocation and organs were dissected for histopathological examination by a pathologist who was blinded to the group assignment. The tissue injuries were graded on a four point scale (0–3). Kruskal Wallis, Mann-Whitney U tests were used for statistical analysis. $P < 0.05$ considered as significant.
Results and Discussions: 1 mouse in group I, 2 mice in group II, 3 mice in group IV, 2 mice in group V, all mice (4) in group VI died before 3 days. In Neo 0.1 group, perivascular inflammation in the lung (median [95% CI] score: 0[0–1]) was lower than Etx (1[0–2]) and control groups (1[0–2]). The interstitial inflammation in lung was more prominent in the Etx group(2[1–3]) compared to the control(1[1–3]) and the Etx + Neo 0.3 group (1[1–1]). Vacuolar degeneration in liver was lower in Etx + Neo 0.3 group (0[0–0]) compared to etx group (1[0–2]). The liver injury score was highest in etx group (3[2–5]) and was lower in Neo 0.3 group (0,5[0–3]) than the control group (1,5[1–3]) There were no differences between Etx and Etx + Neo 0.1 groups regarding organ injury.
Conclusions: Neostigmine at a dose of 0.1 mg/kg was not protective against histopathological organ injury in endotoxaemia and 0.3 mg/kg was not tolerated probably due to non-specific parasympathetic action including cardiovascular effects.
Reference:
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A-620

Effects of propofol vs. methohexital on neutrophil function and immune status in critically ill patients

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Introduction: Sedatives, i.e. propofol and methohexital, have a variety of negative side effects on neutrophil leukocytes, lymphocytes and monocytes which all play a vital role in the defense against invading micro-organisms [1]. In this study, we investigated these effects in critically ill patients with long-term sedation.
Patients and Methods: In this observative clinical study, we analyzed 21 critically ill patients with long-term sedation who either received propofol (n = 12, APACHE II 26 ± 4) or methohexital (n = 9, APACHE II 28 ± 6) after ICU admission. Patients in the propofol group (P) (9 male, 3 female) had a mean age of 55 ± 15 years. In the methohexital group (M) (8 male, 1 female) mean age was 48 ± 18 years. Both sedatives were administered according to clinical requirements. Neutrophil leukocyte function was assessed as phagocytosis and respiratory oxidative burst activity. Furthermore, cellular markers of monocytes and lymphocytes (CD3, CD4, CD8, CD19, CD57, CD122) were assessed. Measurements were made on ICU admission, day 3, day 7 and day 14 of drug administration. Patients' demographics and results were compared by Mann-Whitney U test and one-way repeated measurements ANOVA with an all pair-wise multiple comparison procedure.
Results: Both groups were well matched in terms of age, height and body weight. ICU length of stay was comparable (22 ± 7 vs. 20 ± 9 days). Mortality was 0/12 and 2/9, respectively. Absolute numbers of leukocytes and sub-populations were comparable between both groups at each time point. We found no difference in neutrophil oxidative burst and phagocytosis within and between both groups at the different time points. With respect to lymphocyte and monocyte CD marker expression, no differences within each group and between the time points were found.
Conclusion: Effects of methohexital and propofol on neutrophil leukocyte function, expression of lymphocyte and monocyte markers were not different in critically ill patients with long-term sedation.
Reference:
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A-621

Edaravone attenuated LPS-induced cytokines production in human whole blood

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Background and Goal of Study: Edaravone (3-methyl-1-phenyl-2-pyrazolin-5-one), a brand-new drug for cerebral infarction, has been considered to have a therapeutic effect on endotoxin shock due to its scavenging action on a hydroxyl radical, which is an important factor in critically septic patients. The results of previous experimental studies have suggested an inhibitory action of edaravone on cytokines production (1,2). However, whether or not edaravone attenuates cytokines production in human whole blood is still unproven. Therefore, we investigated the effect of edaravone on tumor necrosis factor-α (TNF-α) and interleukin-10 (IL-10) production induced by LPS in human whole blood.
Materials and Methods: After human investigations committee approval, informed consent was obtained from 6 healthy volunteers. Blood samples were drawn into citrate containing tubes and diluted with 5 volumes of endotoxin free medium. The diluted blood was placed in a 24-well plate (Becton Dickinson, NJ). After various doses (0–300 μg/ml) of edaravone were added, whole blood was stimulated with LPS (10 ng/ml). Then the blood was incubated for 24 hours at 37°C in a carbon dioxide incubator and centrifuged to remove blood cells. Supernatant samples were collected and stored at −80°C until assay. Plasma TNF-α and IL-10 concentrations were quantified with enzyme-linked immunosorbent assay. Statistical analysis was performed with a non-parametric test. $P < 0.05$ was considered to be significant.
Results and Discussions: Edaravone attenuated significantly LPS-induced TNF-α production dose-dependently. Edaravone suppressed significantly LPS-induced IL-10 production at a concentration more than 30 μg/ml.
Conclusions: The results of the present study show that edaravone inhibited not only TNF-α but also IL-10 production in human whole blood. These results suggest a possible therapeutic effect of edaravone on sepsis in humans.
References:
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A-622

Duodenotomy does not influence proximal duodenal motility

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Background and Aim of Study: The effects of surgical procedures on intestinal motility are still under debate [1]. In order to quantify the effects of duodenotomy on duodenal motility activity the present study used the electric impedance technique (IMP).
Materials and Methods: Ten pigs (32–40 kg) were instrumented under general anaesthesia with a central venous catheter (CVC) and a percutaneous enterogastrostomy (PEG) [2]. Duodenal phases I–III and the duration of the migrating motor complex (MMC) were measured by an IMP catheter, which was introduced into the proximal duodenum either via the PEG by endoscopy (group A), or through surgical placement via duodenotomy (group B). According to manometric criteria, the duodenal motor patterns

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were defined as described by Nguyen [3]. Data are shown as box blots indicating median, 25% and 75% quartiles, and range. Significance is defined when $P < 0.05$.

Results: Neither the interdigestive phases I–III nor the MMC cycle length were significantly influenced by this surgical procedure.

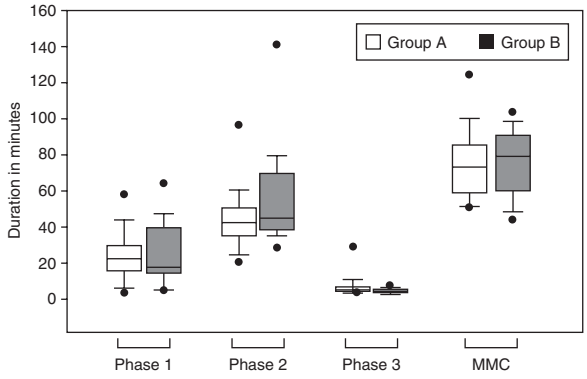

Figure 1. Length (min) of phase I–III and MMC-cycle.

Conclusion: A simple laparotomy with duodenotomy did not affect the proximal duodenal motility activity.

References:

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A-623

Influence of acute elevation of intracranial pressure on duodenal motility activity and mucosal blood flow

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Background and Aim of Study: In head injured patients the inhibition of gastroduodenal motility plays a pivotal role in the resistance to enteral feeding [1]. We investigated the effects of intracranial pressure on the duodenal motility and its mucosal blood flow.

Materials and Methods: 11 pigs (32–37 kg) were instrumented with a luminal impedance and microdialysis catheter into the proximal duodenum. Duodenal motility was continuously recorded and the interdigestive phases I–III and the cycle length of the migrating motor complex (MMC) were defined [2]. Lactate, pyruvate, and glucose concentrations were measured during physiological states and during elevated intracranial pressures of 10 up to 50 mmHg in six pigs. Five pigs served as controls. Data are shown as box blots indicating median, 25% and 75% quartiles, and range. Significance is defined when $P < 0.05$.

Results: All interdigestive phases and the MMC cycle length (min) were comparable between the groups (Fig.1). Spontaneous MMC cycle did not seem to be disrupted during the elevation of the ICP. The mean concentration of lactate and glucose were comparable between the groups, whilst the concentration of pyruvate was partially higher in the study group than the controls ($p < 0.05$). This was associated with a decrease in lactate to pyruvate ratio ($p < 0.05$).

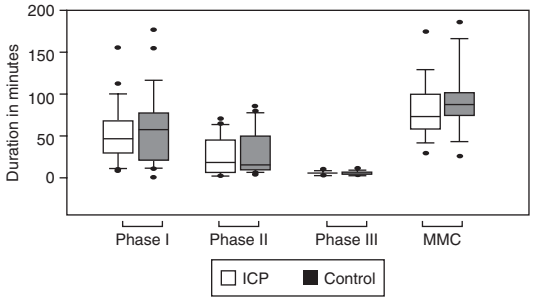

Figure 1. Length (min) of phase I–III.

Conclusion: The present study suggests that a short termed increase of intracranial pressures of up to 50 mmHg, did not influence duodenal motility activity. A considerable deterioration of the duodenal mucosal blood flow could be excluded through the lactate to pyruvate ratio.

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A-624

Use of Proton Pump Inhibitors (PPI) for prevention of gastrointestinal bleeding in ICU patients

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Background: Stress-related mucosal disease (SRMD) develops in patients in the ICU and can result in clinically important bleeding. The most common used medication for prevention are histamin-2-receptor antagonists and sucralfate (1). However a study shown no effect of such a prevention on the frequence of significant gastrointestinal bleeding (2). Little is known about the effect of PPI on SRMD in the ICU setting.

Methods: Between 01/2001 and 12/2003 all patients with an ICU stay >24 h were entered into the study retro-spectively. All patients received 40 mg Pantoprazol (Altana Pharma Germany) daily. With the ICD 10 codes all patients with acute gastrointestinal bleeding were identified. Thereafter the patients charts were reviewed. Exclusion criteria were: known petic ulcer, admission due to symptoms of acute gastrointestinal bleeding (AGB), no endoscopic verification, recently done gastric operation.

Results: 4406 patients were treated on the ICU. The ICD codes filtered 87 patients with AGD. Exclusion were: 58 patients with symptoms of AGB on admission, 9 patients with known peptic ulcus, 11 patients without endoscopic verification, 3 patients with a stay <24 h.

The remaining 6 patients (0.14%) showed all the known risk factors (mechanical ventilation, coagulopathy) for AGB (3).

Conclusion: Stress-ulcer prophylaxis with PPI seems to be effective in the prevention of AGB in the ICU setting. In comparison with prophylaxis with histamin-2-receptor antagonists (2) the treatment with PPI appears more effective. All patients shown the known risk factors.

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A-625

Effect of the opioid antagonist MNTX on intestinal motility in vitro

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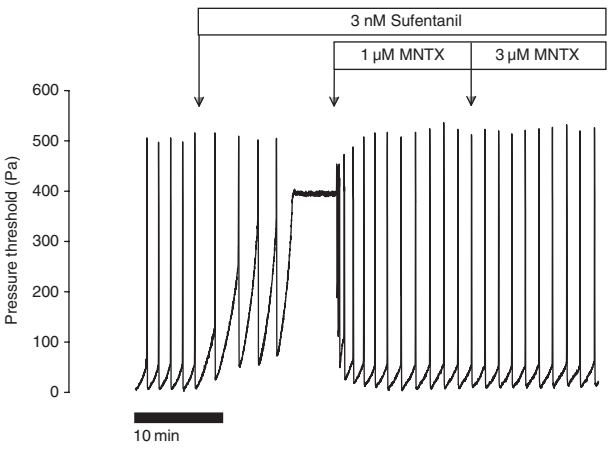
Background and Goal of Study: Apart from the desired analgetic effect, opioids have a pronounced inhibitory effect on intestinal peristalsis and result in a marked prolongation of gastrointestinal transit time (1). The aim of the study was to evaluate if the opioid antagonists naloxone and MNTX were able to restore peristalsis after induction of a complete block of peristalsis.

Materials and Methods: Guinea-pig small bowel segments were excised and mounted in a tissue bath. Luminal perfusion of the segments with Tyrode's solution resulted in an increase of the intraluminal pressure until the pressure threshold (PT) – the trigger of a peristaltic contraction – was reached. A drug-induced increase of the PT is defined as inhibition of peristalsis, while a decrease of the PT is interpreted as a stimulation of peristalsis (2). Primarily a complete block of peristalsis was induced, adding sufentanil 3 nM to the tissue bath, before increasing concentrations of naloxone or MNTX were added.

Results and Discussions: Naloxone as well as MNTX restored peristalsis at least to baseline values in all tested concentrations.



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Conclusion(s): In contrast to naloxone, the peripheral opioid antagonist MNTX does not cross the blood brain barrier and is easy to titrate. Therefore MNTX might be a preferable substance to maintain the analgesic potency of opioids and to preserve or restore intestinal motility in the clinical setting.

References:
1 Holte K. Br J Surg 2000; 87: 1480.
2 Fruhwald S. Crit Care Med 2000; 28: 2893.

A-626

Remifentanil versus fentanyl for postoperative analgesia in critical ill adults

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Background and Goal of Study: Analgesia based sedation techniques are becoming more established in the ICU setting (1). The purpose of this study was to compare remifentanil and fentanyl infusions for analgesia in post-operative patients requiring mechanical ventilation.

Materials and Methods: After receiving ethical committee approval, a prospective randomized, double-blind study was performed. 44 adult ICU patients received infusion of either remifentanil 0.1 μg/kg/min or fentanyl 0.025 μg/kg/min diluted to the same volume. Analgesic infusion was titrated to Behavioral pain scale (BPS) score of 3. Propofol was added if sedation was unsatisfactory after BPS score 3 had been achieved. Chi-square, Mann-Whitney U tests were used for statistical analysis.

Results and Discussion: Data is given as number of patients (n) or median (95% CI) in the table below.

	Group R (n = 11)	Group F (n = 11)	p
Age (yrs)	44 (16–80)	32 (16–76)	0.06
Female/Male (n)	12/10	14/8	0.38
Weight (kg)	60(30–90)	50(20–89)	0.14
Duration of operation (min)	240(120–660)	240(64–657)	0.93
ICU stay (days)	3(2–32)	2(2–13)	0.11
Mechanical ventilation (min)	1140(685–1542)	1110(795–2670)	0.79
Propofol needed for sedation (n)	4	6	0.36
Number of titrations	5(0–10)	4(0–9)	0.59
Time to BPS score 3(min)	12.5(0–480)	7.5(0–240)	0.25
Time to extubation (min)	10(5–380)	10(2–174)	0.6
Nurses' assessment of analgesia	4(3–5)	4(1–5)	0.27
Nurses' assessment of sedation	4(2–5)	5(1–5)	0.45
Physician's assessment of analgesia	4(1–5)	5(1–5)	0.81

Remifentanil provided better analgesia at the start of the infusion; fentanyl provided better analgesia after cessation of the infusion. The incidences of complications were also similar between the two groups.

Conclusion: We conclude that remifentanil infusion provides clinically similar analgesia to fentanyl infusion in adult postoperative ICU patients.

Reference:
1 Jacobi J, Fraser GL, Coursin DB. Crit Care Med 2002; 30:119–41.

A-627

Procalcitonin as an early prognostic marker of adverse outcome in patients with acute heart failure after complicated cardiac surgery

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Background and Goal of Study: Increased Procalcitonin (PCT) levels early after cardiopulmonary bypass (CPB) were correlated with higher risk of various events after heart surgery (1). The aim of our study was to detect whether PCT 10 ng/ml on day 1 after coronary artery bypass grafting (CABG) surgery predicts poor outcome in patient (pts) with acute heart failure.

Materials and Methods: 24 prospectively studied pts. after elective CABG surgery requiring CPB. Inclusion criteria: the need of epinephrine >0.1 μg/kg/min and intra-aortic balloon pump >16 hours after surgery; exclusion:pts. with chronic deseases, reoperation, urgent operation, preoperative LV ejection fraction (LVEF) 35%, mitral regurgitation > I degree and survival 48 hours after surgery. Plasma PCT, C reactive protein (CRP), cardiac output (CO) and LVEF were measured within 24 hours after surgery. Perioperative data expressed as Mean ± SD and compared using paired t-test. $P < 0.05$ was significant.

Results and Discussions: Two groups of pts: with PCT < 10 ng/ml (n = 12) and PCT < 10 ng/ml (n = 12). There were no significant differences in age, preop. LVEF, EuroSCORE. Longer CPB and cross-clamp were in PCT < 10 ng/ml group. Postop. data are shown in tables.

Table 1.

Data	PCT < 10	PCT < 10	p
SAPS II	41.2 ± 4.3	61.5 ± 10.3	0.01
CRP, mg/L	84.25 ± 35.5	64.7 ± 34.5	0.46
CO, L/min	5.3 ± 1.9	5.45 ± 2	0.9
LVEF, %	35.2 ± 11.3	35 ± 18	0.9
Ventilation, hour	74.7 ± 30.8	265 ± 185.8	0.089
ICU stay, day	8.7 ± 3	22 ± 17	0.175

Table 2.

Complication	PCT < 10	PCT < 10
Neurological	3/12 (25%)	6/12 (50%)
Renal	0/12 (0%)	9/12 (75%)
Sepsis	0/12 (0%)	9/12 (75%)
Death	0/12 (0%)	6/12 (50%)

Conclusion(s): PCT level 10 correlated with longer CPB, cross-clamp, higher SAPS II score, higher complications and mortality rate.

Reference:
1 M. Meisner, et al. Intensive Care Med 2002;28:1094–1102.

A-628

Differential effects of nitric oxide synthases on heme oxygenase-1 in the normal and stress exposed liver

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Background and Goal of Study: The heme oxygenase (HO) and the nitric oxide synthase (NOS) pathway, both, protect the liver from dysfunction under pathological conditions, such as inflammation or ischemia/reperfusion (1,2). Here, we studied the function of NOS and the effect of endogenously generated nitric oxide (NO) on HO-1 regulation in the normal and stress exposed liver.

Materials and Methods: Anesthetized male Sprague-Dawley rats (n = 5–7) received vehicle, N_{ω}-nitro-L-arginine-methylester (L-NAME), S-methylisothiourea (SMT), or Lipopolysaccharide (LPS). After 6 h liver tissue was analysed for HO-1 and iNOS, by Northern, Western bloting, and necrosis by H&E staining. Data are presented as mean (±SEM), and differences were determined by ANOVA.

Results and Discussion: Blockade of the constitutive isoform of the NOS (cNOS) by L-NAME induced HO-1 mRNA in the normal liver (Table 1). This effect was associated with elevated AST and LDH activity ($p < 0.05$), and liver necrosis. The inducible NOS (iNOS) was not detectable in the normal liver. Moreover, inhibition of iNOS by SMT did not result in HO-1 induction, indicating that cNOS is primarily responsible for the suppressing action on HO-1 in the normal liver. In sharp contrast, following LPS challange, blockade of iNOS led to an upregulation of HO-1 above LPS and control levels (Table 1).

Conclusion(s): Blockade of NO-synthesis upregulates HO-1 in the rat liver. The supression of HO-1 by NO is based on the intact function of cNOS in the normal, and on iNOS in the stress exposed liver.

Table 1. Hepatic HO-1 mRNA, relative densitometric units.

Control	L-NAME	SMT	LPS	LPS + SMT
1.0 (±0.2)	8.9 (±2.2)*	2.5 (±0.6)[#]		
1.4 (±0.3)			3.6 (±0.4)*	6.9 (±0.7)*[§]

$p < 0.05$ *vs control, [#]vs L-NAME, [§]vs LPS.

References:
1 Pannen BHJ, et al. J Clin Invest 1998; 102: 1220–8.
2 Hoetzel A, et al. Hepatology 2001; 33:925–37.

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A-629

Mannitol and the prevention of lipid peroxidation during liver resection surgery

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Background and Goal of Study: We examined the efficacy of mannitol in the prevention of lipid peroxidation during major liver resections performed under hepatic inflow occlusion.

Materials and Methods: Thirty patients, ASA II–III were included in this prospective randomised study. All patients received combined general and

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epidural anaesthesia. They were randomly allocated to either receive mannitol 20% 1.5 ml · kg^{-1} (group M) or normal saline 1.5 ml · kg^{-1} (group S) intravenously, before the performance of hepatic vascular occlusion. Venous blood malondialdehyde concentration (MDA), as an index of lipid peroxidation, was measured spectrophotometrically at selected timepoints.

Results and Discussions: Patients in both groups presented with raised, compared to baseline, MDA values ($p < 0.05$) for the period starting before the release of vascular occlusion until six days postoperatively. In patients receiving mannitol lower MDA values were observed ($p < 0.05$) compared to group S at the end of operation.

Conclusion: Mannitol might have a free radical scavenging activity for a short period after its administration to patients undergoing liver resection surgery with inflow vascular occlusion, but it does not seem to produce a sustained antioxidant effect after the end of operation. Furthermore, we could not confirm a positive impact on the postoperative clinical course of patients receiving mannitol.

Reference:

1 Selzner N, Rudiger H, Graf R, Clavien P. Protective strategies against ischemic injury of the liver. Gastroenterology 2003; 125:917–36.

A-630

Effects of PEEP on liver function and splanchnic microcirculation

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Introduction: The effects of positive end-expiratory pressure (PEEP) on liver function and blood flow in experimental and clinical studies revealed non-uniform results. In this clinical study, we investigated the effects of PEEP on liver function (indocyanine green plasma disappearance rate, ICG-PDR) and splanchnic microcirculation as estimated by regional PCO_2 (P_RCO_2) using gastric tonometry.

Methods: With approval by our local ethics committee and written consent, we studied 14 patients after elective coronary bypass surgery using extracorporal circulation (13 male, one female; age 48–74, mean 63 ± 7 years). All patients underwent extended hemodynamic monitoring by a pulmonary artery catheter for clinical indication. ICG-PDR and gastric mucosal P_RCO_2 were assessed on ICU admission (PEEP 5 mbar), two hours after increasing PEEP to 10 mbar and again after two hours at PEEP 5 mbar. In addition, cardiac index (CI), central venous pressure (CVP) and left atrial pressure (LAP) were measured. All patients were on pressure-controlled ventilation and inspiratory peak pressure was adapted to maintain $PaCO_2$ constant. Vasoactive drugs, blood pressure, minute volume and sedation were kept constant.

Results: CI significantly increased during the study. However, there was a trend for ICG-PDR to change between the different time points ($p = 0.05$). However, the difference between regional and arterial PCO_2 (PCO_2-gap) significantly increased following PEEP5 (1) and remained higher at PEEP5 (2) than at PEEP5 (1).

	PEEP5 (1)	PEEP10	PEEP5 (2)
CI [l/min/m^2]	2.7 ± 0.5	3.0 ± 0.6*	3.1 ± 0.4*
CVP [mmHg]	8 ± 4	9 ± 3	8 ± 3
LAP [mmHg]	7 ± 3	9 ± 3	8 ± 3
PDR [%/min]	24.0 ± 6.9	22.0 ± 7.9	25.3 ± 7.8
PCO_2-gap [kPa]	0.2 ± 0.9	1.1 ± 1.0*	0.9 ± 1.0*

$P < 0.05$; *vs. PEEP5 (1), $^+$vs. PEEP 10 (ANOVA).

Conclusion: Increasing PEEP from 5 to 10 mbar was accompanied with a trend towards a decrease in liver function and blood flow (ICG-PDR). The changes in PCO_2-gap were within the physiological range and of no clinical relevance. An increase in PEEP from 5 to 10 mbar can be applied without compromising liver blood flow and function and splanchnic microcirculation.

A-631

Procalcitonin (PCT) versus markers of infection and their impact on antibiotic prescribing in the ITU

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Background and Goal: The markers traditionally used for diagnosing sepsis (pyrexia, tachycardia, tachypnoea, leucocytosis, raised C-reactive protein (CRP)) are all non-specific markers of inflammation and are not sensitive or specific for sepsis. Procalitonin (PCT) can be used for the differential diagnosis of bacterial infections, systemic inflammation and viral infection[1]. We studied the relationship between PCT and markers of inflammation and looked at the influence of PCT on decision-making in antibiotic prescription.

Materials and Methods: Retrospective and prospective study on an adult intensive care unit. PCT tests were done after liaising with a consultant microbiologist. Brahms® PCT-Q semi-quantitative immunochromographic tests were used with the ranges <0.5 ngml^{-1}, 0.5–2.0 ngml^{-1}, 2.0–10.0 ngml^{-1} and >10 ngml^{-1}. Data on demographics, diagnosis, admission APACHE II scores, vital signs, inflammatory markers, microbiology cultures and antibiotic prescription were recorded. For each PCT measurement it was determined whether there had been a change of treatment within the 24 hours following it, and, in conjunction with a consultant in ICU and microbiology, whether the PCT level had been useful in the decision.

Results and Discussions: 101 PCTs with corresponding inflammatory markers were measured in 30 patients (Apache: 21 (mean), age: 53 y (mean)). Correlation (R2) between PCT and inflammatory markers was 0.005 for temperature, 0.009 for WCC and neutrophils and 0.134 for CRP. On 59 (58%) occasions at least 2 of the SIRS criteria were present at the time PCT levels were taken. 28 (28%) antibiotic decisions were found to be strongly influenced by PCT levels.

Conclusions: "Usual" inflammatory markers correlate poorly with PCT. PCT measurements enabled us to monitor success of antibiotic use and gave us confidence to withhold and stop antibiotics although at times the inflammatory parameters suggested otherwise. More rational use of antibiotics will have economical implications, which outweighs the costs of PCT assays.

Reference:

1 Meisner M.: Procalcitonin (PCT)- A new, innovative infection parameter. Biochemical and clinical aspects, ISBN: 3-13-105503-0, Thieme Stuttgart, New York 2000.

A-632

Characteristics of the long-stay (over twenty-eight days) intensive care patient: an analysis of five years experience

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Background and Goal of Study: Hypothermia may be therapeutic in stroke victims; however, hypothermia provokes vigorous shivering. Doxapram markedly reduces the shivering threshold (triggering core temperature) in rabbits[1] and has been shown to reduce postanesthetic shivering.[2] However, the effects of doxapram on thermoregulatory responses have not been quantified. We thus determined the effect of doxapram on the major autonomic thermoregulatory responses in humans.

Materials and Methods: Nine healthy volunteers (5 men and 4 women, 18–40 yr) were studied on 2 days: Control (no drug) and Doxapram (target plasma 4 μml, a fairly high dose). Core warming was started 15 min after doxapram or saline administration when plasma concentrations were near steady state. Each day, skin and core temperatures were increased to provoke sweating and subsequently reduced to elicit peripheral vasoconstriction and shivering. We arithmetically compensated for changes in skin temperature to determine the sweating, vasoconstriction, and shivering thresholds. Sedation was evaluated using Observer's Assessment Sedation/Alertness scale. Paired t tests were used to identify differences between the days. Data presented as means ± SDs; $P < 0.05$ was statistically significant.

Results and Discussions: Potential confounding factors were similar on both study days. The sweating threshold was not affected by doxapram (Control: 37.5 ± 0.4°C, Doxapram: 37.3 ± 0.4°C, $P = 0.29$). However, doxapram tended to reduce the vasoconstriction threshold (36.8 ± 0.7 vs. 36.4 ± 0.5°C; $P = 0.11$) and significantly reduced the shivering threshold from 36.2 ± 0.5 to 35.7 ± 0.7°C ($P = 0.012$). Neither sedation nor symptoms of panic were observed on either study day.

Conclusion(s): The observed reduction in the shivering threshold explains the drug's efficacy for treatment of postoperative shivering; however, a reduction of only 0.5°C is unlikely to markedly facilitate induction of therapeutic hypothermia as a sole agent.

References:

1 Okuyama K, Matsukawa T, Ozaki M, et al. Anesth Analg 2003; 97: 759–62.
2 Wrench IJ, Singh P, Dennis AR, et al. Anaesthesia 1997; 52: 32–6.

A-633

The outcome of long-stay (over twenty-eight days) intensive care patients: a follow-up study

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Background and Goal of Study: The outcome of patients spending one to two weeks in intensive care has been studied [1,2] and appears to justify

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such admissions [2]. The outcome of longer-stay patients is less clear however.
Materials and Methods: We identified a cohort of 68 patients who had spent 28 days or longer in our unit, having been admitted between July 2000 and July 2002. We recorded their Glasgow Outcome Score, by chart review or telephone, in the third quarter of 2003.
Results and Discussions: One was untraceable. Thirty-three were dead, including fourteen who died during their intensive care stay. Of the thirty-four survivors seventeen were living normal active lives, fifteen were disabled but independent, while only two were dependent on daily support. None were left vegetative.
Conclusion(s): In summary, one to three years after discharge, about half (49%) of the group had died, while a quarter lived normal active lives. While the remaining seventeen (25%) described some disability, only two patients needed daily support.
References:
1 Lipsett PA, Swoboda SM, Dickerson J et al. Ann Surg 2000; 231(2): 262–8.
2 Heyland DK, Konopad E, Noseworthy TW et al. Chest 1998; 114 (1): 192–8.

A-634

Long-stay intensive care patients requiring readmission: incidence, admisission characteristics and hospital outcome

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Background and Goal of Study: Readmission to an Intensive Care Unit (ICU) after a previous lengthy ICU stay would appear to indicate a poor outlook. This has not been studied, however.
Materials and Methods: Analysis of 11,007 ICU admissions over 5 years identified 147 lasting beyond 28 days; 22 of these died during that ICU admission and 125 survived to ward discharge. We identified all instances of return to ICU from the wards of these patients. We assessed their length of stay, APACHE 2 score on readmission and survival to hospital discharge.
Results and Discussions: Of 125 patients discharged from ICU after 28 or more days, 23 (18.4%) required readmission. This group included two patients readmitted twice and one readmitted four times (in total, 28 readmissions). Their average APACHE 2 score on readmission was 16.7, similar to our average of 14 for the period. Mean length of stay during readmission was 10.6 days – longer than our average of 4.4. Of the 23 patients, two died during their second ICU stay and another 4 died in this hospital after ward discharge. One was sent home moribund, respecting his desire to die at home. Eight patients were discharged to other acute hospitals; two of them died there, with 6 surviving to discharge. Eight patients were subsequently discharged from this hospital.
Conclusion(s): 15.6% of long-stay ICU patients required readmission. Of this subgroup, 40% (9 of 23) died during their stay in hospital, or immediately on discharge, while 60% (14 of 23) went home. Return to ICU after a long stay is rare, and clearly indicative of severe illness; however in this series most (60%) of these patients survived to discharge.

A-635

A comparison of mortality prediction systems in patients with diffuse bacterial peritonitis

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Background and Goal of Study: Early classification of patients with peritonitis by means of scoring systems provides the adequate selection for surgical and therapeutic procedures and comparison of different therapies (1). We compared the prognostic value of APACHE II and SAPS II scoring systems as well as Mannheim Peritonitis Index (MPI) for assessment of outcome in the patients with diffuse bacterial peritonitis.
Materials and Methods: We enrolled 194 adult patients (mean age 49.6 $\pm$ 19.5 years) with secondary diffuse bacterial peritonitis in a prospective observational study during the period from 1999 to 2003. All patients were hospitalized into the ICU of the university hospital. The scores according to APACHE II, SAPS II, and MPI were assessed during 24 after admission to ICU. The predictive values of the scores were estimated using regression analysis (coefficient of determination r^2). The discrimination was assessed using areas under the receiver operating characteristic curves (AUC). Standardized mortality ratios (SMR) were calculated. Variables were expressed as mean $\pm$ SD or 95% confidence interval (CI) and as relative frequencies.
Results and Discussions: The mean APACHE II, SAPS II and MPI scores were 9.6 $\pm$ 8.4, 28.8 $\pm$ 16.7, and 23.9 $\pm$ 6.9, respectively. The hospital mortality rate was 19.1% (37 patients). The predicted mortality risk was 18.9%, 9.6%, and 33.6% for APACHE II (diagnostic category weight for gastrointestinal perforation/obstruction), SAPS II and MPI, respectively. The values of calibration ($p \leqslant 0.05$) and discrimination and SMR are summarized in the table.

	r^2 (residual SD)	AUC (95% CI)	SMR
APACHE II	0.87 (12.1)	0.87 (0.82–0.92)	1.01
SAPS II	0.89 (11.7)	0.82 (0.76–0.87)	1.99
MPI	0.38 (24.3)	0.85 (0.79–0.90)	0.57

The calibration was adequate for APACHE II and SAPS II scores. The discrimination was good for all systems. The APACHE II score had the most accurate overall mortality prediction, as reflected by the SMR.
Conclusion: In patients with diffuse bacterial peritonitis, APACHE II is the most accurate prognostic scoring system as compared to SAPS II and MPI.
Reference:
1 Bosscha K, van Vroonhoven ThJMV, van der Werken Ch. *Br J Surg* 1999; 86: 1371–1377.

A-636

Incidence and mortality related to ventilator-associated pneumonia

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Background and Objective: Ventilator-associated pneumonia (VAP) is one of the most threatening complications in patients receiving mechanical ventilation (MV) and remains a major cause of morbidity and mortality. VAP is the most common nosocomial infection among intensive care units patients. We performed a retrospective study to determine the incidence and the mortality related to VAP.
Methods and Materials: The study was conducted in the Neurosurgery ICU of UHC of Tirana. During a 2-years period (2000–2003), all patients admitted to the ICU who had received mechanical ventilation were potentially eligible for the study. The study population consisted of 188 patients who for at least 48 hours at any point during their ICU stay. They were patients after intracranial operations (136 patients) and those with cranial and spinal trauma (52 patients). The diagnosis of VAP was defined as the occurrence of a new and persistent radiographic infiltrate not otherwise explained, appearing on chest radiograph along with 2 of the following: body temperature 38.3°C, leukocytosis ($\geqslant$10.000 WBC/ml), purulent tracheal aspirate (1). $p \leqslant 0.05$ is considered as statistically significant.
Results: Over the period of the study, from the188 patients who received mechanical ventilation 72 patients (38.29%) developed VAP (55 traumatized and 17 post-operate). The onset of VAP was most likely to occur during the first 2 weeks of mechanical ventilation (46 or 63.9%). The duration of mechanical ventilation was longer among patients who suffered VAP compared with the patients who did not develop VAP (17.5 $\pm$ 6.7 days versus 8.0 $\pm$ 6.3 days, $p < 0.01$). In this study the mortality attributed to VAP was 26.4% (19 patients). This mortality was greater in the traumatized patients (15 patients or 78.95%).
Conclusion: Our study showed that VAP is one of the commonest pathology in the ICU patients treated with mechanical ventilation. VAP prolongs significantly the duration of mechanical ventilation and increase the mortality rate among intensive care units patients.
Reference:
1 Papazian I, Bregeon I, Thirion X, et al. Effects of ventilator-associated pneumonia on mortality and morbidity. *AM J Respir Crit Care Med* 154: 91–97; 1996.

A-637

Factors influencing decision criteria for allocation of intensive care unit beds in Greek neurosurgical patients

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Background and Goal of Study: To determine the methodology of decision making for allocating intensive care unit (ICU) beds for neurosurgery patients. To evaluate methods that may improve triaging and adequacy of available ICU beds for neurosurgical patients.
Materials and Methods: We studied 83 neurosurgical patients who underwent general anesthesia and were admitted to the Intensive Care Unit during the period of twelve months. We calculated the pre and postoperative APACHE III score and recorded the criteria for ICU admission as stated by

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the neurosurgical medical team. We evaluated these findings against the criteria for ICU admission of the American College of Critical Care Medicine (1).
Results and Discussions: Patients requiring ICU admission in need of extensive intensive treatment (priority[1] – emergency cases) and patients requiring intensive neuromonitoring with possible intervention (priority 2 – monitoring cases) comprised 77% and 23% respectively. Criteria for ICU admission decision (in order of significance) were: prognosis of underlying and acute disease, characteristics of tumor location, type of neurosurgical operation, age, number of available beds and legal liability. Non medical criteria did not influence decision. Preoperative neurological APACHE III sub score on ICU admission was 1.5 ± 0.45 and 18.20 ± 1.40 respectively and total APACHE III score was 17.83 ± 3.19 and 33.65 ± 2.37 in priority 1 and 2 patients respectively. Postoperative neurological APACHE III subscore on ICU admission was 4.16 ± 1.24 and 20.25 ± 1.62 respectively and total APACHE III score was 38.16 ± 4.16 and 51.40 ± 2.86 in priority 1 and 2 patients respectively.
Conclusion(s): The APACHE III and postoperative neurological sub score were good predictors of outcome in priority 2 but not priority 1 patients ($p < 0.0062$). The criteria for ICU admission complied fairly well with the American College of Critical Care Medicine guidelines.
Reference:
1 *Crit Care Med* 1999 Mar; 27(3):633–638.
Acknowledgement: The University of Athens Neurosurgical Clinic of Evangelismos Medical Hospital.

A-638

Predictive value of unmeasured ion component of base excess in septic patients with the high risk of death

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Background and Goal of Study: The effect of Stewart's independent variables: strong ion difference and total weak acid concentration, allows the assessment of an unmeasured ion component (UIC) of the base excess (BE). The UIC and the standard BE < -5 mEq/l were associated with the increased risk of death (1,2). We decided to compare the standard BE and the effects of Na-Cl difference, albumin and UIC, in patients with severe sepsis (SAPS II > 40), who survived or died.
Materials and Methods: The following variables were based on data collected during the first day of admission and were determined (mEq/l) according to simplified Fencl-Stewart method (2): (a) standard BE – from arterial blood gas analysis; (b) Na-Cl effect $= [Na^+] - [Cl^-] - 38$; (c) Alb effect $= 25 \times [42 - \text{albumin (g/l)}]$; and (d) UIC = standard BE – Na-Cl effect – Alb effect.
Results and Discussions: Among 25 studied patients, 13 survived and 12 died. There were no significant differences in demographic data. The standard BE and UIC were significantly lower, and UIC < -8 Eq/l was observed more often in critically ill septic patients, who died than those who survived, but the Na-Cl and Alb effects on BE were not different between both groups.

	Survived	Died	*P**
N	13	12	
Standard BE	1.2 ± 1.0	−1.7 ± 1.1	<0.05
Na-Cl	3.5 ± 0.8	5.9 ± 1.6	NS
Alb	2.7 ± 0.2	1.9 ± 1.0	NS
UIC	−4.9 ± 0.9	−11.5 ± 1.5	<0.001

NS – Not significant; *Student t-test.

Conclusions: The standard BE and UIC of the standard BE may be predictable for mortality in critically ill septic patients. Results of our study, conducted on patients with the mean risk of death 41.5%, confirmed the earlier observations (1,2). To assess the proper predictive value of UIC in the patients with the different risk of death the further studies are needed.
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Acknowledgment: Supported by KBN 3 PO5E 109 24.

A-639

First year experience of APACHE II scoring in intensive care and high dependency care units in St Lukes Hospital, Malta

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Background and Goal of Study: APACHE II scoring is widely used to assess quality of care in intensive care, and to compare performance of different units (1). The aim of the study was introduce ongoing APACHE II scoring and standardised mortality ratio (SMR) calculation in the intensive care and high dependency care unit (ITU/HDU) at St Luke's Hospital, Malta; and to provide baselines against which the performance of future years can be measured.
Materials and Methods: A prospective, consecutive, non-interventional study was carried out over 4 months. Physiological variables were collected at the bedside by the same two people (2). Admission and outcome data was also collected. APACHE II score, predicted mortality and SMR were then calculated retrospectively. One patient was excluded because of missing variables; children less than 16 years old and burns patients were also excluded.
Results and Discussions: 251 patients were included – 106 medical and 145 surgical patients. The SMR for the whole unit (ITU and HDU) was 0.74. Overall performance for surgical patients was better than for medical patients (SMR medical 0.83; surgical 0.60). A trend to worse outcome in older age groups was also observed, with the worst being 60–69 age group (SMR 0.88).
Conclusions: Total ITU/HDU performance was better than expected, with all values being less than 1. The SMR of the unit (0.74) can be used as a baseline for future years The study also indicates a need to investigate subgroups of patients who need increased attention, with the aim to improve outcome. APACHE II scoring is now being done daily for all patients. The plan is to repeat the study comparing outcomes of A&E admissions with ward admissions; and excluding elective post-operative surgical admissions.
References:
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A-640

Validity and reliability of the Turkish version of confusion assesment method for the intensive care unit (CAM-ICU)

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Background and Goal of Study: Delirium is a serious problem, common in the intensive care units (ICU), and can cause significant morbidity and mortality, if unrecognized and untreated. Diagnostic instruments for delirium should be developed and the ICU personnel should be educated. This study aimed to evaluate the reliability and validity of Turkish version of CAM-ICU (YBU-KDO) to identify delirium in the ICU patients.
Materials and Methods: 60 patients, who stayed in the ICU >48 hours, were included into our study. The ICU nurse and the intensivist performed independent YBU-KDO ratings. YBU-KDO has four features: an acute onset of mental status changes or fluctuating course, inattention, disorganized thinking and an altered level of consciousness. The patient is diagnosed as delirious with the first two features and either feature 3 or 4. A psychiatrist interviewed the patient and the family members to assess for delirium. T-test, chi-square test and Kappa tests were used for statistical analysis.
Results and Discussions: The mean ± SD of weight and APACHE II score on admission were 72 ± 15 and 18 ± 8. 29 patients were male. Delirium was diagnosed in 26(43%) patients. The delirious patients were older (63 ± 19 yrs), more commonly had previous ICU stay (54%), emergency admission (100%) and stayed in the ICU longer (12 ± 19 days) compared to non-delirious patients (51 ± 19 yrs, 18%, 62%, 4 ± 2 days, respectively). In YBU-KDO only verbal attention test was applied to test the inattention and increasing the cut-off value from 8 to 12 increased the agreement. This form of YBU-KDO had acceptable sensitivity (65–69%), excellent specificity (97%) and reliability (kappa = 0.96).
Conclusion: We think inclusion of YBU-KDO into daily charts would allow early diagnosis, implementation of preventive measures and the treatment of delirium in the ICU.
Reference:
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A-641

Mild therapeutic hypothermia – pitfalls and pearls

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Background and Goal of Study: Mild therapeutic hypothermia improves neurological recovery after prehospaital cardiac arrest (1) and has become a standard procedure in postresuscitative care. Our goal was to study the complications during MIH (2).
Materials and Methods: We evaluated retrospectivly 30 patients after VF-OHCA with regard to complications associated with the use of MIH. MIH was induced by a surface cooling protocol and maintained for 12–24 hours. Incidence of koagulopathy, electrolyte-disorders, pneumonia, pancreatitis, elevated amylase, hemorrhage and arrhythmias requiring treatment were documented.

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Results and Discussions: Median age of the patients was 60,5 years (32–75 years) with all patients (100%) having presumed cardiac cause of OHCA and ventricular fibrillation (VF) as the initial ECG-rhythm. All patients (100%) were intubated at the scene.

Complication	Incidence in %
Hypokalemia	73,3 (n = 22)
Severe hypokalemia (≤ 3,0 mmol/l)	36,6 (n = 11)
Pneumonia	70 (n = 21)
Elevated amylase	53,3 (n = 16)
Arrhythmia	23,3 (n = 7)
Elevated INR (1,3–1,5)	16,6 (n = 5)
Platelet reduction > 30%	10 (n = 3)
Insulin resistance	16,6 (n = 5)
Hyperkalemia during rewarming	3,33 (n = 1)
Hemorrhage	0
Pancreatitis	0
Throbocytopenia	0
Leukopenia	0

Conclusion(s): MIH is a safe therapy when the clinician is aware of the potential side effects. Electrolyte-disorders and pneumonia should be anticipated and treated preemtively.

References:

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A-642

Bacterial flora isolated in septic patients with gunshot injury

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Background and Goal: Gunshot wounds get contaminated since the beginning from the exogenous or endogenous flora of the injured himself.
Materials and Methods: From 314 patients with gunshot injury admitted in intensive care, 85 of them or 27.07% manifested the symptoms of sepsis, whereas 21 of them or 24.7% have displayed a clinical framework of the septic shock. Average age 43 years of age, 71 M & 14 F.
Results and Discussions: T° present in 100%, fevers have been manifested and treated in 54, as well as tachycardia, polypnea, dyspnea, neck rigidity, etc. Empiric therapy started with β-Lactaminics and aminoglucosidics. Specific therapy started after the interruption of the empiric therapy in 64% of the cases, after 3–6 days. Supportive therapy: Liquids, plasma, electrolytes in 100%, and parentheral nutrition in 82% of the cases, entheral one for the rest. There have been administered: vassal active drugs, mechanic ventilation & anti-H2 in 100%, steroids in 14.28% of the cases. The isolated causes have predominated: Klebsiella, E. Coli, Pseudomonas, Providentia, Acinetobacter etc. 137 microbial strains have been identified. Mortality 20 cases or 23.52%.
Conclusions: Sepsis encountered in 27%. Nearly in ¼, or 23.5% a mixed infection and in ?, or 29.4% of them re-infection was detected. Negative gram bacteria occupied the main place. They were distinguished in 82.5% of the cases. The Enter bacteria prevailed in 70.1%.

E. Coli 24.1% and Klebsiella pneumonia 14.6%. There was discovered a high percentage of resistant strain towards several antibiotics.

More sensible results: amikacin, ceftazidim, pefloxacin, whereas as to Staphylococcus also cefazolin. Multi resistant strains were differentiated at a high frequency, 73%. Etiological structure and high frequency of multi-resistant indirectly indicate that a great part of the studied infections pertain to the hospital nature.

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A-643

Circuit survival time in CVVH with unfractionated heparine versus nadroparine

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Background and Goal of Study: The length of continuous venovenous hemofiltration (CVVH) depends on anticoagulation of the machine circuit. Circuit survival time is determined by blood line permeability and filter clotting.
Materials and Methods: This is a prospective, randomized study that was made in the intensive care unit as approved by the hospital ethics committee. Patients with severe sepsis that required CVVH were assigned to 2 groups: group A – 16 patients (received Unfractionated Heparine UFH) and group B – 16 patients (received Nadroparine). Patients younger than 18 year and those who had active bleeding were excluded from the study.

Group A: Anticoagulation – priming 2000 IU of UFH in 500 ml normal saline; prefilter bolus of 40 IU per kg; maintenance dose adjusted to ACT value every 2 hours and to aPTT every 6 hours (blood sampled postfilter).

Group B: Anticoagulation – priming with 950 antiXa IU in 500 ml normal saline; prefilter bolus of 20 antiXa IU per kg; maintenance with 5 antiXa IU per kg per hour.

Data underwent statistical analysis: average, standard deviation, Student's t-test. The duration of CVVH, clotting score at blood line and filter were analyzed.

Results and Discussions:

	Group	Average	Standard deviation	t-test
Duration (hours)	A	39,937	18,951	0,742451
	B	36,312	24,010	
Clotting line score	A	2,625	0,916	0,534064
	B	2,25	1,388	
Clotting filter score	A	2,125	0,640	0,171807
	B	1,625	0,744	

Conclusion(s): There was no significant difference in average circuit life among the two groups. We found Nadroparine easier to manipulate because no anticoagulation monitoring is needed. The patients had no sign of bleeding.

Reference:

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A-644

Influence of different ways of alimentary therapy on selected serum lipids in sepsis

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Background and Goal of Study: Sepsis is accompanied by metabolic disorders which lead to several changes in serum concentration of lipids[1,2,3]. The crucial element in the treatment of sepsis patients is alimentary therapy. The aim of the study is to assess the dynamics of selected lipids in sepsis patients as related to the applied alimentary therapy.
Materials and Methods: Thirty patients (aged 18–60) entered the study, who were randomly chosen to form two groups, 15 patients each. In group I, for 10 days, patients received a full balanced parenteral diet according to the AiO system. In group II patients were put on an enteral diet. Fifteen patients served as controls. On the 1st, 4th and 10th day of therapy FFA was studied according to Dole's method, total cholesterol, HDL-cholesterol and triacyloglicerols by a direct enzymatic method using polyanions. LDL-cholesterol was calculated on the basis of total cholesterol, HDL-cholesterol and TG values. Parameters were compared using ANOVA/MANOVA analysis.
Results and Discussions: In the course of sepsis, a significant fall was observed in the levels of total cholesterol, HDL-cholesterol and LDL-cholesterol in group I ($p < 0{,}001$) and total cholesterol ($p < 0{,}01$), HDL-cholesterol ($p < 0{,}05$) and LDL-cholesterol ($p < 0{,}01$) in group II. The implemented alimentation type did not influence the levels of total cholesterol, LDL-cholesterol, TG and FFA values. Patients fed enterally showed higher concentrations of HDL-cholesterol ($p < 0{,}05$).
Conclusion(s): Sepsis leads to significant reduction of total cholesterol, HDL-cholesterol and LDL-cholesterol. In our study an enteral nutrition applied in the treatment of sepsis correlates with higher concentrations of HDL-cholesterol.

References:

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3 Fraunberger P, et al. Clin. Chem. Lab. Med. 1999; 37: 357–362.

A-645

Assessment of simple vs double transpulmonary thermodilution

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Background and Goal of Study: Hemodynamic monitoring is essential for the management of the critically ill patients. Transpulmonary double

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dilution (DT) is the gold standard to measure intrathoracic volumes. PiCCO system calculate indexed intrathoracic blood volume (ITBVI), global end diastolic blood volume (GEDVI), extravascular lung water (EVLWI) and measure cardiac index (CI) with transpulmonary single dilution (ST). We prospectively studied the agreement between ST and DT transpulmonary measurements of cardiac output and intrathoracic blood volumes.

Materials and Methods: All patients who need invasive hemodynamic investigation were included in the study. ST and DT were prospectively compared using the Pulsion Picco and the Pulsion Cold Z-021 monitor respectively. The relations between ITBVI, GEDVI, CI, EVLWI were compared between both techniques. Correlation between variables were analysed by linear regression. Bland-Altman analysis was used to compare the agreement among the different methods. $P < 0.05$ was considered as significant

Results and Discussions: 50 matched sets of IC, ITBVI, GEDVI, measurements between ST and DT were collected in 15 critical ill patients. A significant relation between IC, ITBV, GEDVI, EVLWI does exist. The means differences in measurements (ST-DT) are resumed in table 1.

	Biais	+2 DS	−2 DS	r^2
IC	−0.5	0.7	−1.8	0.56
ITBVI	−184	76	−444	0.65
GEDVI	−388	320	−1096	0.69
EVLWI	−9	7	−24	0.93

However EVLWIst overestimated EWLWI at low normal value and underestimated at higher values.

Conclusion(s): Parameters derived from the simple thermodilution obtain by the PiCCO system do not allow a real assessment of left ventricular preload and pulmonary blood volume in the extreme values.

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Is ΔPP a good indicator of preload in ICU?

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Background and Goal of Study: Assessment of cardiac preload is of major importance for the management of critically ill patients. Left ventricular end-diastolic area (LVEDA) can be determined with transesophageal echocardiography. Intrathoracic blood volume index (ITBVI), global end diastolic volume index (GEDVI), and variation of pulse pressure (ΔPP) during mechanical ventilation are used as surrogates for cardiac preload. The objective of our study was to find out if there is a correlation between these different parameters in order to determine preload at any given moment during resuscitation.

Materials and Methods: Following haemodynamic data were obtained from transpulmonary thermodilution with the double dilution technique (cold Pulsion): ITBVI, GEDVI, cardiac index CI. LVEDA was measured using the transgastric short-axis view, and ΔPP was determined from changes in peripheral pulse pressure during the respiratory cycles. The relationship between ΔPP and respectively ITBV, GEDV, CI, and LVEDA was analysed and discriminated by various ranges of CI ($<$ or $=$ 3.0 and $>$3.0 l/min/m^2) within patients. The correlations between variables were also analyzed by linear regression analysis. $P < 0.05$ was considered as significant.

Results and Discussions: 15 patients were included into the study. Overall 50 measurements were performed. Correlations between ITBV, GEDV, LVEDA and ΔPP were moderate ($r^2 = 0.47, 0.46, 0.43$ respectively). No correlation was observed between ΔPP and other values within ranges of CI $<$ 3 l/min/m^2. However the relationship was significant with a CI $>$ 3 l/min/m^2 ($p < 0.05$, $r^2 = 0.60, 0.66, 0.4$ respectively).

Conclusion: ΔPP is not reliable enough to evaluate preload in patients with low CI.

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Prophylaxis with granulocyte colony-stimulating factor improves the outcome of high-risk colorectal cancer patients with lowered postoperative body temperature

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Background and Goal of Study: Perioperative hypothermia is a risk factor after major surgery (1). Previously we have shown that prophylaxis with granulocyte colony-stimulating factor (G-CSF) improves the outcome of hypothermic septic rats (2). In a clinical trial we now explored whether G-CSF prophylaxis may improve recovery especially in high-risk patients with lower body temperature after colorectal cancer surgery.

Materials and Methods: After ethical approval 80 patients (ASA class 3&4) undergoing colorectal cancer surgery were randomized to: 1) G-CSF + cefuroxime/metronidazole (G/cef-met), 2) G-CSF + ofloxacin/metroni-dazole (G/ofl-met), 3) placebo + cef-met or 4) placebo + ofl-met. G-CSF was given s.c. 12 h prior and 12 and 36 h after surgery. All patients were warmed and their core temperature recorded intraoperatively. Primary endpoints were patients quality of life, complication rate and length of stay, secondary imunological parameters (granulocyte phagocytosis, cytokine release, HLA-DR expression).

Results: The G-CSF patients tended to have lower postoperative body temperatures: 35.0 vs. 35.3, $p = 0.16$. However, G-CSF improved the phagocytic capacity of granulocytes and the HLA-DR expression on macrophages (G-CSF + cef-met vs. placebo $p = 0.04$ and $p = 0.03$). Patients with a greater temperature decrease had a higher TNF-alpha; release on the 3rd postoperative day ($p = 0.2$) and lower IL-18 levels (450 pg/ml vs. 241 pg/ml, $p = 0.01$).

The patients with G-cef had fewest postoperative complications (16% vs.53%, 40% and 45%, $p = 0.1$) and the shortest length of stay (12 vs. 13, 13.5 and 14 days, $p = 0.01$). Furthermore they reached the best quality of life rate at discharge (60 ± 23 points, $p = 0.1$).

Conclusions: Although the patients with G-CSF tended to lower body temperature after surgery than those with placebo, their overall postoperative restitution was better. This might be due to an enhanced number and phagocytic activity of granulocytes. The role of IL-18 with regard to postoperative complications needs further evaluation.

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Evaluation of single intensive care unit performance in Croatia using APACHE II and SAPS II systems

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Background and Goal of Study: To evaluate intensive care unit performance using: Acute physiology and chronic health evaluation II (APACHE II) and Simplified acute physiology score II (SAPS II) in a single University hospital in Croatia.

Materials and Methods: We prospectively observed 395 patients without younger than 16 years old, burned, heart surgery patients and patients whose length of stay in ICU was less than 4 hours. Predicted mortality for every patient and standardized mortality ratio (SMR) for hospital and ICU was calculated. Predictive value of scoring systems was evaluated with discrimination and calibration measures.

Results and Discussions: Hospital SMR is high (APACHE II = 1.58; SAPS II = 1.60). SMR in the ICU is on the upper margin of SMRs in the literature which is indicative for high hospital departments mortality because high dependence rooms lack. Both evaluated scoring systems had good discrimination power as expressed by area under receiver operating characteristics curve (APACHE II = 0.821 and SAPS II = 0.827), but their calibration was less perfect (Hosmer-Lemeshow – APACHE II: C = 17.473; df = 8; p = 0.026 and SPAS II: C = 22.961; df = 8; p = 0.003). Elective patients had higher proportion and lower predicted and observed mortality than the emergency or medical patients. There are no major differences between the last two groups in the predicted and observed mortality.

Conclusion(s): It is necessary to perform customisation of scoring systems. There are no major differences between scoring systems. Quality of care in our hospital is worse than in original reports which requires further analysis.

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A-649

Outcome measured by mortality and length of stay in a surgical intensive care

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Background and Goal of Study: Predictions of outcome, measured by length of stay (LOS) and mortality, can assist in planning and optimize intensive care facilities and utilization. The aim of this study was to evaluate predictive factors for intrahospitalar outcome in patients admitted to a surgical ICU.

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Materials and Methods: All 185 adult patients who underwent scheduled or emergency noncardiac surgery admitted to a surgical ICU between April and July 2004. The variables prospectively recorded were: social demographics data, core temperature (Tc) measured before surgery, on arrival on ICU and every two hours until 6 hours after admission, ASA physical status, emergency or scheduled surgery, magnitude of surgical procedure, anesthesia technique, amount of fluids during anesthesia, use of temperature monitoring and warming techniques, duration of the anesthesia, LOS in ICU and in the hospital and SAPS II score. Assessment of the relationship between each clinical variable and long ICU stay or mortality was made using univariate analysis performed by simple binary logistic regression with an odds ratio (OR) and its 95% confidence interval (95%CI).
Results and Discussions: Mean LOS in the ICU was 4.09 ± 10.23 days. 20% of patients stayed longer than 3 days in ICU. Significant risk factors for staying longer in ICU were SAPS II (OR 1.13, 95%CI 1.08–1.17, $p < 0.001$), ASA (OR 4.76, 95%CI 1.87–12.10, $p = 0.001$ for ASA III/IV patients), amount of colloids (OR 4.95, 95%CI 1.51–16.21, $p = 0.008$), plasma (OR 1.84, 95%CI 1.16–2.90, $p = 0.009$) and blood (OR 1.31, 95%CI 1.01–1.69, $p = 0.039$) used during surgery. Fourteen (7.6%) patients died in ICU and 29 (15.7%) died during their hospitalization. Statistically significant independent risk factors for mortality were emergency surgery (OR 7.11, 95%CI 2.90–17.42, $p < 0.001$), major surgery (OR 5.50, 95% CI 1.13–26.69, $p = 0.034$), high SAPS II scores (OR 1.11, 95% CI 1.07–1.14, $p < 0.001$), longer stay in ICU (OR 14.57, 95% CI 5.87–37.18, $p < 0.001$ for LOS longer than 3 days) and in the hospital (OR 1.02, 95%CI 1.01–1.04, $p < 0.001$).
Conclusions: Prolonged ICU stay is more frequent in more severe patients at admission and it is associated with higher hospital mortality that is also more frequent in patients submitted to emergent surgery and major surgery.

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Acute renal failure after cardiac surgery 2004 versus 2002

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Background: Acute renal failure (ARF) requiring renal replacement therapy (RRT) after cardiac surgery remains a cause of major morbidity and mortality (1). Our objective is to assess the incidence and outcome of ARF after cardiac surgery with cardiopulmonary bypass (CPB) in 2004 compared to 2002.
Methods: We compared retrospectively demographic and perioperative data in consecutive adult patients undergoing cardiac surgery with CPB in 2002 (544 patients) and 2004 (276 patients). ARF was defined as a rise in serum creatinine above 120 μmol/l or twofold rise of baseline value. RRT was indicated on clinical and biological grounds. Data are expressed as mean ± SD. Continuous variables were analyzed with unpaired *t*-test. Categorical variable were compared by Fisher's exact tests and a P-value of <0.05 was considered significant.
Results: There is no difference regarding demographic, perioperative factors and type of surgery in the two groups. In 2004, 7.6% of patients developed ARF after cardiac surgery with CPB compared to 11.9% in 2002 ($p = 0.0027$). 3.7% of all patients required RRT in 2002 vs. 1.4% in 2004 ($p = 0.029$). In-hospital mortality in ARF patients decreased between the two periods of time: 20% in 2002 vs. 4.8% in 2004 ($p = 0.015$). There is no statistical difference regarding in-hospital mortality in ARF patients requiring RRT: 52.4% in 2002 vs. 25% in 2004 ($p = 0.23$). Higher percentage of patients received aprotinin (38% vs. 21%, $p < 0.001$), metilprednisolon (42% vs. 16%, $p < 0.001$) and intraperative hemofiltration (15.3% vs. 8%, $p = 0.002$) in 2004 compared to 2002.
Conclusions: The incidence of ARF after cardiac surgery decreased significantly in 2004 compared to 2002. The outcome of the patients with ARF improved. Larger used of anti-inflammatory strategy (aprotinin, metilprednisolon and intraoperative hemofiltration) may be involved in decreasing the incidence of ARF in cardiac surgery.
Reference:
1 Mangano C.M. et al. *Ann Intern Med* 1998; 128 (3): 194–203.

A-652

Radical surgery for esophageal cancer: our experience and analysis of risk factors for perioperative mortality

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Background and Goal of Study: Radical operative therapy for esophageal cancer is usually connected with a significant mortality and morbidity (1). Purpose of this study is analysis of potential risk factors for mortality after radical surgery for esophageal cancer and presentation of our experience with this kind of surgery.
Materials and Methods: There were 65 patients undergone radical surgery for esophageal cancer from the June 2003. to the April 2004. in our University hospital for chest diseases. We analyzed as mortality risk factors: sex, age, albumin, aspartate transaminase, alanine transaminase, gamma glutamyl transferase, creatinine, hemoglobin, leucocytes, fibrinogene, prothrombine time, activated partial thromboplastine time, forced expiratory volume in the first second, vital pulmonary capacity, diffusion capacity for carbon monoxide (all preoperative), duration of surgery, perioperative infused fluid volume, perioperative transfusion, duration of stay in the ICU.
Results and Discussions: In our study perioperative mortality was 15.38%. Incidence of complications: pulmonary 44.61%, cardiac 6.15%, and surgical 27.69%. There were no statistically significant differences between groups of patients connected with most of analyzed factors. The most important finding is positive correlation of level of gamma glutamyl transpherase with perioperative mortality (Fisher $p = 0.012$ for gamma glutamyl trasferase >38 U/L, and Fisher $p = 0.017$ for gamma glutamyl transferase >76 U/L – Fishers 2 × 2 test).
Conclusion(s): Among the analyzed factors, only factor of potential prognostic importance for patients undergoing radical surgery for esophageal cancer could be the level of gamma glutamyl transferase.
Reference:
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A-653

EUROscore and cost of ICU stay after cardiac surgery

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Background and Goal of Study: EUROscore (ES) is a commonly accepted scale to assess the operative risk of cardiac surgical patients. The most expensive part of cardiac surgical procedure is connected with ICU stay. It seems to be obvious that the cost of ICU stay should be linked to the preoperative ES, but these relations were not explored previously. The aim of this study was to compare total cost and length of ICU stay in patients with various ranges of preoperative ES.
Materials and Methods: Individual cost of ICU stay of 1265 consecutive adult patients who underwent cardiac surgery was calculated over the 10 months period. Individual data for each patient were extracted from hospital laboratory, X-ray department, magazine, pharmacy and blood bank and then added, creating total cost of ICU stay for each individual patient. Salaries of the ICU personnel and media were not included. Local currency (polish zloty) was converted to Euro to enable comparisons to other European countries (exchange rate for 13.12.2004). Length of ICU stay for each patient was extracted from the database and cost of 24 hours of ICU stay was calculated. Descriptive statistics, ANOVA and Pearson's correlation were used. $p < 0.05$ was considered significant. Data are expressed as mean ± SEM.
Results: Correlation of individual cost of ICU stay versus individual ES for each patient was on the borderline of statistical significance ($r = 0,3$; $p < 0.01$).

ES	No of pts	% of pts	ICU stay (hours)	Mean total cost (Euro)	Mean daily cost (Euro)
0–2	335	27%	30 ± 2	174 ± 12	144 ± 2
3–5	526	42%	40 ± 2	253 ± 18	148 ± 3
⩾6	403	32%	*68 ± 5	*477 ± 39	*168 ± 6

(*$p < 0.05$)

Duration of ICU stay, mean total ICU cost and mean daily ICU cost stay was not different between 0–2 and 3–5 ES ranges. Patients with ES ⩾ 6 spent more time in ICU and their daily cost was also higher – all differences were statistically significant towards groups with lower ES ranges.
Conclusion(s): Patients with ES 0–2 and 3–5 have similar length of ICU stay and generate similar cost. Patients with ES ⩾ 6 stay longer on the ICU and their stay is significantly more expensive.

A-654

Is it important to assess patients satisfaction in ICU?

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Background and Goal of Study: The investigation of the sources of patients' satisfaction and discomfort in the intensive care unit is still an

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actual problem and should be done periodically. The aim of our study was to evaluate patients' satisfaction and to detect possible sources of discomfort based on an original questionnaire, taking in consideration the problems and the specific of our surgical intensive care unit.

Materials and Methods: 207 patients admitted in ICU (between January 2004–October 2004) were included in the study after obtaining the informed consent. They have filled in the questionnaire during the first 24 h after their discharged from ICU.

Results and Discussions: The first four main sources of discomfort were pain (120 patients, 57,9%), anxiety (88 patients, 42,51%), hunger and thirst (87 patients, 42,47%) and insomnia (82 patients, 39,61%). Immobilization, noise, venous punctures were other important sources of stress and discomfort.

On the other side, for 78,7% of the patients, the quality of the staff care was the most impressing. All patients who were asking for help to solve their problems received it properly care.

Conclusion(s): It is important to assess patients' satisfaction in ICU because from such questionnaire we can identify the main sources of discomfort and we can take the necessary measures to diminish these sources. Moreover we consider it is important to have such assessments periodically in order to keep stuff attention awake of these sources of discomfort.

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A-655

Role of systemic inflammatory response in acute renal dysfunction after cardiac surgery with cardiopulmonary bypass

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Background: The pathophysiology of acute renal dysfunction (ARD) after on-pump cardiac surgery still remains under discussion. However, it is known that systemic inflammatory response increases after cardiopulmonary bypass (CPB)[1]. The aim of this study was to evaluate the role of the systemic proinflammatory response in ARD occurring after on-pump cardiac surgery.

Material and Methods: After informed consent, 62 patients scheduled for cardiac surgery with CPB were prospectively included. Plasmatic C-reactive protein (CRP), TNF and IL 6 levels were measured respectively before (T0), 30 min after the start of CPB (T1), at the end of CPB (T2), on ICU arrival (T3) and on day 1 (T4) and day 2 (T5) after surgery. ARD was defined as a 25% increase of the serum creatinine level. Data were compared with ANOVA and the Mann-Whitney test.

Results: ARD occurred in 36 patients (60%). We found no difference in the evolution of CRP, TNF nor IL 6 within both groups of patients with (ARD+) or without ARD (ARD−) ($p = 0.75$, 0.86 and 0.18 respectively). There was neither a difference within their plasma peak levels (CRP: 254 ± 78 mg/l vs 243 ± 86 mg/l $p = 0.44$, TNF: 17.4 ± 24.4 pg/ml vs 22.5 ± 43.2 pg/ml $p = 0.93$, IL 6: 465 ± 471 pg/ml vs 578 ± 566 pg/ml $p = 0.61$).

Conclusion: Postoperative ARD after on-pump cardiac surgery is not related to an increase in systemic pro-inflammatory response.

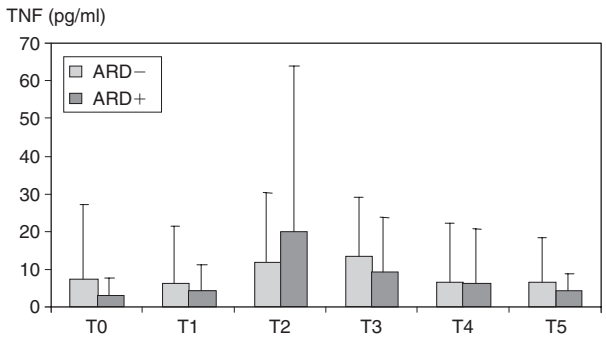

Figure 1. Evolution of TNF concentration between both groups.

Reference:

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A-656

Evaluation of renal function in on-pump cardiac surgery with the cockcroft method compared to creatinine clearance measurements

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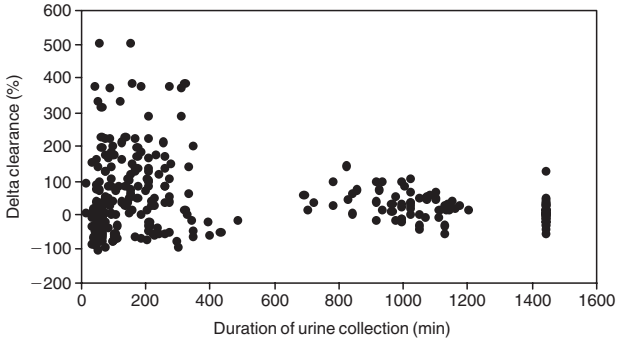
Background: For evaluation of renal function in cardiac surgery creatinine clearance still remains the gold standard. The latter is not easy to perform and depends on the quality of urinary collection. A simplified method has been proposed by Cockcroft[1]. The objective of our study was to evaluate whether the correlation between the creatinine clearance and the Cockcroft method depends on the timing of the urinary collection.

Material and Methods: After informed consent, 60 patients scheduled for cardiac surgery with cardiopulmonary bypass (CPB) were prospectively included. Creatinine clearance was calculated with the Cockcroft method and as follows: $C = UV/P$. Data were compared with regression analyses. $P < 0.05$ was considered as significant.

Results: For urinary collection times below 400 min, the difference between both methods varies greatly (table 1).



Conclusion: Creatinine clearance is unreliable for evaluating renal function in on-pump cardiac surgery for urinary collection times below 400 min. The Cockcroft method seems to be more accurate because it does not depend on the quality of urinary collection.

Reference:

1 Cockcroft DW et al Nephron 1976, 16(1): 31–41.

A-657

Severe outbreak of multidrug-resistant Acinetobacter Baumannii in neapolitan intensive care unit: clinical and genetic characteristics

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Background and Goal of Study: The rapid emergence of multidrug-resistant *Acinetobacter baumannii* (Acb) was observed in a tertiary care teaching hospital in Naples (Italy). We studied the clinical characteristics and genetic epidemiology of this infection.

Materials and Methods: From June 2003 to July 2004, Acb was isolated from 75 patients in the cardiorespiratory intensive care unit. SAPS II and SOFA scores were calculated at admission and at the time of Acb isolation. Genotype analysis by *Apa*I digestion and pulsed field gel electrophoresis (PFGE) was performed in twenty multiresistant Acb isolates.

Results and Discussions: 92% of the Acb isolates showed a multidrug-resistant (MDR) antibiotype, including ampicillin-sulbactam, carbapenems and aminoglycosides, but were susceptible to colistin. Acb was responsible for 39 infections and 36 colonizations. 19 patients showed the presence of the Acb at the hospital admission, while in 56 it was isolated during the hospitalization. 37 patients had a ventilator-associated pneumonia. Genotype analysis showed the same macrorestriction PFGE pattern. This profile was identical to that of an epidemic Acb clone previously isolated in a different ICU in Naples. Type 1 integron of 2.2 kb was amplified from the chromosomal DNA of all multiresistant Acb clones isolated. Sequence analysis of the integron showed the presence of three gene cassettes: *aacA4*, which confers resistance to amikacin, netilmicin, and tobramycin; an unknown ORF; and $bla_{oxa\text{-}20}$, which confers resistance to amoxicillin, ticarcillin, oxacillin, and cloxacillin and carbapenems. Crude mortality was 60%. On the basis of the

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SAPS II and SOFA scores, and of the presence of co-pathogens (44 patients), the Acb-attributable mortality was 36%.
Conclusion(s): Reinforcement of surveillance control measures (i.e. temporary ward closure, proper hand washing and patient care by dedicated nurses) and combination therapy using colistin, rifampin, and carbapenems, led to a sharp containment of endogenous infection. An inter-hospital spread of MDR Acb seemed to be occurring citywide. Rigorous infection control measures may contain intra-hospital diffusion.
Reference:
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Acknowledgements: Supported by MIUR grant (PRIN 04).

A-658

Limitations of central venous pressure and peripheral venous pressure agreement in intensive care unit patients

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Background and Goal of Study: Measuring peripheral venous pressures (PVP) through peripherally inserted cannulae might be an alternative to measuring central venous pressures (CVP) (1). Our aim was to determine the agreement between CVP and PVP measurements in critically ill patients and to define a subgroup of patients in which CVP can be used interchangeable with PVP.
Materials and Methods: 24 hour simultaneous paired PVP and CVP measurements were recorded from 41 critically ill patients with a central venous catheter and a peripheral venous catheter on the dorsum of the hand. The range of agreement was defined as mean bias ±2SDc (corrected standard deviation for repeated measurements from same individuals) as described by Bland and Altman (2). According to this approach patients were divided in two groups; good agreement group, poor agreement group. χ^2-test, Mann-Whitney-U tests were used to compare the two groups.
Results and Discussions: In 94 (>10%) measurements pairs the biases were outside the ±2SDc limits of agreement. There were no difference between the two groups regarding vital functions and total fluid balance during 24 hours of measurements.

	CVP-PVP Agreement	
	Good (n = 15)	Poor (n = 26)
Age (years) (mean ± SD)	42 ± 25	37 ± 24
Male/Female	7/8	8/18
APACHE II score	18 ± 8	16 ± 9
Admission diagnosis		
Respiratory/hemodynamic/neurologic/sepsis	10*/4/0/1	1/19/3/3
Postoperative patients	12	22
Patients requiring mechanical ventilation	14	20
Bias between CVP and PVP	−7 ± 2	−7 ± 5
Measurements pairs with disagreement	0(0–0)	2(1–10)*

*$p < 0.05$ between the two groups

Conclusion(s): PVP measurements might be an alternative to CVP measurements only in a selected group of ICU patients with respiratory problems but without hemodynamic instability.
References:
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A-660

Implicit memory formation during sedation with propofol

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Background and Goal of Study: Awareness and explicit memory occur in 0.2% of noncardiac and nonobstetric surgical cases. Data concerning the incidence of implicit memory are conflicting. Several studies indicated implicit memory formation in anesthetized or sedated patients (1). Explicit and implicit memory may lead to psychological morbidity following anaesthesia as well as ICU sedation. It was our goal to determine the incidence of explicit and implicit memory at a concentration of propofol corresponding to the C50 for loss of consciousness (LOC).
Materials and Methods: 20 patients were enrolled in the study group. Patients received spinal anaesthesia for intraoperative analgesia and a target controlled infusion of propofol with a target concentration of the age-adjusted C50 for LOC (2). 10 nouns were presented in random order (10 repetitions) via headphones during a steady state propofol effect site concentration. Depth of sedation was assessed according to the OAA/S and by recording the BIS (Version 3.1) and the AAI Index (AEP Monitor/2, Danmeter). Postoperative testing included a structured interview and a recognition task for explicit memory and a wordstem (WS) completion task for implicit memory. Distractor words were used to determine the rate of spontaneous correct responses.
Results and Discussions: We found no explicit memory formation. WS completion test showed significantly more correct results for test words than for distractor words ($p = 0.016$, one-sided Mc Nemar test). BIS, AAI and OAA/S averaged over the time of word presentation (18 min) did not differ between patients with and without implicit memory (Mann-Whitney-U-test). However sample size was too small to detect minor differences.
Conclusion(s): Implicit memory formation is not suppressed by a concentration of propofol corresponding to the C50 for LOC. Although such concentrations are rarely used intraoperatively, they are typically employed for ICU sedation. In the ICU painful stimulation may additionally enhance memory (3), which we have found to occur even in the absence of pain.
References:
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A-661

Hypokaliaemia and hypomagnesemia during acute coronary syndrome

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Background and Goal: The serum level of Potassium (K^+) is routinely investigated while the serum level of Magnesium (Mg^{++}) is ignored. The aim of this study is to register the serum level of K^+ and Mg^{++} in dynamics in patients with acute coronary syndrome (ACS).
Material and Methods: The study includes 25 patients, 8 women and 17 men at the average age of 59 years (from 36 to 85 years). 16 patients have Acute Myocardial Infarction (AMI) and 9 are with unstable angina. The samples are taken at 3 stages: 1. till the 6-th hour from registration 2. at 24-th hour and 3. at the 3-rd day. The substitution is made with Kalium-Magnesium asparginat (Panangin – Gedeon-Richter) at the 48-th hour intravenous. After that throught the mouth. The correlation between the serum levels of K^+ and Mg^{++} at the different stage is investigated.
Results: 80% of patients in I-st stage have hypokaliaemia at average of 3,15 mmol/l (from 2,3 to 3,3 mmol/l) and 28,98% of them have hypomagnesemia. After substitution with Panangin (K^+ 80 mmol and Mg^{++} 83 mmol intravenous) for first two day and K^+ 56 mmol and Mg^{++} 58 mmol p.o. at the 3-rd day the lower serum level of K^+remains in 28% of patients while hypomagnesemia is corrected. The correlation of serum level of K^+:Mg^{++} is 2,76 (from the first sample); 4,48 (from second stage) and 4,39 (from the last).
Conclusion: Hypomagnesemis is transitory and there is no sign of the 3-rd day, while hypokaliaemia is corrected slower in patient with ACS. The cause of the transient hypomagnesemia observed in the early stage of ACS is the enhancement of lypolysis, induced by catecholamine excess, and the higher level of free acids in the blood.
References:
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2 Fazekas T. et al., Magnesium and the Heart: Antiarrhythmic Therapiy with Magnesium, Clin. Cardiol., 1993, 16, 768–774.

A-662

Effect of hyperbaric oxygen treatment on the serum malondialdehyde levels in the experimental CO poisoning

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Background and Goal of Study: We intended to research the changes in serum malondialdehide (MDA) levels in experimental acute carbon monoxide (CO) poisoning and the effect of different oxygen treatment protocols.
Material & Methods: Sixty Sprague Dawley rats were separated randomly into 6 groups. CO in 2000 ppm concentration was applied for one hour to Groups I, II and III, for two hours to Group IV, V, VI. After the poisoning procedure, 100% NBO_2 for 1–1,5 hours was applied to Group I and IV, 2ATA 100% HBO_2 for 1–1,5 hours to Group II and IV and 3ATA 100% HBO_2 for 1–1,5 hours to Group III and VI respectively. For the measurements of COHb and

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MDA levels, 1.5 ml blood samples were taken in pre-poisoning (C1-M1), post-poisoning (C2-M2) periods, after treatment (C3-M3) and after 24 hours (C4-M4).

Results and Discussion: In all groups, COHb levels were increased after CO poisoning at C2 ($p < 0.001$). They dropped to 2%,1% respectively after different treatment protocols. However, the increase in MDA levels continued at M2 and M3 in all groups. At M4 while MDA levels of 100% NBO_2 and 2ATA HBO_2 groups were significantly high ($p < 0.05$) compared to control (M1) values, MDA levels of 3ATA HBO_2 group decreased to control values.

Conclusion: Serum MDA levels could be used as a marker, pointing the severity of lipid peroxidation and the effectiveness of treatment protocols (1). It was also concluded that following the serum MDA levels were important in decreasing the incidence of early and late neurological sequells and among the oxygen treatment protocols for lowering MDA levels, improving oxidative stress, 3 ATA 100% HBO_2 for 1,5 hour was the most effective modality.

Reference:

1 Piantadosi CA. *Respr. Care Clin. N. Am*. 1999; 5(2): 183–202.

A-663

Increased superoxide production after intermittent pringle maneuver

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Background and Goal of Study: The Pringle maneuver (PM), hepatic inflow occlusion, during hepatic surgery reduces intraoperative bleeding and blood transfusion requirement (1), but hepatic ischemia/reperfusion injury (IRI) is inevitable. Xanthine oxidase (XO) can serve as a critical source of ROS that contribute to inflammatory signaling, IRI and impaired vascular function (2,3). The authors followed changes of plasma XO activity and superoxide production during hepatic surgery under PM and the influence of XO on endothelium-dependent vascular relaxation.

Materials and Methods: Eleven patients that underwent hepatectomy under intermittent PM were studied. Blood was withdrawn before PM and 20 minutes after final reperfusion. Plasma XO activity was measured using a spectrophotometer. Superoxide production was measured by cytochrome *c* reduction by plasma XO. The influence of XO on endothelium-dependent relaxation was assessed in isolated rat aortic ring segments, which were incubated with/without XO. NADH was added 15 min before isometric tension measurements as a substrate.

Results and Discussions: After final reperfusion, plasma XO activity had increased four-fold with a concomitant increase in superoxide production. The XO + NADH-dependent inhibition of vascular relaxation was reversible by addition of CuZn SOD.

Conclusion(s): Significantly more XO is released into the systemic circulation after intermittent PM, with subsequently increased superoxide production. The impaired nitric oxide bioavailabity by the XO-induced superoxide after intermittent PM indicates hepatic surgery under PM might be beneficially managed using antioxidative drugs or anesthetics with a known antioxidative effect.

References:

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A-664

Evaluation of central vein catheter thrombosis in ICU patients

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Background and Goals: Asymptomatic catheter-related central vein thrombosis (CVT) which is diagnosed by venographic studies is mentioned to be as high as 66%. Moreover, when thrombosis occurred, the risk of catheter related sepsis was declared to be 2.6% higher. In this prospective study we aimed to diagnose CVT early as possible, its incidence and risk factors.

Material and Methods: ICU patients that needed a central venous access for at least 48 hours were included in this prospective study. The catheters were inserted via internal jugular or subclavian vein at bedside under aseptic conditions using the Seldinger technique. Diagnosis of vein thrombosis was detected by color Doppler ultrasound examination performed in less than 24 h after catheter removal. The protocol was approved by the ethic committee.

Results: One hundred and thirty three patients (56 F, 77 M), mean 59.2 years old (18–91 years), were included in the study. Catheters mean duration time was 11.2 days and duration of insertion mean time was 6.06 min (4–20 min). In 116 patients catheter insertion was performed with a single puncture, in 14 patients with double and in 3 patients with 3 puncture. Catheter localization in the patients were as follows: in 101 patients right subclavian vein, in 21 patients left subclavian vein, in 8 patients right internal jugular vein and in 2 patients left internal jugular vein. Catheter related thrombosis was diagnosed in 5 patients (3.75%) while catheter infection was seen in 1 patient (0.8%).

Discussion: Generally the chemotherapeutic agents administered via the central vein catheter have thrombogenic effect. When we study our CVT diagnosed 5 patients we found out that all of them were over 50 years old, the mean catheter duration time was 8.8 days. But these results were not statistically significant when compared with the other patients under 50 years old and more than 8.8 days of mean catheter duration time. Out of 118 patients who were not under anticoagulation therapy 4 had CVT while 15 patients who had anticoagulant therapy 1 had CVT diagnose which was found statistically insignificant ($p > 0.05$).

Conclusion: We suggest that in order to get clinical significance of the causes that effect CVT, more sensitive investigations with higher number of patients must be studied.

A-666

Importance of nasopharyngeal sampling in the infection control of ICUs

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Background and Goal of Study: ICU patients are at high risk to acquire nosocomial infections, which could greatly influence the clinical outcome. Hence the early detection of these infections and the adequate antimicrobial treatment are essential. We aimed to screen nasal colonisation and determine development rate of severe clinically and microbiologically proven infections (pneumonia, sepsis) caused by identical bacteria.

Materials and Methods: This retrospective study was performed for the 1999–2001 period at our 6-bed tertiary referral surgical ICU. All patients who were expected to stay over 48 hours at the ICU were routinely screened for nasal carriage of micro-organisms at admission and afterwards continuously (nasal swabbing on every 3rd day of stay). Positive endotracheal aspirates and positive blood cultures were retrieved for those patients who had proven nasal colonisation and were on antibiotic course due to clinically evident nosocomial infections.

Microbiologically positive endotracheal aspirates (EA) and blood cultures (BC) were analysed for the presence of identical bacteria previously found by nasal swabbing (NS).

Results and Discussions:

	2001	2002	2003	Total
NOP	136	133	139	408
NS+	21	55	66	142
NS+ and EA+	12	23	30	65
NS+ and BC+	0	2	1	3
NS+ and EA+ and BC+	1	2	1	4

NOP: Number of admitted patients with over 48 hour stay at ICU; +: positive culture.

Conclusion(s): Based on our results nearly 50 percent of patients with positive culturing of nasopharyngeal samples are expected to develop severe systemic nosocomial infections caused by identical pathogen and required antimicrobial treatment. Nasal swabbing can be of help in the early start of targeted antibiotic therapy and therefore can shorter the length of stay and lower healthcare expenses. Further studies are needed to determine the predictive value of nasopharyngeal sampling.

A-667

Surgical patients needing postoperative intensive care: a survey in Catalonia

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Background and Goal of Study: Progress in surgery and anaesthesia has gone parallel with the development of intensive and high dependency care units. Within an extensive survey of anaesthetic activity in Catalonia in 2003 (ANESCAT), we quantified and analysed characteristics of the patients requiring intensive postoperative care (IPOC).

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Materials and Methods: We designed a prospective and cross-sectional survey using information reported by anaesthesiologists through a questionnaire for every anaesthetic procedure performed during 14 randomised days along 2003. All public and private hospitals (131) practising anaesthesia around Catalonia (6.704.146 inhabitants) participated in the survey. The level of postoperative care required for every procedure was recorded. We calculated proportion of patients requiring IPOC and extrapolated to the entire activity and general population comparing patient characteristics.
Results and Discussions: A total of 23,136 questionnaires were collected. The proportion of patients needing IPOC was 7.7%, which extrapolates to 44,686 patients annually. The remaining only required recovery unit supervision. The median age (percentile 10–90%) of patients was 61 years (24–79). Distribution by gender was (54.8% male vs. 45.2% female). Those patients classified preoperatively as urgent (excluding obstetric cases) required IPOC more frequently (18.7% urgent vs. 7.9% elective). The percentage of ASA I, II, III and ⩾IV patients status classification requiring IPOC were (2.7%; 5.6%; 11.9%; 43.4%) respectively. The most frequent procedures derived were general surgery (25.1%), orthopaedics (25.0%) and cardiac surgery (10.8%). Surgical specialities with the highest proportion of patients requiring IPOC were cardiac (90.2%), thoracic (45.6%) and neurosurgery (44.3%).
Conclusion(s): About 0.66% of the Catalonian population has needed an intensive postoperative care unit during 2003. This figure is clearly higher to those observed in other national surveys (1). We foresee an increase in resources of IPOC due to increase in the number of oldest patients and more comorbidity among surgical population.
Reference:
1 Minerva Anestesiol 2004; 70: 473–91.

A-668

Risk of pathogen growth in propofol administration systems

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Background and Goal of Study: Propofol is a short-acting intravenous anaesthetic agent, containing egg phosphatide, soya-bean oil and glycerol but no antimicrobial preservatives. Propofol has been implicated in hospital acquired infections and manufacturers insist on asepsis throughout the infusion period (1). Propofol infusions are often maintained for more than 24 hours, mainly in ICU at room temperature. We postulated that contamination of such infusion systems with pathogenic organisms could lead to sustained seeding of patients' bloodstreams with increasing numbers of pathogens. This study was undertaken to establish (i) the ability of common pathogens to multiply in Propofol at room temperature, and (ii) the ability of pathogens to migrate upstream and multiply in the Propofol reservoir.
Materials and Methods: Four common local pathogens (MRSA, *P aeruginosa, P mirabilis* and *C albicans*) were inoculated separately into Propofol, incubated at 35°C and periodically subcultured. Subsequently, administration setups were contaminated at probable entry sites (mechanical junctions) with an equal mixture of the four pathogens. Systems were maintained at room temperature, sampled at 2 and 18 hours, sub-cultured onto blood (Oxoid) and cled (Oxoid) agar, and incubated in air at 35°C. Inoculum weights of 100 cfu/ml were used throughout, equalling the maximum total organism load on hands of Healthcare Workers (HCW) in our hospital. Appropriate controls were performed throughout.
Results and Discussions: Maximum inoculum weight from HCW hands in our hospital was 100 cfu. At 35°C MRSA, *P aeruginosa*, *P mirabilis* and *C albicans* grew exponentially in propofol. No growth or upstream migration occurred at room temperature over 24-hours.
Conclusion(s): At 35°C propofol is an efficient growth medium for common pathogens, but at room temperature the pathogens MRSA, *P aeruginosa, P mirabilis* and *C albicans* were unable to multiply or migrate upstream in infusion systems. At low inoculum weight and room temperature, Propofol does not increase the risk of bloodstream contamination with exponentially multiplying pathogens.
Reference:
1 Trepanier CA, Lessard MR. *Can J Anesth* 2003; 50: 533–537.

A-669

Haemodynamic monitoring during lung recruitment: ScvO2 or CO?

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Background and Goal of Study: High intrathoracic pressures during lung recruitment may cause haemodynamic instability (1). The question in this study was whether central venous oxygen saturation ($ScvO_2$), CVP or MAP monitoring could replace cardiac output (CI) measurements during lung recruitment.
Materials and Methods: 10 patients suffering from ARDS were recruited. All patients were ventilated in pressure control mode ($FiO_2 = 1.0$, respiratory rate = 20, I:E = 1:1). Following basic haemodynamic measurements and blood gas analysis alveolar recruitment was done: PEEP was set at 26 of cmH_2O then 40 cmH_2O of pressure amplitude was applied for 40 seconds. Optimal PEEP was then determined as follows: V_T was reduced to 4 ml/kg, then the PEEP was reduced from 26 by 2 cmH_2O in every 4 minutes and the optimal PEEP was defined as 2 cmH_2O above the level of PEEP, where the PaO_2 suddenly dropped by >10%. After setting the PEEP at the optimal level, the "40/40" manoeuvre was applied again and the tidal volume was set as 6 ml/kg. Haemodynamic parameters determined by arterial thermodilution (PiCCO) and $ScvO_2$ were measured during lung recruitment, then in every 8 minutes till the optimal PEEP was reached. For statistical analysis Pearson's correlation was performed.
Results and Discussions: There was a significant positive correlation between CI and $ScvO_2$ ($r = 0.432$, $p < 0.002$), significant negative correlation between CI and CVP ($r = -0.402$, $p = 0.003$) and no correlation was found between CI and MAP ($r = -0.180$, $p = 0.89$).
Conclusion(s): The results of this pilot study suggest, that $ScvO_2$ monitoring may be an alternative to invasive haemodinamic monitoring during lung recruitment or when defining optimal PEEP in ARDS.
Reference:
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Hyperthermia at intensive care of tickborne meningoencephalitis severe courses

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Tickborne virus meningoencephalitis (TBME) is an infectious disease widely spread on territory of Russia, some Asian and European countries. With its severe courses like meningoencephalitis, poliomyelitis, poliencephalitis and poliencephalomielitis lethality up to present time reaches 70–90%. Before 1970th patients mostly died from severe courses of meningoencephalitis in acute period of the disease but in the period of 1999 and 2003 there were observed no cases of lethality from meningoencephalitis itself but it was caused by its complications.
Goal: To define significance of hyperthermia in intensive therapy at severe cases of Tickborne meningoencephalitis.
Materials and Methods: Analyses of 38 records of treatment patients with severe cases of Tickborne encephalitis were performed. All patients showed brain edema, body temperature 38–39°C. impairment consciousness level up to 11–12 score at Glasgo scale, bulbar disturbances up to 12–13 score at Pittsburg scale. All patients were artificially lung ventilates (ALV) from the first day their staying at the hospital. There were defined two groups of patients. The first group (control) of 18 patients received traditional treatment according to a record not including hyperthermia and the second group (experimental) of 20 patients together with traditional therapy undergone hyperthermia. Hyperthermia was conducted from the first hours of patient's admittance to the Intensive care unit. Hyperthermia was reached by lowering body temperature to 32–34°C covering head with ice. Hyperthermia was applied within two or three days and then evaluation of neurological status was made. If brain edema clinics remain hyperthermia was continued up to five days. ALV continued till full spontaneous breathing restored.
Results: Lethality in control group made 65% in experimental group it made 35%.

Period of coma with the patients of the first group was within 10–15 days and in the second group it made 4–6 days.
Conclusions: Hyperthermia is an effective method in complex therapy of acute faze of meningoencephalitis.

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The relationship of oxygen consumption and sedation state is modified by a greater surgical invasion

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Background and Goals: It is known that oxygen consumption index (VO2I) in postoperative patients depends on the depth of sedation (1). On the other hand, VO2I was also influenced by inflammation (2). This study was carried

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out to clarify whether the relationship of VO2I and the depth of sedation could be influenced by the degree of surgical invasion.
Materials and Methods: We studied 30 patients undergoing either major abdominal surgery (group A; n = 24) or anterior-posterior cervical spine surgery (group B; n = 6), who required mechanical ventilation overnight postoperatively. VO2I was measured with Puritan-Bennett 7250 Metabolic Monitor. In addition to VO2I measurements, Ramsay sedation scale (RSS) was evaluated by the nursing stuff. The measurement was done after the patients rested for at least 30 minutes. The measurements were made every 2 hours, and a total of 168 measurements was performed. Midazolam was used for induction and maintenance of intravenous sedation after admission to the ICU. The initial dose was 0.04 mg/kg/hr and the dose was adjusted by varying the dose by 10% increase or decrease to maintain the adequate depth of sedation (RSS 3–5). The depth of sedation was classified into 3 states, ie, light sedation (RSS 2–3), moderate sedation (RSS 4) and heavy sedation (RSS 5–6). CRP was evaluated as deltaCRP, the difference between the preoperative values and the values 2 days after operation.
Results and Discussions: Data are presented mean plus minus SD. deltaCRP of group A was significantly higher than that of group B (15.7 plus minus 8.2 mg/dl and 7.1 plus minus 4.3 mg/dl, respectively). The heavy sedation state showed a significantly lower value of VO2I compared with the moderate and light sedation states in group B. In contrast, there was no correlation between VO2I and RSS in group A.
Conclusion(s): The results of deltaCRP show that group A had a greater degree of inflammation than group B. The results suggest that the inflammatory state could modify the relationship between sedation and oxygen consumption.
References:
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Could we rely on a new portable echocardiograph to assess bedside haemodynamics in the critically ill?

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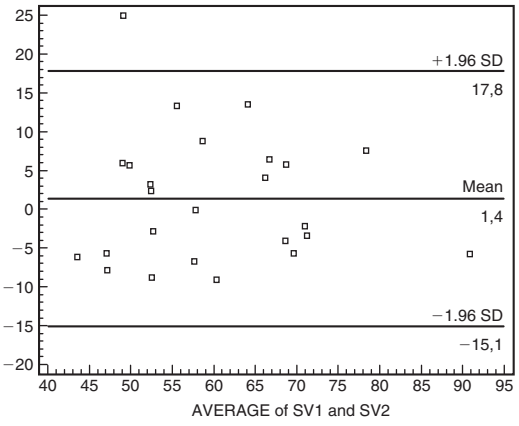
Background and Goals: The classic echocardiography machine is large and bulky. Till now, visualisation with portable echocardiographs was limited. We aimed to evaluate for the first time in Europe an echocardiograph in notebook format for clinical use in an ICU.
Material and Methods: A Vivid 7 echocardiograph (GE Ultrasound, Horton, Norway) was compared with a new handheld device, Vivid*i* (GE Ultrasound, Haifa, Israel). We studied 25 cardiac surgical patients. All patients underwent two consecutive transthoracic echocardiographic examinations, performed by two independent anaesthetists, well trained in echocardiography. After measuring left ventricular end-systolic and diastolic area, mean aortic valve area (AVA) and time velocity integral of the flow across the aortic valve (TVI), we calculated: stroke volume (SV), cardiac output and fractional area contraction (FAC). Agreement between the haemodynamic measurements was assessed with ANOVA multi-variance analysis and a Bland and Altman analysis.
Results and Discussion: The intraobserver and interobserver variability were respectively 3–7% and 4–7%.



Conclusions: Limits of agreement for area measurements (FAC) are comparable with those of combined Doppler and area measurements (SV). The mean of the difference between the two devices approaches the zero line suggesting reliable imaging with the handheld device permitting adequate evaluation of global haemodynamics.

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Family needs in the Intensive Care Unit: development of a questionnaire

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Background and Goal of Study: Survival and quality of life are the primary aims in medicine. Another important aspect is satisfaction of needs of patients and next of kin[1]. Validated instruments for assessment of family needs and satisfaction have been developed for North America[2]. No instrument exists in Europe, except for France[3]. This study assesses content validity of such a questionnaire.
Materials and Methods: A German version of a validated questionnaire[2] was created. The translated instrument was presented to patients, next of kin, ICU nurses and ICU physicians to assess content validity including the following: understandability of each of the 42 items of the questionnaire, relevance of each item, appropriateness of wording, length, completeness of the questionnaire, range of answers and overall impression.
Results and Discussions: 39 questionnaires with sufficient answers were returned.

Overall impression	Excellent or very good	71.8%
	Satisfactory	10.3%
	Unsatisfactory or poor	5.1%
	Empty	12.8%
Coverage*	Absolutely or mostly complete	82.0%
	Reasonably complete	2.6%
	Unsatisfactory or poor	0.0%
	Empty	15.4%
Overall understandability**		90.0%
Overall relevance to Swiss culture **		85.5%

*All aspects of medical treatment and nursing are covered.
**Only results for excellent/good are shown.

Based on the inquiry, questions with agreement <90% were discussed and 13 of them were rephrased in a roundtable to further improve understandability.
Conclusion(s): This preliminary German questionnaire concerning family needs in the ICU shows good content validity. As compared to the original questionnaire[2] no questions had to be omitted or added. To assess construct validity, reliability, sensitivity and feasibility a follow-up study is under way.
References:
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2 Heyland DK, J Crit Care 2001; 16: 142–9.
3 Azoulay E, Am J Respir Crit Care Med 2001; 163: 135–9.
Acknowledgement: supported in part by Astra Zeneca.

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The role of probiotics in preventing multiple-trauma patients from infections in Intensive Care Unit (I.C.U.)

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Background and Goals: Infections, in I.C.U. multiple-trauma patients (head trauma, thoracic trauma, surgical trauma, fractures), is a big nightmare for I.C.U. doctors. The administration of antibiotics in preventing such infections has caused many discussions. Is the PROBIOTICS administration, a solution in preventing these infections?
Material and Methods: We have studied, starting from the day of entrance in I.C.U., 35 multiple trauma patients (20 male, 15 female), aged between 25 and 50 years, with APACHE II SCORE ⩽ 10 and ISS: 8 ± 2. (Patients with peritonitis and abdominal operation have been excluded.) These patients have been randomly assigned in 2 groups, group A (18 patients) and group B (17 patients): The patients of group A, from their first day in I.C.U., have received both treatment for their subjacent problems and Saccharomyces bulardii (caps ultra-levure), two capsules every 6 hours, for 10 consecutive days. The patients of group B have received treatment only for their subjacent problems. Alimentation through feeding tube has been given in both groups. Laboratory tests, such us blood tests, urine tests, rectum temperature, chest radiograph, trachea and urine culture, blood culture were

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performed everyday, in both groups. Symptoms like vomiting and diarrhoea were being monitored.
Results: The administration of Saccharomyces bulardii (caps ultra-levure) was well accepted, without side effects. During the first 10 days from the day of entrance in I.C.U., in group A two (2) cases of certified infection have been noted, whereas in group B seven (7) cases of certified infection have been noted. The difference between the two groups is statistically significant ($p = 0{,}04$).
Conclusions: The administration of Saccharomyces bulardii as prophylaxis to I.C.U. patients, reduces the danger of a future infection to them. Saccharomyces bulardii (caps ultra-levure) is well accepted by the patients and the cost of treatment is very low.
References:
1 Colum Dunne et al. Antonie van Leeuwenhoek 1999;76: 279–292.
2 Cremonini F. Aliment Pharmacol Ther 2002; 16: 1461–1467.
3 Ailsa L. J Clin Gastroenterol 2003; 36 (2): 111–119.

A-677

Voltage-gated sodium channel changes in NMJ during sepsis

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Background and Goal of Study: Sepsis is one of multiple factors responsible for polyneuropathy in the ICU. Voltage-gated sodium channels (Na(v)s) in neuromuscular junctions (NMJ) play a role in the propagation of the action potential. The objective of our work is to study the impact of sepsis on the functionality of Na(v)s.
Materials and Methods: The study was realised on two groups of rats: group S rats underwent caecal ligation and puncture and C rats were the control group. Using the patch-clamp technique in isolated rat flexor digitorum brevis myofibers, we investigated the electrophysiological effects on Na(v)s 10 days after the start of sepsis.
Results and Discussions: 63 and 36 measurements were realised in group S and C respectively. Voltage dependence of peak Na+ conductance (gNa) was low 10 days after the start of sepsis. We conclude that it is possible to calculate from conductance the number of open gate channels (nb S: 279 vs C 498). The magnitude of Na+ current amplitude (Im) was diminished. However the activation τm and inactivation τh constants of gate channels were identical. The half inactivation potential $V_{1/2}$ was significantly different.

	S	C	p
Im (nA)	1.84 ± 0.14	4.89 ± 0.662	<0.05
gNa (mS/cm^2)	9.3 ± 0.005	16.6 ± 0.004	<0.05
τm (ms)	0.223 ± 0.02	0.173 ± 0.026	0.14
τh (ms)	0.40 ± 0.012	0.44 ± 0.024	0.17
$V_{½}$ (mV)	−40.24	−36.6	<0.05

Sepsis attenuates sodium channel activity, decreases the peak Na(+) current amplitude and the conductance without modifying the opening properties of channel gating.
Conclusion(s): These results show that sepsis induces modification of the electrophysiology of Na(v)s at NMJ. This can be due to modification of the number of channels, or variation of their subunits. Further studies must be done to confirm this hypothesis.

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Euglycemic hyperinsulinemia in a ewe septic shock model

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Introduction: Euglycemic hyperinsulinemia (EH) has been shown to reduce plasma concentrations of tumor necrosis factor alpha in lipopolysaccharide-induced systemic inflammation in pigs (1). The aim of our study was to investigate whether EH could improve survival in a sheep septic shock model.
Methods: Fourteen anesthetized, mechanically ventilated, hemodynamically monitored sheep received 1.5-gram/kg body weight feces intraperitoneally to induce sepsis. After two hours, animals were randomized to: EH group ($n = 7$) – insulin 0.25 U/kg/hour, 20% glucose (to maintain blood glucose 40~90 mg/dl), and potassium (to maintain potassium level 4.0~5.5 mmol/L); control group ($n = 7$) – no insulin. Ringer's lactate (RL) + hydroxyethyl starch (Voluven) (volume ratio = 1:1) was titrated to maintain pulmonary artery occlusion pressure (PAOP) at baseline level throughout the experimental period without administration of any antibiotics or vasoactive drugs. The animals were followed until spontaneous death or for a maximum of 30 hours.
Results: There were no differences between groups in blood glucose or potassium concentrations. Arterial insulin concentration was significantly higher in the EH group. Time to develop hypotension and oliguria was similar in both groups. PaO_2/FiO_2 decreased in both groups. Interleukin-6 (IL-6) levels initially increased in both groups but decreased more in the EH group than in the control group ($p < 0.05$). There was no difference in survival time (19.9 ± 2.2 vs 17.8 ± 2.7 hours, EH group vs control group respectively, $p = 0.54$).
Conclusion: In this clinically relevant septic shock model, EH seemed to have anti-inflammatory effects, reflected by lower IL-6 concentrations. However, EH did not have beneficial effects on hemodynamics, organ function, or survival.
Reference:
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A-679

Can liver perfusion improve by adding dobutamine to norepinephrine in septic shock?

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Background and Goal of Study: To investigate the effect of dobutamine when added to norepinephrine on liver perfusion as measured by the plasma disappearance rate (PDR) of indocyanine green (ICG) in septic shock.
Materials and Methods: 10 patients fulfilling the criteria of septic shock were recruited in this auto-control clinical trial. Mean arterial pressure (MAP) was kept above 70 mmHg with norepinephrine and invasive haemodynamic monitoring by PiCCO was commenced. Hypovolaemia as indicated by intrathoracic boold volume index (ITBVI) <850 ml/m^2, was corrected and then the ICG PDR was measured by the LiMON, by giving 0.25 mg/kg ICG. If PDR ⩽ 18% dobutamine was administered at a rate of 5 μg/kg/min. After 60 minutes of treatment haemodynamic and PDR measurements were repeated. Blood samples were taken when haemodynamic stability by norepinephrine was achieved (t_0) and after one hour of inotropic support (t_1). Serum lactate, CRP, PCT levels, liver and renal function and blood gas analysis (arterial and central venous) were performed. For statistical analysis paired sample T-test was used.
Results and Discussions: There was no difference in cardiac output (4.0 ± 0.9 vs. 4.0 ± 0.9 L/min/m^2, $p = 0.91$), heart rate (102 ± 15 vs. 108 ± 25/min, $p = 0.95$), central venous haemoglobin saturation (76 ± 9 vs. 77 ± 10%, $p = 0.37$), and serum lactate levels (1.75 ± 1.45 vs. 2.15 ± 1.40 mmol/l, $p = 0.36$) between the two measurement points. PDR increased slightly but it did not achieve statistical significance (14.7 ± 6.7 vs. 16.1 ± 8.7%, $p = 0.22$).
Conclusion(s): The results of this pilot study suggest that routine administration of dobutamine to norepinephrine in order to improve liver perfusion in septic shock cannot be supported, as indicated by the non-significant change in ICG PDR. These results are in contrast to recent animal data (1), however, the completion of the study is required to come to firm conclusions.
Reference:
1 De Backer D, Zhang H, Cherkhaoui S, et al. *Shock* 2001; 15: 208–14.

A-681

Terlipressin or norepinephrine in hyperdynamic septic shock: a prospective, randomized study

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Background and Goals: To compare, in patients with hyperdynamic septic shock, the effects of norepinephrine (NE) or terlipressin (TP) on haemodynamic parameters and renal function.
Material and Method: Twenty patients with hyperdynamic septic shock were prospectively randomized to receive NE or TP after fluid resuscitation. Global haemodynamic parameters, oxygen consumption, urine flow, creatinine clearance, and arterial blood lactate levels were measured.
Results: Mean arterial pressure, systemic vascular resistance, pulmonary vascular resistance, and left and right ventricular stroke work were significantly increased with both drugs. With TP, but not with NE, a significant decrease in heart rate (from 113 ± 17 to 104 ± 11 b · min^{-1}, $P < 0.01$) and cardiac index (from 5.1 ± 1.7 to 4.2 ± 1.6 L · min^{-1} · m^{-2}, $P < 0.05$) was observed, with no change in stroke volume. Oxygen delivery (from 784 ± 131 to 701 ± 92 mL · min^{-1} · m^{-2}) and consumption (from 244 ± 69 to 210 ± 54 mL · min^{-1} · m^{-2}) were significantly decreased with TP, but not

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with NE. Blood lactate concentrations were significantly decreased with both drugs. Renal function assessed by urine flow, creatinine clearance and sodium extraction fraction was improved with both drugs.
Conclusions: In patients with hyperdynamic septic shock, both NE and TP were effective to raise mean arterial blood pressure. With TP, but not NE, the improvement in blood pressure was achieved at the expense of cardiac index and oxygen consumption which were significantly decreased. Renal function was improved with both drugs. Larger studies should be carried out to further evaluate the impact of these findings on long-term organ dysfunction or survival of septic shock patients.

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Increasing mean arterial pressure in patients with septic shock: effects on oxygen variables and renal function

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Background and Goals: The effects of increasing mean arterial pressure (MAP) were measured on oxygen variables, and renal function in septic shock.
Material and Methods: Twenty-eight patients with septic shock who required fluid resuscitation and pressor agents to increase and maintain MAP $>$ 60 mmHg were included in a prospective, open-label, randomized, controlled study. Patients were treated with fluid and norepinephrine to achieve and maintain a MAP of 65 mmHg. Then, they were randomized in two groups: in the first group (n = 14), MAP was maintained at 65 mmHg, in the second group (n = 14), MAP was increased to 85 mmHg by increasing the dose of norepinephrine. Haemodynamic parameters (MAP, heart rate, mean pulmonary artery pressure, pulmonary artery occlusion pressure, cardiac index, systemic vascular resistance index, pulmonary vascular resistance index, left and right ventricular stroke index), metabolic parameters (oxygen delivery, oxygen consumption-calorimetric method, arterial lactate), and renal function parameters (urine flow, serum creatinine, creatinine clearance) were measured.
Results: After introduction of norepinephrine, similar values of haemodynamic, metabolic, and renal function parameters were obtained in both groups. No changes were observed in group 1 during the study period. Increasing MAP from 65 to 85 mmHg with norepinephrine in group 2 resulted in a significant increase in cardiac index from 4.8 $\pm$ 1.8 to 6.0 $\pm$ 1.6 $L \cdot min^{-1} \cdot m^{-2}$ ($P < 0.01$). Arterial lactate (3.1 $\pm$ 1.4 and 2.6 $\pm$ 1.6 $mEq \cdot L^{-1}$) and oxygen consumption (247 $\pm$ 32 and 228 $\pm$ 52 $mL \cdot min^{-1} \cdot m^{-2}$) did not change. No changes were observed in renal function parameters: urine flow 61 $\pm$ 38 and 73 $\pm$ 46 mL, serum creatinine 163 $\pm$ 182 and 150 $\pm$ 143 $\mu mol \cdot L^{-1}$, and creatinine clearance 48 $\pm$ 39 and 70 $\pm$ 68 $ml \cdot min^{1} \cdot 1.73\,m^2$.
Conclusions: Increasing MAP from 65 to 85 mmHg with norepinephrine neither affects metabolic parameters nor improves renal function.

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A possible role of white adipose tissue in sepsis

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Background and Goal of Study: It has recently been established that white adipose tissue, besides its metabolic role, storing and releasing fatty acids, has a major role in secreting a variety of hormones and mediators which are referred to as adipokines.[1]

In particular, it has been suggested that adipose tissue releases pro-inflammatory cytokines, e.g. IL-6 in response to hypoxia. Thus we felt tempted to investigate how adipokine expression relates to sepsis in an animal model.
Methods: After obtaining a Home Office licence under the Animal Rights Act, we investigated sixteen healthy, non-obese male mice (body weight 25–28 g). Eight animals served as controls, in another eight animals, sepsis was induced by intra-peritoneal LPS injection. Twenty-four hours after induction of sepsis, the experimental animals were killed and RNA extracted from epididymal fat was investigated by real time PCR, in order to quantify expression of IL-6, IL-18, nerve growth factor (NGF), hypoxia-induced factor (HIF), adipsin and adiponectin in comparison to controls.
Results: Twenty-four hours after induction of sepsis, real time PCR revealed significant increases in the expression of IL-6 (500 fold), NGF (10 fold), TNF_{α} (5 fold) and HIF (3 fold), while there were significant decreases in the expression of IL-18 (0.4 fold), adipsin (0.15 fold) and adiponectin (0.2 fold).
Conclusions: These results show that white adipose tissue is an organ system which actually suffers from hypoxia during sepsis. It responds by a marked increase in the expression of pro-inflammatory cytokines. At the same time, the expression of anti-inflammatory cytokines as well as the expression of adipsin and adiponectin is reduced. Thus, we propose the hypothesis that white adipose tissue may be an important contributor to the pathophysiology of sepsis.
Reference:
1 Trayhurn P and Wood IS. Adipokines: inflammation and the pleiotropic role of white adipose tissue. *British Journal of Nutrition* 2004; 92: 347–355.

Resuscitation and Emergency Medicine

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Austrias Nationwide Early Defibrillation Program

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Background and Goal of Study: Significant improvement of survival and neurological outcome after out of hospital cardiac arrest (OHCA) has been reported trough public access defibrillation (PAD). Therefore a nation wide non-governmental initiative run by the Austrian Red Cross was started in November 2001 to provide public accessible Automated External Defibrillators (AEDs). Supported through a multimedia campaign 1785 AEDs were placed all over Austria until October 2004. Austrian data showed hospital discharge rate after OHCA at 10.6% so far.
Materials and Methods: Data about all OHCA incidences in which AEDs were used by bystanders irregardless of their profession were recorded according to Utstein Style since December 2002.
Results and Discussions: 52 incidences where reported over a period of 30 months. 5 cases were excluded due to the use of the AED by professional first responders. OHCA was confirmed in 44 cases. Shock was indicated in 23 out of these 44 incidences (52.3%) and advised correctly in 22 arrests (95.7%). Correct analysis was impaired by ECG artefacts in one case and lead to false negative decision. In presence of non shockable ECG-rhythms in 18 cases no shock was indicated correctly every time (100%). Six times no cardiac rhythm was recorded. Mean time from emergency call to first AED shock was 4.78 $\pm$ 3.08 minutes vs. 9.91 $\pm$ 3.65 (p = 0,0002) minutes until EMS arrival, as first time point of possible AED shock by professional helpers. 15 individuals were admitted to an intensive care unit (65.2%). 11 out of the 15 (47.8 % of all patients found with shockable rhythms) primary survivors already left the hospital in good neurological condition.
Conclusion(s): A significant reduction of "Call-to-shock-time" was observed resulting in improved survival and neurological outcome. However the number OHCA incidences were an AED was used was low. Further research is necessary to clarify cost-effectiveness.
Reference:
1 Caffrey S. L., et. al. Public use of automated external defibrillators. N Engl J Med 2002; 347 (16):1242–7.

A-685

Vasopressin + Milrinone for cardiopulmonary resuscitation (CPR) in pigs with myocardial infarction – effect on cardiac index

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Background and Goal of Study: Vasopressin (VP) in contrast to epinephrine (EPI) increases coronary perfusion pressure during and after CPR [1]. Milrinone (MIL) compared to placebo improves cardiac index (CI) after CPR in pigs [2]. Could the combination of VP and MIL, with its absence of beta-adrenal stimulation, for CPR in pigs with myocardial infarction [3] lead to an increase of CI?

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Materials and Methods: After institutional approval, a median thoracotomy was performed in 32 pigs and they were instrumented for measurement of CI and mean arterial pressure (MAP). After Induction of a 4 minute period of ventricular fibrillation, the circumflex coronary artery was ligated. All pigs received a standard open heart CPR according to the ILCOR 2000 guidelines. The pigs were randomised into four different vasopressor groups (each n = 8). G1 (EPI 30 μg/kg); G2 (VP 0.4 IU/kg); G3 (VP 0.2 IU/kg + EPI 15 μg/kg); G4 (VP 0.4 IU/kg + MIL 50 μg/kg bolus over 5 min. and 0.4 μg/kg/min). CI and MAP were measured before CPR and 4,8,15 and 30 min after restoration of a spontaneous circulation (ROSC). ANOVA for repeated measures was used, $p < 0.05$ was considered statistically significant, all data are expressed as mean ± SD.
Results and Discussions: All animals were resuscitated successfully and showed no significant differences in MAP.

	Cardiac index (CI ml/min/kg)			
	G1	G2	G3	G4
Before CPR	118 ± 24	139 ± 38	109 ± 24	146 ± 39
ROSC + 4	113 ± 33#	102 ± 44#	114 ± 15#	169 ± 64
ROSC + 8	106 ± 42	76 ± 27#	117 ± 39	128 ± 41
ROSC + 15	67 ± 22#	70 ± 19#	88 ± 39	121 ± 23
ROSC + 30	66 ± 13#	71 ± 18#	69 ± 36#	121 ± 35

#$p < 0.05$ compared to G4.

Conclusion(s): VP + MIL compared to all other groups improves significantly CI without a decrease in MAP. It therefore could be an alternative to ADR for CPR and should be further investigated.
References:
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2 Niemann J. et al., Circulation 2003(108)24:3051–55.
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A-686

Impairment of correct ECG-analysis of automated external defibrillators due to electromagnetic interference

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Background and Goal of Study: Automated External Defibrillators (AEDs) have been designed to provide lifesaving shocks within the first, decisive minutes after sudden cardiac arrest. As ECGs are obtained from the body surface, electromagnetic fields were detected to weaken signal quality [1]. We tested the hypothesis that strong electromagnetic fields are not able to impair correct ECG-analysis and produce wrong positive shocks in AEDs currently available in Austria.
Materials and Methods: Five AEDs were tested: Access® (Access Cardiosystems), CR+® (Medtronic), Fred Easy® (Schiller), HS1® (Philips), Responder® (GE Healthcare). Four sites were selected in a transformer substation, which provided strongest electromagnetic fields generated by high voltage power lines (50 Hz ac) and power lines for the Austrian Railway Company-network (16$$ Hz dc). Participants were laid on the floor and tested parallel and perpendicular to the source.
Results and Discussions: The AEDs were tested on 19 healthy subjects at 4 sites (n = 152 for each AED).

	Wrong Pos. (n/%)	True Neg. (n/%)
Access®	0	152/100%
CR+®	0	152/100%
Fred Easy®	4/2.63%	148/97.37%
HS1®	0	152/100%
Responder®	9/5.92%	143/94.08%

Our findings suggest that strong electromagnetic fields are able to impair ECG analysis of AEDs. Since wrong positive results did not occur in all devices tested, we conclude that models of different manufacturers are unequally susceptible to electromagnetic interference. As the areas studied were of restricted access, further research will be necessary to evaluate the impact of electromagnetic interferences on AED analysis in places accessible to the general public.
Conclusion: Some of the AEDs available in Austria are susceptible to strong electromagnetic fields.
Reference:
1 Schlimp CJ, Breiteneder M, Lederer W. Acta Anaesthesiol. Scand. 2004;48:595–600.

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Automated external defibrillators in Austrian correctional facilities

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Background and Goal of Study: Death in correctional facilities often comes prematurely. Mortality due to drug overdose, suicide and cardiovascular disease is increased notably among inmates [1]. As part of a nationwide Public Access Defibrillation (PAD) campaign, the Austrian Red Cross equipped Austria's correctional facilities with Automated External Defibrillators (AEDs). It is the goal of this study to perform a descriptive analysis of AED-uses in correctional facilities and to test the hypothesis whether a reduction of call to shock time can be achieved by the AEDs' implementation.
Materials and Methods: 28 penitentiaries were equipped with AEDs by the first quarter of 2003. By then, approximately 7800 people were in detention. The incidences, in which an AED was used, were analyzed in regard of the inmate's age, gender, medical history, date, time, location and type of incidence.
Results and Discussions: Seven incidences occurred, drug abuse was found in 3 (42.9%) cases, all of whom died as a consequence to hypoxia after opiate intoxication. Suicide by strangulation was attempted in two cases (28.6%), one survived, suffering form neurological damage. Shock was indicated in presence of ventricular fibrillation and delivered in two cases, both of whom could not be resuscitated. Mean call-to-shock time, respectively call to the result of the first analysis was 206 sec. ± 108.76 sec SD. This was three times faster than it took the EMS to arrive at the scene (mean 617 sec ± 157.66 sec. SD).
Conclusion: Accessibility within a three minutes range, time consuming access, well trained, highly motivated staff and close surveillance 24 h per day seemed promising for an effective AED implementation. Only two cases of shock-able rhythms were found. Consequently, these facts do not permit an overall assessment of the effectiveness of AEDs in these settings. An impressive reduction of the call-to-shock time could be shown. Further research will be needed to evaluate if AEDs prove to be as effective as in other settings.
Reference:
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A-688

Perioperative cardiac arrest and cardiopulmonary resuscitation: are we doing it right? experience from a developing country

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Background and Goal of Study: Cardio-pulmonary resuscitation is an integral part of anaesthetic training. In Nigeria, these skills are taught mainly during medical school and postgraduate training. The study sought to assess how closely anaesthetists in a Nigerian teaching hospital abide by existing guidelines?
Materials and Methods: All perioperative adult cardiac arrest that occurred in 2003 were prospectively studied. All patients <12 years and cardiac arrests occurring outside the direct supervision of the anaesthetists were excluded. Duration of arrest, cardiac arrest rhythm, management and cadre of presiding anaesthetist were documented along with immediate outcome.
Results and Discussions: Thirteen cardiac arrests occurred in 2147 cases resulting in an incidence of 6 per 1000. The mean age of patients was 30.23 ± 11.06 years. Orotracheal intubation, manual ventilation with 100% O_2 and cardiac compressions were instituted in all cases. Seven patients had non- VF/VT rhythms.

Table 1. Therapy given during arrest.

Therapy given	Number of patients	Mean dose (SD)	Mean number of doses
Epinephrine	13	2.9 mg (1.3)	3.5
Atropine	13	2.7 mg (0.8)	1.5
Defibrillation	3	880 J (207)	3

The mean duration of arrest was 25.7 ± 13.3 minutes.
The average interval between epinephrine doses was 7.5 minutes which is more than twice the recommended guidelines. Atropine was administrated

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regardless of cardiac arrest rhythm and defibrillation was not optimal. Immediate survival occurred in 5 patients (38.46%).
Conclusion(s): Anaesthetists in our hospital are not applying proper resuscitation guidelines. The lack of organized simulation practice resulted in deficient knowledge and skills. There is a need for a dedicated cardiac arrest team to ensure frequent practice in cardiopulmonary resuscitation.

A-689

Advanced life support and critical care in spaceflight

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Background and Goal of Study: Increased human presence in space within the next decades requires clear guidelines for treatment of medical emergencies onboard manned orbital platforms.
Materials and Methods: During an international TEMOS project, sponsored by German Aerospace Agency DLR, scenarios for the most likely medical emergencies with high impact on mission outcome were investigated:

Trauma with burns and inhalation injury, severe cardiac dysrhythmias with myocardial ischaemia, internal haemorrhage with hypovolaemic shock and complex situations during extravehicular activities with loss of spacesuit integrity. Procedures and devices were tested in Gagarin Cosmonaut Training Centre Russia in spacecraft mock-ups, in centrifuges and in parabolic flights. Algorithms were developed and tested in Human Patient Simulator in Germany. Broadband tele-medical links were utilized when applicable.
Results and Discussions: Proposed changes include: modification, standardisation and addition of telemedicine equipment in space segment and in ground facilities, improvement of ALS algorithms on board the ISS and Soyuz TM spacecraft, addition of drugs, instrumentation, diagnostic devices and ALS-related hardware to the existing ISS medical equipment, upgrade of Soyuz TM descent vehicle for ALS during de-orbit, modification of re-entry trajectories, implementation of standard protocol for vital data collection using minimal intrusive monitoring devices and the use of HPS as an additional tool for decision making support in operational space medicine.
Conclusion(s): Application of project results in analogous terrestrial environments and strategies for emergency medical support in interplanetary mission are the next research goals.
Reference:
1 TEMOS Project, German Aerospace Agency 2001–2004.

A-690

Volume expansion to increase preload during cardiopulmonary resuscitation (CPR) with continuous airway pressure (CPAP)

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Background and Goals: This investigation was designed to evaluate the changes in haemodynamics and blood gases under repetitive volume expansion during CPR with a continuous airway pressure (CPAP). The aim was to evaluate the amount of volume needed to see significant changes in these parameters.
Material and Methods: Nine domestic swine (weight: 25 kg) were studied after induction of ventricular fibrillation. After two minutes external chest compression were initiated at a rate of 100 cpm (Thumper) combined with a CPAP of 30 mbar. Also intravenous epinephrine was administered as a bolus (45 μg/kg), followed by a continuous infusion (13 μg/kg per min). Three minutes later the first of fife volume applications (Voluven 200 ml each) was given. Before and after each application, arterial blood gases, acid base status, haemodynamics (MAP, CO, CPP, CoPP) and tidal volumes were sampled.
Results: The CPR-protocol was performed in nine piglets. The mean arterial pressure (MAP) increased statistically significant with volume application of 400 cc and more. The cardiac output (CO) raised up significantly starting from a volume of 600 cc and more. We saw no significant changes in coronary perfusion pressure (CoPP), cerebral perfusion pressure (CPP) and PO2-levels. PCO2 increased significantly with volume application, but etCO2 remained stable. At high volume levels (800 cc) the tidal volume (VT) decreased.
Conclusions: Increasing the preload by volume expansion with an application of 24 ml/kg KG and more is beneficial for CO in pigs undergoing CPAP-CPR. Avoiding the negative influence of CPAP on venous return by increasing preload might be a mechanism explaining these results.

A-691

Combination of hypertonic saline and vapressin in CPR of domestic pigs

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Background and Goal of Study: Several studies showed that application of vasopressin (1) and hyperonic saline (2,3) during CPR improves resuscitation success. Though the combination of these promising medications has not been tested yet.
Materials and Methods: Cardiac fibirllation was induced in 40 domestic pigs. After 6 minutes of cardiac arrest cpr was started. Animals were divided in four groups. They received either epinephrine and normal saline (Gr. I) or epinephrine and hypertonic saline (NaCl 7,2%, Gr. II) or vasopressin and normal saline (III) or vasopressin and hypertonic saline (IV). After 5 minutes of cpr animals were defibrillated. Arterial, left ventricular, central venous and intracranial pressures were measured continiously. Myocardial (MPP) and cerebral perfusion pressures (CPP) were calculated. Myocardial (MBF)and cerebral blood flows (CBF) were measured by coloured microspheres before cardiac arrest and during CPR.
Results and Discussions:

Group (n)	I (10)	II (10)	III (10)	IV (10)
ROSC	0	6	2	7
MBF	1,4 ± 0,5	2,6 ± 0,4	1,6 ± 0,5	2,8 ± 0,5
CBF	0,9 ± 0,4	1,5 ± 0,5	1,0 ± 0,5	1,6 ± 0,4
MPP	32 ± 10	31 ± 11	36 ± 11	35 ± 13
CPP	40 ± 15	38 ± 16	44 ± 19	45 ± 22

Resuscitation success was significantly higher in group II than group I and significantly higher in group IV than in I and III (chi^2-test, $p < 0.05$). CBF and MBF in group II and IV were significantly higher than in I and III (ANOVA, $p < 0.05$) MPP and CPP did not differ.
Conclusion(s): Application of hypertonic saline effects higher resuscitation success by increasing myocardial and cerebral blood flow in combination with vasopressin as well as in combination with epinephrine. Vasopressin is not superior to epinephrine.
References:
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2 Krep H et al: Resus, 2004; 63; 73–83.
3 Breil M et al: Resus, 2003; 307–17.

A-692

Bispectral Index (BIS) is improved after vasopressin, but not after fluid resuscitation therapy during uncontrolled haemorrhagic shock

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Background and Goal of Study: Recent investigations reported a correlation between the bispectral index (BIS) and cerebral hypoperfusion during cardiac surgery (1) and cardiopulmonary resuscitation (2). This study was designed to report the changes of BIS during uncontrolled haemorrhagic shock.
Materials and Methods: Following approval of the Animal Investigational Committee, anaesthetised pigs (12 to 16 weeks, 38 to 42 kg) underwent a simulated penetrating liver trauma. The animals were bled until haemodynamic decompensation, indicated by a mean arterial pressure less than 25 mm Hg, and a heart rate of less than 20% of its peak value. At this point, either a bolus administration of vasopressin (0.4 U/kg; VP group, n = 9), or fluid resuscitation (hydroxyethylstarch 30 ml/kg, and Ringer's solution 30 ml/kg; FR group, n = 9) was performed. FiO_2 was raised to 1.0.
Results and Discussions: Mean arterial blood pressure (MAP) decreased significantly (Baseline vs. intervention: *VP*: 84 ± 17 vs. 19 ± 5 mmHg; *FR*: 76 ± 2 vs. 27 ± 1 mmHg; $P < 0.05$), and heart rate (HR) increased significantly (*VP*: 88 ± 8 vs. 201 ± 33 bpm; *FR*: 104 ± 6 vs. 206 ± 6 bpm; $P < 0.05$) with haemorrhage in all animals. A significant drop of BIS values was observed before hemodynamic decompensation (*VP*: 64 ± 3 vs. 48 ± 12; *FR*: 59 ± 3 vs. 46 ± 5; $P < 0.05$), although MAP and HR were still above the defined intervention threshold. Mean intervention time was *VP*: 32 ± 8 vs. *FR*: 37 ± 4 min. Following 5 min after intervention, both BIS (59 ± 18) and MAP (58 ± 21 mmHg) had increased in the VP group, while BIS (27 ± 7) and MAP (30 ± 3 mmHg) could not be stabilised in the FR group.

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Conclusion(s): In this porcine model of uncontrolled haemorrhagic shock, BIS indicated an impaired cerebral circulation and beginning haemodynamic decompensation. Administration of vasopressin, but not fluid resuscitation therapy, stabilised MAP and BIS.

References:
1 Br J Anaesth. 2003;90:694–8.
2 J Cardiothorac Vasc Anesth. 2003;17:506–8.

A-693

Brain metabolism assessed with microdialysis during fluid resuscitation in uncontrolled haemorrhagic shock after penetrating liver trauma

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Background and Goal of Study: Intracerebral microdialysis is a sensitive tool to analyse metabolic changes (1). Lactate (La) and the lactate/pyruvate (La/Py) ratio are important markers of the redox state of tissue, while elevated glycerol (Gly) indicates cell membrane damage (2). The purpose of this study was to investigate brain metabolism during fluid resuscitation in an established porcine model of uncontrolled haemorrhagic shock.

Materials and Methods: Following approval of the Animal Investigational Committee, 9 healthy piglets (12 to 16 weeks, 38 to 42 kg) underwent general anaesthesia. After preparing a small burr hole, a microdialysis catheter was inserted into the cerebral cortex. An incision across the right liver lobe was performed to simulate a penetrating liver trauma. When mean arterial pressure was less than 25 mm Hg, or heart rate declined progressively to less than 20% of its peak value, all animals were treated with a combination of Ringer's solution (RS; 40 ml · kg^{-1}) and hydroxyethyl starch (HES; 20 ml · kg^{-1}) over 30 minutes. FiO_2 was raised to 100%. After fluid administration, bleeding was controlled by manual compression of the liver. All surviving animals were observed for one hour, while ventilated with a FiO_2 of 50%.

Results and Discussions: Six out of nine animals survived up to the final measurement. At the point of haemodynamic decompensation cerebral interstitial La, La/Py ratio and Gly increased compared to baseline (BL) (mean ± SEM; La 2.1 ± 0.6 mM · L^{-1} vs. 0.9 ± 0.1 mM · L^{-1}; $P < 0.05$; La/Py ratio 0.03 ± 0.01 vs. 0.01 ± 0.01; $P < 0.05$; Gly 30.1 ± 6.0 μM · L^{-1} vs. 17.0 ± 2.5 μM · L^{-1}; $P < 0.05$), respectively. After fluid resuscitation, La and La/Py ratio decreased again, while Gly further increased (42.9 ± 8.7 μM · L^{-1} after 60 min vs. BL; $P < 0.05$).

Conclusion: In this model of uncontrolled haemorrhagic shock, changes of cerebral energy metabolism detected by intracerebral microdialysis indicated anaerobic glycolysis and degradation of cellular membranes during haemodynamic decompensation.

References:
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A-694

A search for safe and rapid method of immobilization. A study in macague monkeys

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Background and Goal of Study: After the rapid incapacitation of persons in Moscow theatre ended in disaster of 119 dead people, it is probably wise to educate and involve anaesthesiologists in the search of rapid and safe forms of immobilization suitable for disaster medicine. Till now some research is published about the use of benzodiazepines, opioids and α_2 agonists for induction of totally reversible immobilization in small laboratory animals. If such a combination is suitable for immobilization in man, it should be tested in Macaque monkey first, because of its similarity to man concerning the sensitivity to respiratory depression.

Materials and Methods: After Ethical Committee approval ten laboratory Macaque Mulatta monkeys, weight 3,2 ± 0,5 kg, were given an injection containing the combination of midazolam (0,25 mg · kg^{-1}), medetomidine (50 μg · kg^{-1}) and fentanyl (5 μg · kg^{-1}) into the deltoid muscle. Onset time (beginning of ataxia), immobilization time (the moment of sinking to the floor) and loss of grip reflex time were obtained. After immobilization haemoglobin saturation and pulse rate were recorded. 20 minutes after the first injection atipamezol (250 μg · kg^{-1} IM), a specific α_2 antagonist, was given and recovery time recorded. Paired t-test with Bonferroni correction was used to analyze the changes in pulse rate.

Results and Discussions: Data are presented as means ± SD. Onset time was 85,8 ± 14 s, immobilization time 221 ± 46,4 s, loss of grip reflex time 235,7 ± 43,2 s. Haemoglobin saturation remained above 90% in all the cases. Pulse rate did not change significantly (P = 0,78). Recovery time was 252 ± 96 s after atipamezol injection. Immobilization was induced in all the monkeys. There was no severe respiratory depression or cardiovascular instability during the study period. Short recovery time after antagonization shows prevailing α_2 agonist component.

Conclusion(s): The present method of totally reversible immobilization is reliable, rapid and safe method in Macaque monkey. Our results encourage similar studies in healthy volunteers.

A-698

Safe use of the Cobra-PLA device in anesthesia and in an emergency

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Background and Goal of Study: The face mask, laryngeal mask, and the Combitube are devices commonly used to ventilate the lungs of nonintubated patients, but some disadvantages may result in inadvertent ventilation-associated complications.The Cobra-PLA is a new alternative in managing the airway (1).

Materials and Methods: The aim of this study was to assess whether the newly developed Cobra-PLA can provide sufficient ventilation and adequate oxygenation in patients with predictable difficult airway undergoing routine induction of anesthesia and in an emergency.

Results and Discussions: We studied 16 patients, ASA physical status I–IV, and were allocated in 2 groups of 8 patients each: Control Group (CR) patients underwent general anesthesia for non-cardiac surgery with predictable difficult airway (Mallampati score 3–4, limited cervical mobility, interincisive dental distance <5 cm) and Emergency Group (E) of patients with unpredictable difficult airway underwent general anaesthesia for emergency surgery. In all cases, the Cobra-PLA was inserted successfully on the first attempt (range, 8 to 29 s; median, 21 s). Ventilation and blood gas variables 10 min after the insertion revealed both sufficient ventilation and oxygenation in all patients. Insertion times for the Cobra-PLA were comparable to those reported for laryngeal mask airways.

Conclusion(s): The preliminary data suggest that the Cobra might be a simple, safe and effective alternative supraglottic device to the LMA Classic to secure the airway.

Reference:
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A-699

Blind insertion of the EasyTube and detection of its position

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Background and Goal of Study: The EasyTube (EzT, Teleflex Rüsch, Kernen, Germany) is a new tube with two lumina for managing anticipated as well as unanticipated airway difficulties. The device is designed to provide sufficient ventilation whether its tip is positioned into the oesophagus or into the trachea. This study was initiated to evaluate the position of the EzT after blind insertion as well as two methods of detection.

Materials and Methods: After ethical committee approval and informed consent, the EzT was blindly inserted into 30 patients following standardized anaesthesia induction. The bulb-oesophageal detector device (EDD) as well as capnography (CAP) were used to detect the position of its distal end.

Results and Discussions: The tip of the EzT was positioned in the oesophagus in all patients. The EDD as well as CAP detected the supraglottic lumen to be used for ventilation correctly in all patients. The cross-check of the distal lumen positioned in the oesophagus revealed one ambiguous result out of 30 with the EDD.

Conclusion(s): Blind manual insertion causes a high probability of positioning the tip of the EzT into the oesophagus. The correct lumen to be used for ventilation can be detected successfully either by an EDD or by CAP.

References:
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Acknowledgement: The EzT used in this study were provided by Teleflex Medical (Rüsch), Kernen, Germany.

A-700

Effect of increase in cardiac output on CO elimination under hyperoxic normoventilation

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Background: Many models, such as the CFK equation have considered CO uptake from the alveoli to the blood (1), however, there has not been any model capable of clearly explaining whether which CO elimination is perfusion-dependent or diffusion-dependent. The purpose of our study is to investigate whether CO elimination is perfusion dependent under normal ventilation with hyperoxic state.
Method: Five anesthetized dogs (18–26 kg) were exposed to 3000 ppm of CO in air until carboxyhemoglobin (COHb) levels reached 40 to 50%. Dogs were randomly assigned to one of two treatments. Hyperoxic normoventilation (HNV) for 60 min; or (2) HNV with dobutamin to increase cardiac output for 60 min. After completion of the treatment, the treatment was continued until COHb levels returned to control levels. Then the dog was re-exposed to CO and the other treatment applied. Control tidal volumes and respiratory rates for the two treatments did not differ. Arterial blood, sampled every five min, was analyzed photometrically for COHb. Cardiac output was measured by thermodilution every 5 min during treatment and used to calculate cardiac index (cardiac output)/(body surface area). The time constant of the fall in COHb (k) during each treatment was determined from a curve fit by method of least squares to values of log COHb plotted versus time. Values of halftime were calculated as (ln 2)/k. Data were expressed as mean ± SD, and halftimes of the treatments assessed using paired t-test. $P < 0.01$ was considered significant.
Results: Cardiac indices were 4.2 ± 1.5 and 8.8 ± 3.0 L/min/m^2 in HNV and HNV with dobutamin treatments, respectively ($p = 0.0032$). The halftime of COHb elimination were 45.0 ± 9.0 and 50.8 ± 4.4 min in HNV treatments and HNV with dobutamine treatments, respectively, which were not significantly different between the two treatments.
Conclusions: Uptake of CO from alveoli to pulmonary capillary blood is stated to be diffusion dependent. Our study demonstrates that CO elimination from capillary blood to alveoli and pulmonary during HNV is also diffusion-dependent, but not perfusion-dependent. These findings suggest that an increase in cardiac output could not contribute to accelerating CO elimination during hyperoxic normoventilation.
Reference:
1 J. Clin. Invest 1965; 44: 1899–1910.

A-701

In-vivo test of bi-directional venturi pump for emergency transtracheal lung ventilation

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Background and Goal of Study: In case an emergency patient cannot be intubated or ventilated using a mask, ventilation with highly pressurized oxygen can be attempted through a thin transtracheal cannula. If the upper airways are obstructed, however, passive expiration through a thin cannula may be inadequate, resulting in increased PEEP because of incomplete emptying of the lungs.
Materials and Methods: We adapted an ordinary "venturi pump" to provide active deflation of the lungs. High oxygen flow through the narrow outlet produces negative gas pressure in the side tube ("expiration"). Manual closure of the outlet forces gas to flow through the side tube ("inspiration"). After successful testing of the device in-vitro, the pump was now tested using a 16 G cannula in an instrumented pig (37 kG) in-vivo. Tidal volume was about 10 mL/kG and respiratory curves were monitored. The animal was ventilated transtracheally using the venturi device and two different gas flows. Intermittent blood gas analysis was performed.
Results and Discussions: Blood gas values (pO_2/pCO_2 in kPa) were, respectively: after equilibration: 25.5/4.8; after 10 min ventilation using an oxygen flow of 10 L/min: 71.4/9.2, 20 min: 71.4/11.4; 30 min: 67.8/12.6. After 20 min equilibration (25.1/5.1), flow was increased to 14 L/min and blood gas analysis showed the following values: 10 min: 78.1/8.4; 20 min: 76.2/8.6 and 30 min: 78.7/9.5. We demonstrated that sufficient oxygenation of an animal can be provided using our venturi emergency ventilation apparatus, though pCO_2 may increase. Higher oxygen gas flows may help to diminish this problem, which might be of limited relevance in the emergency situation anyway.
Conclusion(s): We provide a simple emergency transtracheal ventilation device, which satisfactorily performs in-vivo.
Acknowledgements: This study was supported in part by a grant from the Ministry of Education, Sciences and Culture Mecklenburg-West Pomerania to KM (HWP-MV 2003).

A-702

Percutaneous transtracheal jet ventilation compared with a new oxygen flow modulator in a pig airway salvage model

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Background and Goal of Study: Percutaneous transtracheal ventilation is an effective way for oxygenation in the "cannot intubate, cannot ventilate" situation. Whereas percutaneous transtracheal jet ventilation (PJV) depends on special equipment (e.g. a hand triggered emergency jet injector), the oxygen flow modulator (OFM) is a new small device, which can simply be connected between a transcricothyroidal needle and a low pressure oxygen supply. We compared PJV and OFM in pigs allowed to desaturate to 70% SpO_2 due to respiratory arrest.
Materials and Methods: With approval of the animal protection committee 8 pigs (31 ± 3 kg) were anaesthetized and paralyzed, intubated and ventilated. After instrumentation an emergency transtracheal airway catheter was inserted into the trachea. Then ventilation was stopped. When SpO_2 reached 70% the pig was ventilated after a blood gas analysis for 10 min in random order with OFM or PJV. Then ventilation was stopped again until SpO_2 reached 70% before the pig was ventilated with the second device. Wilcoxon test was used for statistical analysis and $P < 0.05$ was considered significant.
Results and Discussions: With booth devices the animals were resuscitated with success: Whereas PaO_2 differed not significantly between the two devices, $PaCO_2$ was lower during PJV with the oxygen flow modulator.

	SaO_2 before R %	SaO_2 post R %	PaO_2 post R mmHg	$PaCO_2$ post R mmHg
PJV	67 ± 6	99 ± 1	233 ± 58	27 ± 7*
OFM	67 ± 9	99 ± 1	313 ± 110	48 ± 14*

R: Resuscitation; SaO_2: Arterial oxygen saturation; * = $p < 0.05$

Conclusions: The efficacy of the oxygen flow modulator during the experiment was comparable with the efficacy of the hand triggered emergency jet injector.
Reference:
1 Enk D et al: A new device for oxygenation and drug administration by transtracheal jet ventilation. Anesth Analg 1998;86:S203.

Acute and Chronic Pain Management

A-704

Analgesic efficacy and safety of a 2 g loading dose of i.v. paracetamol (acetaminophen) versus 1 g following third molar surgery

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Background and Goal of Study: To evaluate the analgesic efficacy in the immediate postoperative setting of 2 g of i.v. paracetamol (IVAPAP) compared to the recommended 1 g dose; the hypothesis being that the loading dose would result in superior efficacy, as measured by the summed pain relief over 6 h (TOTPAR6).
Materials and Methods: Single center, randomized, double-blind, placebo-controlled, 3-parallel group study. Patients with moderate to severe pain (4-point verbal scale (VS)) and 40 mm (100 mm visual analogue scale (VAS)) following surgical removal of an impacted third molar received IVAPAP 2 g or 1 g or placebo (15 min infusion). Pain relief (5-point VS), pain intensity (VS, VAS), time to remedication, patient global evaluation, adverse events, vital signs and biological tests were evaluated over 8 h.

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Results and Discussions: 297 patients (132 = 2 g; 132 = 1 g; 33 = placebo) were randomized. TOTPAR6 was significantly superior with 2 g: 10.2 ± 6.5 *versus* 1 g: 7.1 ± 5.9 *versus* placebo: 2.8 ± 4.4 ($p < 0.0001$). Comparable results were observed over 8 h. Pain relief and pain intensity difference scores of 2 g were significantly superior to 1 g from T30′ to T8 h and to placebo from T15′ to T8 h. Median time to remedication was significantly longer with 2 g: 5 h 02 min, *versus* 1 g: 3 h 14 min, placebo: 1 h 02 min. No statistically significant difference was observed between the 3 groups regarding the safety profile.
Conclusions: A superior analgesic efficacy of 2 g of injectable paracetamol over the recommended dose of 1 g was demonstrated following third molar surgery in terms of magnitude and duration of analgesic effect, with no difference in terms of safety between groups.
Acknowledgement: Supported by a grant from Bristol-Myers Squibb/UPSA.

A-705

Modulation of remifentanil-induced analgesia and post-infusion hyperalgesia by parecoxib in humans

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Background and Goal of Study: In previous works we showed the existence of opioid-induced hyperalgesia after short-time infusion of remifentanil in an experimental human pain model (1). Furthermore, in the same model, inhibition of central COX was identified as an important mechanism of NSAID-mediated antihyperalgesia in humans (2). Thus, the aim of the investigation was the determination of analgesic and antihyperalgesic properties of parecoxib on remifentanil-induced hypersensitivity.
Materials and Methods: Fifteen healthy volunteers were enrolled in this double blind and placebo controlled study in a cross-over design. Transcutaneous electrical stimulation at high current density (31.2 ± 14.6 mA) induced spontaneous acute pain (NRS = 6 of 10) and stable areas of hyperalgesia for painful mechanical stimuli to pinprick and touch. Pain intensity as well as the extent of the areas of hyperalgesia were assessed before, during and after 30 minutes lasting intravenous infusions of remifentanil (0.1 μg/kg/min) or placebo (NaCl 0.9%). Additionally, a ten minutes lasting intravenous infusion of parecoxib (40 mg) or placebo (NaCl 0.9%) was added either with the onset of electrical stimulation (preventive) or with the start of the remifentanil infusion (parallel). The assessments were separated by 2 weeks wash-out periods.
Results and Discussions: As shown before, remifentanil reduced pain and mechanical hyperalgesia during the infusion, but upon withdrawal, pain and hyperalgesia increased significantly above control level. Preventive administration of parecoxib led to an amplification of remifentanil-induced antinociceptive effects during the infusion (71.3 ± 7% vs. 46.4 ± 17% of control) and diminished significantly the hyperalgesic response after termination of the infusion. In contrast, parallel administration of parecoxib did not show any modulatory effects on remifentanil-induced hyperalgesia.
Conclusions: Parecoxib significantly attenuated remifentanil-induced hyperalgesia in a human pain model, confirming parallel processing of transduction signaling of μ-opioids and prostaglandins (3). Furthermore, adequate timing seems to be of particular importance for the antihyperalgesic effects of COX-2 inhibitors.
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A-706

Cannabinoid plasma levels and side effects after oral application of cannabis extract: a randomised, active placebo-controlled, crossover study in healthy volunteers

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Introduction: Δ9-THC (Marinol®) has been approved for the treatment of HIV-wasting syndrome, and for nausea and vomiting in cancer patients. The significant first-pass-effect of oral cannabinoids and their highly variable gastrointestinal absorption make it difficult to predict dose-related cannabinoid effects in patients. In our study, we investigated plasma levels of orally administered cannabis extract and the most common side effects in a homogenous group of volunteers.
Methods: Capsules, containing cannabis extract standardised on its Δ9-THC- content (20 mg THC each, THC:CBD = 2:1) or placebo (5 mg diazepam) were administered orally together with a standardised breakfast to healthy female volunteers (n = 16) history in a randomized, double-blind, placebo-controlled crossover design. Plasma levels of THC, cannabidiol (CBD) and the two active metabolites THC-11OH and THC-COOH were measured before, 2, 4 and 8 hours after administration of the drugs. The major THC side effects, sedation, "feeling high", vertigo, dry mouth etc. were determined every 60 min for an 8 hrs period by both the individual and an observer using 11-point visual analogue scales (self-rating VAS and observer VAS). SaO_2, RR, heart rate and body temperature were measured every 30 min.
Results: In 12 probands (75%) peak plasma levels of THC and CBD were reached within 2 hrs, in 25% (n = 4) between 2 and 4 hrs after administration, showing THC values between 1.29 ng/ml and 7.91 ng/ml. Peak values of CBD and the THC metabolites showed a similar variance. The maximum VAS for all side effects was seen at 2.6 hrs after drug administration and was significantly enhanced compared to baseline and placebo. However, no correlation was found between the magnitude of the subject's individual plasma level and the intensity of the side effects. Only heart rates were significantly elevated, the systolic RR measurements were lower in the cannabis group, diastolic RR, body temperature and SaO_2 remained unaltered.
Conclusions: Even under well controlled, standardised conditions, plasma levels and bioavailability of orally administered cannabinoid preparations are highly variable. These results further confirm the clinical observation that cannabinoid effects after enteral administration are not clearly dose-related and may considerably vary in each individual. Therefore we conclude that for the design of future clinical studies on therapeutic cannabinoid effects, the individual titration in each subject should be considered an essential part of the protocol.
Acknowledgement: This project was supported by "Fonds Soziales Wien".

A-707

Effect of oral cannabis extract on the development of spontaneous pain and hyperalgesia after intradermal capsaicin injection in humans: a placebo-controlled, randomised crossover study

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Introduction: Analgesic and anti-hyperalgesic properties of cannabinoids have been demonstrated in numerous animal models. The objective of our study was to investigate the effects of orally administered cannabis extract on pain response and hyperalgesia in healthy volunteers by intradermal injection of capsaicin.
Methods: Healthy female volunteers (n = 16, median age 23y, median BMI 22) were randomised for this double-blind, cross-over study. Capsules containing cannabis extract standardised on its Δ9-THC content (20 mg THC, THC:CBD = 1:2) or active placebo (5 mg diazepam) were administered orally together with a standard breakfast.150 min after medication, 20 μl of 0.1% capsaicin were injected intradermally into one forearm. Using an 11-point visual analogue scale (VAS), the initial pain intensity and its decrease were determined at 15 s intervals for the first 2 min, followed by measurements at 2.5, 9 and 15 min after injection. The flare area was assessed by tracing on an acetate sheet 10 min after injection. The hyperalgesic area was determined by pinprick and brush.
Results: Maximum pain intensity was measured immediately after capsaicin injection and disappeared almost completely within 15 min. There was no significant difference in spontaneous pain intensity between both groups, but pain decreased more rapidly under cannabis compared to placebo. Cannabinoid medication had no influence on the flare area or the area of hyperalgesia.
Discussions: Intradermal administration of capsaicin leads to a rapid onset neurogenic inflammation with a local erythema due to the release of neuropeptides from nociceptive nerve endings. The spontaneous pain immediately after capsaicin injection is followed by a secondary mechanical hyperalgesia resulting mainly from central sensitisation. Rukwied et al. described that hyperalgesia after topically administered capsaicin could be prevented by pre-treatment of the skin with patches soaked with the synthetic cannabinoid WIN 55–212. In our study, however, the intensity of the acute capsaicin-induced pain was not affected by oral pre-treatment with cannabinoids. Only a tendency towards a more rapid decrease of the spontaneous pain was found after cannabis. Thus, in contrast to the animal data, no effect on centrally induced secondary hyperalgesia could be observed in this human model.
Reference:
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Acknowledgement: This project was supported by "Fonds Soziales Wien".

A-709

Cell therapy for management of chronic pain

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Background and Goal of Study: Adrenal medullary transplants into the spinal cord subarachnoid space have been demonstrated to reduce pain sensitivity (1). This analgesia most likely results from the release of neuroactive substances, particularly catecholamines and opioid peptides from the transplanted cells into the CSF of the spinal cord. In our laboratory, not to be bothered by immune reaction, chromaffin cells were encapsulated with alginate. Catecholamines and met-enkephalin from encapsulated chromaffin cells were measured quantitatively in vitro. The neurotransmitters were also measured more directly from adrenal medullary transplants in the spinal cord CSF.

Materials and Methods: Isolated bovine chromaffin cells were encapsulated with alginate and poly-L-lysine prior to implantation into rat subarachnoid space to protect them from host immune system. And then catecholamines and met-enkephalin from encapsulated chromaffin cells were measured quantitatively in vitro by HPLC and RIA (Radioimmunoassay) respectively. The animals were randomized into 2 groups, one of which received microencapsulated chromaffin cells and the other empty capsules. The effects of such implants were evaluated on the pain behavior resulting from a chronic constriction injury of the rat sciatic nerve for 30 days.

After sampling CSF of rats catecholamine concentration in CSF was analyzed. Data (mean $\pm$ SD) are considered significant at a $P < 0.05$ (ANOVA for repeated measure and Dunnett's test).

Results and Discussions: After nicotine stimulation, release of catecholamine and met-enkephalin from encapsulated cells was demonstrated. A significant reduction of allodynic response to acetone evaporation was observed in the animals implanted with capsule group compared to empty capsule group. The retrieved chromaffin cells maintain their morphology. Catecholamine concentration in CSF is higher in the cell loaded capsule group. There are no complications related to implantation.

Conclusion(s): In conclusion, we found that encapsulated chromaffin cells remained viable after implantation into the subarachnoid space of rats and produced analgesic effects in a model of neuropathic pain. In the future, further investigation of the production of analgesic substances in the CNS and more intensive immunological studies are required.

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A-710

Pain stimulation by using synchronised somatosensory evoked potentials (SSEPs) and contact heat evoked potentials (CHEPs)

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Background and Goals: Non painful stimuli are transmitted over large A-beta fibres. Somatosensory evoked potentials (SSEPs) evaluate conduction of these fibres after an electrical stimulation of peripheral mechanoreceptors(1). Nociceptive stimuli generate action potentials in nociceptors, which have a higher stimulation threshold and which are associated to thinner A-delta and C nerve fibres, characterised by slower conduction velocities due to minimal or absent myelinisation (2,3). The goal of this study is to verify the feasibility of synchronised SSEPs and CHEPs in normal subjects, in order to create a new electrophysiological tool for clinical use. By using this kind of paradigm, we expect that we can monitor both the velocity of A-beta, and A-delta fibres at the same time.

Methods: 20 healthy normal subjects were investigated (13 females and 7 males). The galvanic stimulation for the SSEPs was applied on the right posterior tibial nerve (8 $\pm$ 3 mA). The CHEP stimulation was applied to the right S1 dermatome at a 52°C (inter-stimulus time: 15 sec; total number of stimuli: 90). A Visual Analogue Scale (VAS) was used to assess pain at the first stimuli and every 3 min thereafter. The acquisition was performed using a Micromed® EEG system Fz-(A1–A2) and CPz-(A1–A2) derivations. The average and single sweep analysis was performed in- and off-line.

Results: The group mean age and height was 25 $\pm$ 7 year and 176 $\pm$ 7 cm respectively. In all subjects, we observed a N1-P1 EPs component with a latency of 564 $\pm$ 105 ms for N1 and 670 $\pm$ 121 ms for P1 that were correlated ($r = 0.9$). No significant variation of amplitude and latency over time was observed for the P1-N1 component ($r = 0.9$ single sweep analysis). In contrast, VAS decreased from 32.7 to 18.5 ($> 42.2\%$ and $p < 0.01$) and did not correlated with N1-P1 latencies component ($r = -0.2$).

Conclusions: By using synchronised evoked SEP and CHEP stimuli a N1-P1 component was observed on the scalp in a normal group of volunteers at a latency of 564–670 ms on Fz and CPz. Those components may reflect the activation of the A-Delta fibres in the S1dermatome. The decrease of VAS during the period of stimulation may reflect the cognitive adaptation to pain over time. We conclude that combined SEP and CHEP stimulation may be helpful to monitor A-Beta, A-Delta and C fibres before, per and after surgery and perhaps during anaesthesia induction.

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A-711

The antiallodynic effect of intrathecal A1, A2 and A3 adenosine receptor agonists in rats with nerve-ligation injury

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Background and Goal of Study: Peripheral nerve injury may result in chronic neuropathic pain, which is characterized by spontaneous pain, hyperalgesia, and allodynia. In the present study, we sought: 1) to investigate the spinal pharmacology of A1, A2, and A3-selective adenosine receptor agonist; and 2) to define the receptor pharmacology of spinal effects on the antiallodynic action and motor dysfunction using Rats with nerve-ligation injury.

Materials and Methods: The left L5 and L6 spinal nerve roots were ligated and, 1 week later, an intrathecal catheter was inserted in male rats. Withdrawal threshold to mechanical stimulation of the left hind paw was determined before and after surgery, confirming mechanical allodynia. The antiallodynic effects of intrathecal A1, A2, and A3 adenosine agonists were determined, and reversal of the effects of adenosine agonists by selective adenosine antagonists was tested. We assessed the motor function in a simple manner by grading the ambulation behavior of rats as the following: 2 = normal; 1 = limping; 0 = paralyzed. The rats were tested for 10 min once every test period.

Results and Discussions: Intrathecal administration of the A1 adenosine agonist produced a dose-dependent antiallodynic action and evoked a motor weakness at a dosage of 30 μg. Intrathecal A2 and A3 adenosine agonist also produced a dose-dependent reduction in allodynia and this effect was associated at 300 μg respectively after a short interval with prominent hind limb weakness. Intrathecal pretreatment with the A1 adenosine-selective antagonist (100 μg) blocked the antiallodynic effect of A1 adenosine agonist (10 μg). The A2 adenosine-selective antagonist (100 μg) prevented the antiallodynic effects of the A2 adenosine-selective agonist (30 μg). The A3 adenosine-selective antagonist (100 μg) prevented the antiallodynic effects of the A3 adenosine agonist (30 μg). Pretreatment with the A2 adenosine-selective antagonist (300 μg) prevented the motor dysfunction induced by A1 (30 μg), A2 (300 μg), and A3 (300 μg) adenosine agonist.

Conclusion(s): We suggest that the antiallodynic effects of the A1, A2, and A3 adenosine-selective agonists are mediated through the activation of spinal A1 adenosine receptors and motor dysfunction effects are mediated through A2 adenosine receptors.

A-712

Clonidine effect on pain after pediatric tonsillectomy: systemic versus local administration

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Background: Children experience significant pain after tonsillectomy. Clonidine (CLO), an alpha2-adrenergic agonist, exhibits analgesic and anti-inflammatory effects in the perioperative period (1). Early benefit (< 48 h) of systemic CLO is controversed after pediatric tonsillectomy (2) while local CLO-ropivacaine infiltration of tonsillar bed enhances pain relief (3). This study evaluates late benefit of CLO administration and questions a local effect.

Materials and Methods: Children (ASA 1–2; age 2 to 12 yr; n = 10 per group)scheduled for tonsillectomy randomly received: intravenous (IV) and local saline (= tonsillar bed infiltration) (Saline group), or IV CLO 2 μg/kg and local saline (IV CLO), or local CLO 2 μg/kg total dose and IV saline (Local CLO). General anesthesia was similar with sevoflurane inhalation, sufentanil 0.25 μg/kg and IV paracetamol 15 mg/kg. Postoperative pain and analgesics

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needs, after evaluation at day 0, were assessed by the parents at day(D)1, D2, D5 and D7 using Objective Pain Scale (5 pts: 1 = no pain, 5 = strong pain unrelieved by treatment). Analgesics needs were left at their discretion (paracetamol, diclofenac). Statistical analysis used ANOVA, Kruskall-Wallis, $P < 0.05$ significant.

Results: Groups did not differ for age (average 4 ± 1.5 yr), weight, intraoperative parameters, pain and analgesics at D0. Long-term parameters D1 until D7 are in Table: pain scores and cumulative (T) doses of analgesics (mean ± SD).

	Saline	IV CLO	Local CLO
Pain score D1	3.5 ± 1.2	3 ± 1.3	2.9 ± 0.7
Pain score D2	3.5 ± 1.1	1.8 ± 1.3*	2.7 ± 0.7
Pain score D5	3.6 ± 1.2	1.7 ± 0.5*	2.2 ± 0.9#
Pain score D7	2.6 ± 1.5	1.8 ± 1.3	1.8 ± 0.7
T paracetamol	6.6 ± 3	9.1 ± 4	5.0 ± 1**
T diclofenac	7.9 ± 5	5.7 ± 3	4.1 ± 3*

$P < 0.05$ with (*)Saline, (**)IV CLO; (#) $P = 0.09$ with Saline.

Discussion and Conclusion: Systemic CLO during tonsillectomy reduces postoperative pain at D2 and D5. These results and others (3) showing lower pain scores at D3 and D5 after local ropivacaine-clonidine infiltration plaid for a local CLO effect deserving additional studies.

References:

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A-713

A systematic review of single-dose glucocorticoid for postoperative pain

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Background and Goal: Glucocorticoids have been used for postsurgical pain relief. We evaluated randomized controlled studies (RCT) on single-dose perioperative glucocorticoid for reduction of post-operative pain.

Materials and Methods: *Search strategy:* We searched the Corchrane Library (Issue 4, 2004); MEDLINE (1966 – December 2004); EMBASE (1980 – December 2004); PubMed (1970 – December 2004) and reference lists of relevant articles. *Selection criteria:* Randomized, double-blind, placebo-controlled clinical trials of a single-dose of a glucocorticoid on acute post-operative pain in adult or pediatric patients. *Analysis:* Forty two RCTs of sufficient quality were identified. Quantitative analysis was not performed due to varied outcome variables.

Results and Discussions: Glucocorticoids were significantly superior to placebo after oral, orthopaedic and spinal surgery (19 of 22 RCTs), after ENT surgery (4 of 10 RCTs). After major abdominal surgery, glucocorticoids were not superior to placebo in any of the 7 included trials. In the only RCT in laparascopic cholecystectomy dexamethasone significantly reduced pain compared with placebo. After major thoracic surgery one RCT demonstrated analgesic effect compared with placebo (after lung surgery) and one RCT did not (after heart surgery).

Conclusions: Single doses of a glucocorticoid are clearly effective for post-operative pain after oral, orthopaedic and spinal surgery. After major abdominal and thoracic surgery the analgesic effect is not well documented.

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A-714

Chronic pain and hypersensitivity after cosmetic augmentation mammoplasty: effects of methylprednisolone, parecoxib, and placebo

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Background and Goal: Chronic postsurgical pain is a major health care problem. The effects of methylprednisolone, parecoxib, and placebo on chronic pain and sensory dysfunction were studied after cosmetic augmentation mammoplasty.

Materials and Methods: A randomized, double blind study of 219 patients who received a single i.v. dose of methylprednisolone 125 mg (n = 74), parecoxib 40 mg (n = 71), or placebo (n = 74) before breast augmentation surgery. A questionnaire was mailed 2 and 12 months after surgery.

Results: Methylprednisolone 125 mg or parecoxib 40 mg reduced acute pain compared with placebo. Response rate 12 months after surgery was 80%. 13% had non-evoked pain, 20% had evoked pain. Activities of daily life were affected in 14%. Hyperesthesia in the methylprednisolone group (30%) was reduced compared with placebo (56%; $P < 0.01$) and parecoxib (51%; $P < 0.02$). Predictors for pain at 1 year were intensity of pain during the first week after surgery (OR = 1.3; 95%CI = 1.1–1.6), pain at 2 months (OR = 18.4; 95%CI = 6.9–49.3), hyperesthesia at 2 months (OR = 2.3; 95%CI = 1.1–5.1) and present hyperesthesia (OR = 3.1; 95%CI = 1.4–6.7). Active drugs reduced the risk for evoked pain compared with placebo at 1 year (methylprednisolone, OR = 0.4; 95%CI = 0.2–0.9; parecoxib, OR = 0.4; 95% CI = 0.2–0.9). Methylprednisolone reduced the risk for hyperesthesia at 1 year (OR = 0.3; 95%CI = 0.1–0.6).

Conclusions: Persistent pain and sensory impairment are common after cosmetic augmentation mammoplasty. Predictors of pain after 1 year were pain during the first week and at 2 months after surgery. Both active drugs reduced the risk for evoked pain compared with placebo 1 year after surgery. Methylprednisolone, but not parecoxib resulted in less hyperesthesia after 12 months.

A-715

Pre-operative analgesic use of a selective COX-2 inhibitor (rofecoxib) in elective craniotomy

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Background and Goal of Study: Traditionally non-selective non-steroidal analgesics (NSAIDs) have been avoided in neurosurgery, because of their anti-platelet action[1]. Excessive opiate use can mimic or exacerbate neurological complications. Codeine can be ineffective, but patient controlled analgesia (PCA) can be used safely[2]. Our study evaluates the analgesic benefits of adding a pre-operative dose of a COX-2 selective NSAID (rofecoxib) in patients undergoing craniotomy.

Materials and Methods: 42 patients were recruited to a double blind, randomised, placebo controlled study. Patients were allocated to receive 50 mg Rofecoxib (group R) or placebo (group P), 1 hour prior to elective craniotomy. All patients received regular paracetamol, and PCA morphine post operatively. Pain scores (VAS), morphine consumption (mg), sedation, nausea and Glasgow Coma scores were recorded at 30 minutes, 2,6,12 and 24 hours post operatively.

Results and Discussion: The trial was completed by 19 patients in the Rofecoxib group [mean age 45 (range 18–65)] and 15 in the placebo group [mean age 46 (range 25–71)]. There were no significant differences found in morphine consumption (using Mann-Whitney U test), pain scores or complication rate at any time during the 24 hr study period. The table below shows mean morphine consumption (mg ± SD).

	Group P	Group R	p value
30 mins	1.4 ± 1.9	2.3 ± 2.0	0.14
2	5.6 ± 4.7	6.8 ± 4.8	0.56
6	12.9 ± 10.9	12.9 ± 9.1	0.70
12	18.1 ± 16.2	19.6 ± 16.5	0.78
24	29.6 ± 25.9	28.4 ± 23.2	0.88

Haemostasis was reported difficult in 2 patients in group P compared to 1 in group R.

Conclusion: The use of rofecoxib in a single preoperative dose, although apparently safe, cannot be recommended for analgesic use in craniotomy, as it confers no benefit compared with placebo.

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A-716

Effects of clonidin on postoperative pain depend on trait anxiety

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Background and Goal of Study: Trait anxiety influences the coping with postoperative pain (1). Individual differences of coping and its consequences on aspects of stress are well described by Lazarus (2). The purpose of this study was to evaluate the influence of trait anxiety on pharmacological effects (clonidin) with respect to postoperative pain.

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Materials and Methods: After IRB improval and written informed consent 28 patients awaiting lumbar disc surgery were randomly assigned to receive double blind either clonidin (0.6 μg/kg/h) or placebo intraoperatively. Anaesthesia was induced and maintained using remifentanil and propofol. Trait anxiety was evaluated using the trait form of the Spielberger State-Trait-Anxiety-Inventory (STAI-G X2). The sample was shifted at the median of the test sum score to form two groups of patients those with a higher level of trait anxiety and those with a lower level of trait anxiety. Postoperative pain management was carried out with patient controlled analgesia using piritramid. Pain scores were measured using a visual analog scale. Postoperative aspects of mood were measured using a multidimensional rating scale. Statistical analysis was performed using analysis of variances.
Results and Discussions: Patients with a lower level of trait anxiety needed more piritramid postoperatively, if they did not receive clonidin intraoperatively. The reverse was found for patients with a higher level of trait anxiety ($p < 0.05$). Considering the interaction between pharmacological effects and trait anxiety contradictory results of several studies regarding the analgesic and sedative effects of clonidin could be explained at least in part.
Conclusion(s): Clonidin influences the postoperative pain in dependency of the trait anxiety.
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Acknowledgement: The study was supported by a departmental fund.

A-717

Intrathecal lidocaine elevates prostaglandin E2 levels in cerebrospinal fluid: a microdialysis study in freely-moving rats

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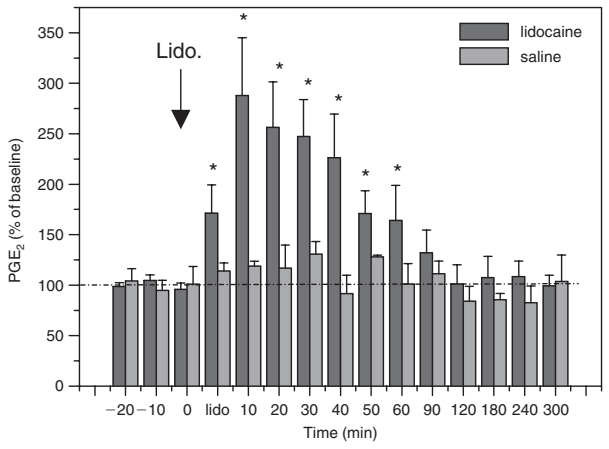
Background and Goal of Study: Clinical evidence with intrathecal anesthetics suggests that preemptive treatments do not consistently reduce postoperative pain. Our previous study found that intrathecal lidocaine even accelerated PGE_2 levels in cerebrospinal fluid (CSF) following formalin-induced inflammation. Therefore, the role of lidocaine alone on spinal prostaglandin E_2 (PGE_2) release was further investigated.
Materials and Methods: Spinal loop microdialysis catheters were implanted in adult male Wister rats. The microdialysis experiments were performed in freely-moving rats following 6 days of recovery. After 1 h baseline sampling at flow rate of 10 μl/min, 50 μl of 2% lidocaine or saline was given intrathecally. Dialysates were further collected for another 5 h and PGE_2 concentrations were analysed by ELISA. Statistical difference was assessed by one-way ANOVA for repeated measures.
Results and Discussions: Intrathecal injection of lidocaine resulted in a significant increases in PGE_2 to 287.8 ± 57.0% of their baseline values within 20 min, although it totally blocked the sensory input. The elevated PGE_2 might contribute to the development of hyperalgesia[1].



Conclusion: Pretreatment with i.t. lidocaine alone may not be beneficial to prevent the development of central hyperexcitability.
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Acknowledgement: Research Grant Program of Belgium Society of Anesthesia and Resuscitation.

A-718

Treatment with parenteral parecoxib followed by oral valdecoxib after major general surgery reduces opioid consumption and opioid-related adverse effects

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Background and Goals: COX-2 selective inhibitors may provide well-tolerated perioperative analgesic efficacy when administered alone or as multimodal therapy.
Materials and Methods: Postoperative opioid consumption and patient-reported opioid-related adverse symptoms were assessed in this randomized, double-blind, placebo-controlled trial of patients who had undergone major general surgery (gastrointestinal, orthopedic, gynecologic, urologic, and thoracic). Patients were randomized to parecoxib (PAR)/valdecoxib (VAL) ($n = 533$; PAR 40 mg IV loading dose on Day 1 followed by PAR 20 mg IV/IM q12 h for ⩾ 3 days then oral VAL 20 mg q12 h for 7 days) or matching placebo (PBO) ($n = 529$). Supplemental analgesia was patient-controlled morphine during IV/IM dosing, and codeine/acetaminophen or hydrocodone/acetaminophen during oral dosing, expressed in morphine equivalents (mg). Frequency, severity, and bother domains of 10 opioid-related adverse effects (fatigue, drowsiness, inability to concentrate, nausea, dizziness, constipation, itching, difficulty urinating, confusion, and retching/vomiting) were evaluated on Days 2 through 10 using the Opioid-Related Symptom Distress Scale (OR-SDS) patient-reported instrument. Symptoms at the upper distress continuum of frequency, severity, or bother were defined as clinically meaningful events (CMEs).
Results and Discussion: The PAR/VAL group showed a 35% reduction ($P < 0.001$ vs PBO) in cumulative Day 1 through 10 morphine equivalents. On Days 2 through 10, OR-SDS-measured total-symptom frequency, severity, and bother distress were reduced by 26%, 27%, and 24%, respectively (nominal $P < 0.001$ vs PBO) in the PAR/VAL group. Risk of experiencing a CME was reduced for 8 of 10 symptoms, and the PAR/VAL group was less likely to experience a CME day with ⩾1, ⩾2, and ⩾3 of the symptoms (nominal $P < 0.001$). PAR/VAL prevented 21%, 29%, and 39% of potential CME days with ⩾1, ⩾2, and ⩾3 of symptoms, respectively.
Conclusions: Treatment with PAR/VAL, compared with PBO, significantly reduced opioid consumption. Clinical benefits included reduced opioid-related symptom distress and significantly fewer patient days with opioid-related CMEs.
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A-719

The different roles of the spinal protein kinase C α and γ in morphine dependence and naloxone-precipitated withdrawal

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Background and Goal of Study: This study was to investigate the roles of spinal protein kinase C (PKC) α, γ in morphine dependence and naloxone-precipitated withdrawal response.
Materials and Methods: To set up morphine dependence model, rats were subcutaneously injected with morphine (twice a day, for 5 d). The dose of morphine was 10 mg/kg in the first day and was increased by 10 mg/kg each day. On day 6, 4 h after the injection of morphine (50 mg/kg), morphine withdrawal syndrome was precipitated by an injection of naloxone (4 mg/kg, i.p.). Chelerythrine chloride (CHE), a PKC inhibitor, was intrathecally injected 30 min before the administration of naloxone. The scores of morphine withdrawal symptom and morphine withdrawal-induced allodynia were observed. One hour after naloxone-precipitated withdrawal, Fos protein expression was assessed by immunohistochemical analysis and western blot was used to detect the expression of cytosol and membrane fraction of PKC α and γ in the rat spinal cord.
Results and Discussions: The results showed that intrathecal administration of CHE decreased the scores of morphine withdrawal, attenuated morphine withdrawal-induced allodynia and also inhibited the increase of Fos protein expression in the spinal cord of morphine withdrawal rats. The expression of cytosol and membrane fraction of PKC α was significantly increased in the spinal cord of rats with morphine dependence. Naloxone-precipitated withdrawal induced PKC α translocation from cytosol to membrane fraction, which was prevented by intrathecal administration of CHE. During morphine dependence, but not naloxone-precipitated withdrawal, PKC γ in the spinal cord translocated from cytosol to membrane fraction,

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and intrathecal administration of CHE did not change the expression of PKC γ in the spinal cord of naloxone-precipitated withdrawal rats.
Conclusion(s): It is suggested that up-regulation and translocation of PKC in the spinal cord contribute to morphine dependence and naloxone-precipitated withdrawal in rats and that PKC α and γ play different roles in the above-mentioned effect.

A-720

Effects of intermittent hemodialysis on buprenorphine and norbuprenorphine plasma concentrations in chronic pain patients treated with transdermal buprenorphine

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Background and Goal of Study: The use of opioids in patients with general and end-stage renal disease is often associated with an increased risk of side-effects. Thus, a dose adjustment is recommended for several agents in this class. On the other hand, opioids are often removed by hemodialysis leading to uncertain analgesic effects. The present study was designed to study the impact of intermittent hemodialysis on the disposition of the buprenorphine and its metabolite norbuprenorphine in chronic pain patients with end-stage kidney disease.
Materials and Methods: After approval of the local ethics committee10 patients with a need for a pain therapy according to step 3 of the WHO analgesic ladder were included in the study (mean age ± SD: 63 ± 14 years). After enrolment in the study the opioid therapy was switched to transdermal buprenorphine (Transtec®, Gruenenthal GmbH, Aachen, Germany), starting with about 50% of the equipotent opioid dose. Transdermal buprenorphine was increased stepwise until the average pain score as measured by using a numeric rating scale (NRS 0–10) was below 4. At least one week later, the patients were asked to provide blood samples for analyses immediately before and after hemodialysis.
Results and Discussions: The median buprenorphine plasma concentrations were found to be 0.16 (0.10–0.52) ng/ml before and 0.23 (0.12–0.56) ng/ml after hemodialysis. A significant correlation between plasma levels and administered doses (51 ± 18 μg/h) was observed (Spearman R = 0.74; $P < 0.05$). In three patients norbuprenorphine plasma levels were detected (>0.05 ng/ml). No differences in pain relief before and after haemodialysis were observed.
Conclusions: Transdermal therapy with buprenorphine in chronic pain patients with end-stage kidney disease is a efficient and safe treatment option. Buprenorphine plasma levels in these patients are unaffected by hemodialysis, and neither buprenorphine nor the metabolite norbuprenorphine seem to accumulate, resulting in no need for any dose adjustment of transdermal buprenorphine in patients treated with intermittent hemodialysis.
Acknowledgement: The study was supported by the Gruenenthal Research Department, Aachen, Germany.

A-721

Activation of naloxone-sensitive and -insensitive inhibitory systems in a human pain model

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Background and Goal of Study: Endogenous pain inhibition is of major importance in chronic pain conditions and has also been shown to modulate pain and hyperalgesia in human experimental pain models. We investigated naloxone sensitivity of acute pain inhibition and possible lasting inhibition in a model of electrically induced pain and hyperalgesia.
Materials and Methods: In a double blind, placebo controlled, cross over study fifteen volunteers underwent four 150 minute sessions of high current density electrical stimulation of their forearms. Two microdialysis fibres were inserted intradermally over a length of 1 cm at the central volar forearm of the subjects. Monophasic, rectangular electrical pulses of 0.5 ms duration were applied at 2 Hz via a constant current stimulator (Digitimer S7, Digitimer, Hertfordshire, UK). The current was gradually increased during the first 15 min of stimulus administration, targeting a pain rating of 6 (11-point scale; 0 = no pain and 10 = maximum tolerable pain) and then kept constant for the remaining time of stimulation. After 60 minutes, naloxone or placebo was given in a controlled infusion targeting increasing plasma concentrations of 0.1, 1 and 10 ng/ml (30 min. each) in three of the four sessions. The first three sessions took place once a week and the final session after 6 weeks. Pain ratings and areas of mechanical hyperalgesia were assessed at regular intervals during all sessions.
Results and Discussions: Pain ratings and areas of hyperalgesia significantly decreased during the sessions to 62%, 70% and 82% of the initial value for pain ratings, areas of punctate hyperalgesia and allodynia. Naloxone reversed this decrease for pain ratings as well as for hyperalgesia. While pain ratings remained constant from session to session, the areas of punctate hyperalgesia successively shrank to 60% of initial value at the fourth repetition. The session effect was not reversed by naloxone.
Conclusions: We conclude that the high current densitiy stimulation provoked central sensitization, but in addition, an acute naloxone-sensitive and a long term naloxone-insensitive inhibitory systems is activated. The long term inhibition may be associated with habituation which is known to modulate endogenous pain inhibitory systems.

A-722

Quantification of analgesic and antihyperalgesic effects of buprenorphine and fentanyl in healthy volunteers

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Background and Goal of Study: We assessed the combination compatibility of the partial μ-agonist buprenorphine with the full μ-agonist fentanyl by quantifying their analgesic and antihyperanalgesic effects when given either alone or in combination.
Materials and Methods: Fifteen healthy volunteers were included in this randomised, double blind, placebo controlled study. Transcutaneous electrical stimulation at high current density (38.4 ± 12.8 mA) induced spontaneous acute pain (NRS = 6 of 10) and stable areas of hyperalgesia for painful mechanical stimuli. Briefly, two microdialysis fibres were inserted intradermally over a length of 1 cm at the central volar forearm of the subjects. Monophasic, rectangular electrical pulses of 0.5 ms duration were applied at 2 Hz via a constant current stimulator (Digitimer S7, Digitimer, Hertfordshire, UK). The current was gradually increased during the first 15 min of stimulus administration, targeting a pain rating of 6 (11-point scale; 0 = no pain and 10 = maximum tolerable pain) and then kept constant for the remaining time of stimulation. Pain intensity as well as the extent of the areas of hyperalgesia were assessed before, during and after an i.v. infusion of 10 minutes' duration of fentanyl (1.5 μg/kg), buprenorphine (1.5 μg/kg), their combination (0.75 μg/kg each) or placebo (saline 0.9%). Assessments were repeated every two weeks.
Results and Discussions: Fifteen minutes after fentanyl application and 45 minutes after buprenorphine application maximum analgesic effects were observed (pain reduction to 47 ± 23% and 59 ± 23%, respectively). The maximum effect of the combination (pain reduction to 58 ± 31%) occurred after 30 minutes and therefore fell between the maxima of single substances. During the whole observation period a supra-additive analgesic and an additive antihyperalgesic effect of both substances could be shown (analgesic effect: AUC fentanyl vs. buprenorphine vs. combination: 35.4 vs. 40.0 vs. 44.0; antihyperalgesic effect: AUC fentanyl vs. buprenorphine vs. combination: 18 vs. 25 vs. 23).
Conclusions: The combination of buprenorphine with the full μ-agonist fentanyl did not lead to any antagonistic effect in our model. On the contrary, both drugs seemed to reinforce each other in their analgesic and antihyperalgesic effects.

A-723

Effects of propofol on remifentanil-induced analgesia and post-infusion hyperalgesia in humans

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Background and Goal of Study: Contrary to postulated preventive analgesic effects clinical observations pointed out that large doses of intraoperative opioids may lead to an increased demand for postoperative pain medication (1). In previous works we showed the existence of opioid-induced hyperalgesia after short-time infusion of remifentanil in an experimental human pain model (2). Aim of the investigation was the determination of analgesic and antihyperalgesic properties of propofol on remifentanil-induced hypersensitivity.
Materials and Methods: Fifteen healthy volunteers were included in this randomised, double blind, placebo controlled and cross-over study. Transcutaneous electrical stimulation at high current density (41.7 ± 14.3 mA) induced spontaneous acute pain (NRS = 6 of 10) and stable areas of hyperalgesia for

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painful mechanical stimul to pinprick and touch. Pain intensity as well as the extent of the areas of hyperalgesia were assessed before, during and after 30 minutes lasting intravenous infusions of placebo (NaCl 0.9%), propofol (1.5 μg/ml), as well as combinations of propofol with the opioid remifentanil in two concentrations (0.025 and 0.05 μg/kg/min). The assessments were separated by two week wash-out periods.

Results and Discussions: Propofol reduced significantly the electrically evoked pain to 75 ± 30% of control. Ninety minutes after completion of the infusion discrete analgesic effects ($p < 0.1$) were still detectable. Propofol alone did not led to any hyperalgesic effects after termination of the infusion. The combination with remifentanil in both concentrations led to additive analgesic effects (52 ± 25% resp. 62 ± 26%), however, during the following 60 min. pain ratings increased and exceeded control values. Furthermore, the hyperalgesic areas remained significantly enlarged as compared to baseline values.

Conclusions: Propofol led to a delay and a weakening of the remifentanil-induced hyperalgesia in humans. Nevertheless, pronociceptive effects were observed also after the combination with propofol, which may contribute to the increased post-operative demand for analgesics after remifentanil-based anaesthesia (1).

References:

1 Guignard et al. Anesthesiology 2000; 93: 409–417.
2 Koppert et al. Pain 2003; 106: 91–99.

A-724

Pre-emptive analgesia with combination of morphine and ketamine

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Background and Goal of Study: Many drugs have been used for pre-emptive analgesia, but their combination has been little studied. The aim of our study was to demonstrate that a preemptive combination of ketamine and morphine is more effective than when these drugs are administered separately.

Materials and Methods: After ethic committee approval and patients' consent a prospective blinded study was performed in patients elicited for abdominal hysterectomy with adnexectomy. Sixty three patients were randomly divided in equal groups. Group M was administered morphine 0.1 mg · kg^{-1} 10 minutes before induction to general anesthesia (GA) and ketamine 0.6 mg · kg^{-1} 10 minutes after laparotomy, group K was administered ketamine 0.6 mg · kg^{-1} 10 minutes before induction to GA and morphine 0.1 mg · kg^{-1} 10 minutes after laparotomy, group MK was administered morphine 0.1 mg · kg^{-1} and ketamine 0.6 mg·kg^{-1} 10 minutes before induction to GA and NS 10 minutes after laparotomy. Postoperative morphine consumption was measured 24 and 48 hours after surgery using PCA device.

Results and Discussions: There was significantly lower PCA morphine consumption in MK group compared to the other groups.

PCA morphine in mg	Group K	Group M	group MK
1st 24 hours	34.1 ***1)	30.2 *2)	22.6
2nd 24 hours	22.0 **3)	29.5 **4)	13.3

***1) K vs. MK, p = 0.0001, *2) M vs. MK, p = 0.0181,
** 3) K vs. MK, p = 0.0032, **4) M vs. MK, p = 0.0099.

Conclusion(s): The combination of pre-emptive administration of morphine and ketamine is more effective than when the drugs are used separately.

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A-725

Co-administration of magnesium confers pain relief with reduced opiod requirement after cardiac surgery

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Background and Goal: Magnesium prevents the induction of central sensitization from peripheral nociceptive stimulation (1). We hypothesized that perioperative treatment with magnesium gluconate would increase the analgetic potency of remifentanil given for pain management after cardiac surgery.

Materials and Methods: In a randomized, double-blinded study 40 patients received remifentanil at 0.2–0.5 μg/kg/min intraoperatively. After induction of anesthesia, patients were either given magnesiumgluconate (n = 20; 86,5 mg/kg bolus followed by a continuous infusion of 13.8 mg/kg/h) or placebo (n = 20). Remifentanil was titrated to effect as soon as pain could be evaluated by either a pain intensity score (PIS) in the intubated patient (range 1–6, 1 representing no and 6 unbearable pain) or later on by a color VAS scale (range 0–100, i.e. no and worst pain, respectively). A PIS ⩾ 3 or a VAS ⩾ 30 induced increases of remifentanil by 0.01 μg/kg/min while a respiratory rate ⩽10 caused a decrease by the same magnitude.

Results: Remifentanil was continued at a dose of 0.05 μg/kg/min in all our patients after arrival at the ICU. Dose adjustments because of insufficient pain control had to be made less frequently in magnesium treated patients before extuation (5 vs. 11 patients). Furthermore, magnesium significantly lowered the remifentanil requirement after extubation on average by 20% ($P < 0.05$). VAS score during the first 12 hours after extubation significantly dropped in the magnesium group from 15 to 1 and in the control group from 13 to 4 ($P > 0.05$), respectively. Dose reductions due to a respiratory rate ⩽10 had to be made 35 times in magnesium treated patients as compared to 23 times. Although magnesium serum levels were increased immediately after surgery (1.31 ± 0.25 vs. 0.8 ± 0.25, $P < 0.05$) it did not prolong time to extubation (134 ± 28 vs. 137 ± 21 min).

Conclusion: Magnesium gluconate at the dosage we applied effectively reduced the remifentanil requirement for adequate postoperative pain management in patients after cardiac surgery. No serious side effects were observed.

Reference:

1 Woolf CJ, Thompson SW. Pain 1991;44:293–9.

A-726

Concomitant use of non-opioid analgesics and morphine after major surgery – is there a clinically relevant morphine sparing effect? A meta-analysis of randomized trials

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Background and Goal of Study: Concomitant use of non-opioid analgesics and morphine after major surgery is thought to decrease morphine consumption and the risk of morphine-related adverse effects, and to improve analgesia.

Materials and Methods: We searched (electronic databases, bibliographies, any language, to 7.2004) for randomized, placebo-controlled trials testing the efficacy of paracetamol, non-steroidal anti-inflammatory drugs (NSAID) or selective cyclo-oxygenase-2 inhibitors (Cox-2) given concomitantly with patient-controlled analgesia with morphine after major surgery, and reporting on cumulative 24 hours morphine consumption. A clinically relevant morphine sparing effect was defined as a decrease in the incidence of morphine-related adverse effects or as an improvement in analgesia. Data were combined using a fixed effect model, and were expressed as weighted mean difference (WMD), relative risk (RR), odds ratio (OR), and number-needed-to-treat/harm (NNT/H) with 95% confidence intervals (CI).

Results and Discussions: We analyzed data from 50 trials (4661 patients). Median cumulative 24 hours morphine consumption in controls was 49 mg; it was significantly decreased with paracetamol (WMD, −8 mg), Cox-2 (−12 mg), and NSAID (−19 mg). Pain intensity at 24 hours was significantly reduced with NSAID (about 1 cm on the 10 cm VAS); with paracetamol, the effect was not significant, and for Cox-2, relevant data were scarce. With NSAID, the incidence of nausea/vomiting was reduced (RR 0.75, 95%CI 0.62–0.91; NNT 15), as was the incidence of sedation (RR 0.69, 0.54–0.88; NNT 37); the risk of serious bleeding complications was increased (OR 5.50, 1.30–23.3; NNH 50). Both NSAID and Cox-2 increased the risk of oliguria and renal failure.

Conclusions: For concomitant NSAID only there is some evidence of a clinically relevant morphine sparing effect after major surgery. However, there is only little decrease in the incidence of morphine-related adverse effects, and the risk of potentially serious NSAID-related adverse effects is not negligible.

A-727

Naloxone suppresses the pain relief effect of "cough-trick" during venipuncture: a crossover volunteer study

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Background and Goal of Study Background: In previous study we have shown that the easily performed "cough-trick" (CT) reduced pain during

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venipuncture (VP), although the mechanism remained unclear. Here we tested whether the endogeneous opioid system is involved in analgesic effect of CT.

Materials and Methods: Fifteen healthy male volunteers recruited according to inclusion criteria were blinded to the aim of the study. They were punctured with 20 G cannula in the dorsal vein of dominant hand without CT procedure and received 0.075 mg/kg intravenous opioid-receptor antagonist naloxone (NX). Thirty minutes after NX administration the dorsal vein of contra lateral hand was punctured with CT procedure. The intensity of pain during VP according to 100-mm visual analogue scale (VAS-100) was the primary endpoint. The intensity of pain on subsequent catheter insertion, hand withdrawal, palms sweating, blood pressure, heart rate, blood glucose concentration and success of volunteers' blinding were also recorded. The threshold of pain on pressure applied to glabella with the pressure probe of algesimeter (10 mm) was recorded before, 35 and 60 minutes after NX infusion.

Results and Discussions: Thirteen volunteers (age 25.5 ± 3.2 years; mean ± SD) finished the study. The intensity of VP pain with CT procedure after NX infusion was comparable with that without CT: 26 (16–38) vs. 22 (16–30) mm on VAS; median (interquartile range); $P > 0.05$. The pressure pain threshold decreased: 6.8 ± 2.3 vs. 6.2 ± 2.3 mm; $P = 0.024$; and the blood glucose concentration increased after NX administration: 4.8 ± 0.9 vs. 5.2 ± 0.8 mmol/l; $P = 0.004$; mean ± SD. The incidence of hand withdrawal reaction and sweating, heart rate and blood pressure did not change.

Conclusion(s): Endogeneous opioid system might be involved in the analgesic mechanism of CT although the distraction effect should be excluded in future study.

Reference:

1 Usichenko TI. *Anesth Analg* 2004; 98: 343–345.

A-728

Comparison of postoperative pain by different methods in the removal of gases after laparoscopic hysterectomy

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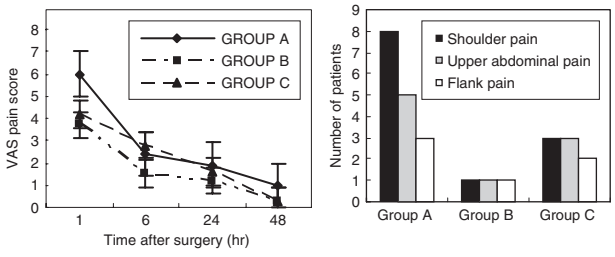
Background and Goal of Study: Laparoscopic surgery may allow a significant reduction in postoperative pain and analgesic consumption compared with conventional methods (1). Nevertheless, some patients still experience significant pain. We investigated degrees of postoperative pain and the incidences of shoulder pain versus the different methods of gas removal after laparoscopic surgery.

Materials and Methods: Sixty ASA class I or II patients were included in this study. In Group A (Control group, age 45.4 ± 2.9 years, n = 20), residual carbon dioxide was removed by the classic method without a drain tube. In Group B (Suction group, age 46.5 ± 7.2 years, n = 20), residual carbon dioxide was removed using a suction device aggressively without a drain tube. In Group C (Drain group, age 45.9 ± 4.1 years, n = 20), residual carbon dioxide was removed by the classic method with a drain tube. The intensities of abdominal and shoulder pain were assessed 1, 6, 24 and 48 hours after surgery using a visual analog scale (VAS) and a verbal rating scale (VRS). We also assessed the mean hospital stay for the three groups.

Results and Discussions: The abdominal pain scores (VAS and VRS) at 1 hour after surgery and the incidence of shoulder pain, epigastria pain and flank pain were significantly higher in Group A than in the other groups for 1hour after surgery ($P < 0.05$). Mean hospital stay was significantly longer for group C.



Conclusion(s): After laparoscopic surgery, the active removal of residual carbon dioxide may be a simple and safe method that significantly reduces postoperative shoulder and abdominal pain.

Reference:

1 Barkun JS, Barkun AN, Sampalis JS, et al. Lancet 1992; 304: 1116–9.

A-729

Small dose ketamine does not reduce postoperative opioid analgesic requirements after cardiac surgery

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Background and Goal of Study: Addition of a small dose of ketamine to opioids may increase the analgesic effect and prevent opioid-induced hyperalgesia and acute tolerance to opioids[1]. We therefore tested the hypothesis that intraoperative small-dose ketamine improves postoperative analgesia after CABG with remifentanil-based anaesthesia.

Materials and Methods: 50 patients scheduled for elective CABG were enrolled in this double-blind study under remifentanil-based anaesthesia. They were randomly assigned to intraoperative ketamine or saline (control) supplementation. After induction of anaesthesia patients received the ketamine infusion 10 mcg/kg/min or saline infusion over the entire operation period. Anaesthesia was maintained with remifentanil, atracurium and a propofol infusion. All patients were given 0.15 mg/kg of morphine 45 min before the end of surgery. Pain scores and morphine consumption were recorded for 24 hours after surgery. Postoperative pain was treated with morphine, 3 mg of morphine was given IV at 5-min intervals. Data (mean ± SD) were analyzed by Student t-test, ANOVA and Mann Whitney U-test, with $p < 0.05$.

Results and Discussions:

	C Group	K Group
Time to first analgesic (min)	186 ± 27	325 ± 42*
Morphine (mg) consumption 24 h	26 ± 7	24 ± 6

Values are mean ± SD. *$p < 0.05$.

The Ramsay score was not different between the two groups. The incidence of side effects was comparable in the two groups.

Conclusion(s):

(1) Small-dose ketamine did not decrease morphine consumption in CABG patients during the first 24 h after.
(2) Ketamine increased significantly the time required until demanding the first dose of morphine postoperative.

Reference:

1 Guillou N, Tanguy M, Seguin P et al. *Anesth Analg.* 2003 Sep;97(3):843–7.

A-730

Adrenaline improves the quality of patient controlled epidural analgesia after thoracotomy

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Background and Goal of Study: Thoracic epidural analgesia (EA) using continuous infusion of bupivacaine combined with fentanyl provides effective postoperative analgesia after thoracotomy (1). However, increased consumption of the preparations required for the adequate postoperative analgesia may lead to adverse effects. Adrenaline has been shown to reduce the risk of side effects during EA (2). Thus, the main goal of our study was to assess the patient controlled analgesia (PCEA) combining opioid-local anesthetic mixture and adrenaline administered after thoracotomy.

Materials and Methods: We enrolled 50 adult patients after major thoracic surgery in a prospective, randomized study. All patients were given PCEA using 0.125% bupivacaine and fentanyl (2 mcg/ml) either without (BF group, n = 25; 44.2 ± 1.9 yrs; 20 males/5 females) or with adrenaline (2 mcg/ml) (ABF group, n = 25; 43.6 ± 2.1; 18 males/7 females). Pain scores were assessed in rest and coughing by 10-point visual analog scale (VAS) at 1, 3, 6, 12, 18, and 24 h after ICU admission. In addition, the consumption of drugs and the incidence of adverse effects (sedation, pruritis, urine retention, and nausea/vomiting) were recorded. Data were compared using Student's *t*-test and χ^2 test. $p < 0.05$ was regarded as statistically significant.

Results and Discussions: VAS in coughing was significantly lower in the ABF group comparing with the BF group at 3, 6, 12, 18, and 24 h after ICU admission. The consumption of drugs requested for the adequate analgesia (VAS < 3) decreased significantly in the ABF group as compared to the BF group and was 213 ± 4 vs. 225 ± 2 mg/24 hours and 319 ± 1 and 344 ± 3 mcg/24 hours for bupivacaine and fentanyl, respectively. In the BF group, we registered urine retention, nausea, and vomiting in 24%, 20%, and 16% of the patients, respectively. Among these adverse effects, only one episode of pruritis was recorded in the ABF group.

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Conclusion: After thoracotomy, PCEA using the combination of adrenaline with bupivacaine-fentanyl mixture reduces the consumption of both bupivacaine and fentanyl and declines the incidence of the adverse effects, therefore improving the quality of analgesia.

References:
1 Macias A. et al. *Anesth Analg* 2002;95:1344–1350.
2 Niemi G et al. *Anesth Analg* 2002;94:1598–1605.

A-731

Effect of preemptive administration of analgesics on surgery-induced tumor cells proliferation

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Background: Surgical stress and anesthesia interfer with immune system (1). Postoperative analgesia provided by morphine attenuates surgery-induced tumor proliferation (2). Because preemptive analgesia can contribute to reduce postoperative pain, our study assessed the preemptive effect of common analgesic drugs on surgery-induced tumor cells proliferation in a validated rat model of lungs metastases (2).

Material and Methods: Adult male Wistar rats were assigned to different groups (n = 4–6 per group) and received either intraperitoneal (IP): saline (controls), ketamine 10 mg/kg, clonidine 10 μg/kg or fentanyl 40 μg/kg. In different animals, same IP drugs and doses were administered 30 min before an abdominal incision performed under sevoflurane anesthesia. In all the rats, tumor cells (MADB106, from rodent mammary adenocarcinoma) were intravenously injected in the tail 5 hours after the aforementioned treatments as previously described (2). Three weeks later, animals were euthanazied and lungs removed to allow a count of surface metastases. Statistical analysis used ANOVA and posthoc test, $P < 0.05$ was significant.

Results and Discussion: Metastases counts are expressed in Table as mean ± SD (95% CI).

	IP Saline	IP Ketamine	IP Clonidine	IP Fentanyl
No surgery	21 ± 14 (11–31)	63 ± 30 (44–82)*	23 ± 13 (11–36)	20 ± 7 (13–26)
Abdom incision	51 ± 36 (20–82)**	59 ± 24 (29–89)	44 ± 18 (21–66)	42 ± 24 (22–62)

*$P < 0.01$; **$P < 0.05$ with no surgery-IP saline (controls).

Conclusion: In unoperated animal, only ketamine promotes tumor proliferation, an effect unrelated to NMDA antagonism but mediated through beta-adrenergic stimulation (3). In operated rats, incision by itself enhances tumor metastasis but pre-incisional administration of different analgesic drugs does not affect the immunosuppressive effect of surgical injury.

References:
1 Nichols et al, Clin Exp Immunol 1993; 94: 4–10.
2 Page et al, Pain 1993; 54: 21–28.
3 Melamed et al, Anesth Analg 2003; 97 : 1331–1339.

A-732

Hypertensive patients have less postoperative pain than normotensives after laparoscopic cholecystectomy

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Background and Goal of Study: We compared the postoperative pain in hypertensive patients and normotensive patients after laparoscopic cholecystectomy.

Materials and Methods: This study was approved by our Ethics Committee. After obtaining informed consent, 24 ASA II–III patients were included in this study. The patients were randomized in two equal groups A (hypertensive patients) and B (normotensive patients). General anesthesia was induced with propofol (2.5 mg/kg), fentanyl (2 microg/kg), succinylcolina (1 mg/kg). Vecuronium (0.1 mg/kg) was used to facility mechanical ventilation and sevoflurane 1.5–2% for hypnosis. The pain score and the sedation score were done at 0, 30, 60 minutes, 4, 8, 12, 24 hours. Statistical analysis was performed using a two sides Student's t test and the Mann Whitney U test ($p < 0.05$-statistical significance).

Results and Discussions: There were no significant differences in demographic data (age, sex, weight) surgical duration and anesthesia duration between the groups. No higher intraoperative incidence or adverse events were reported in both groups.

We measured pain at rest and on deep breath (10 point verbal numerical rating scale) for 1, 4, 8, 12, 24 hours postoperatively in all patients.

40 mg petidine was given whenever the pain score was smaller than 4 points.

The numbers of rescue analgesic petidine doses were significantly lower in hypertensive than normotensive patients (80 ± 34 mg vs. 114 ± 29 mg).

The sedation score was higher in normotensive patients (group B) but not significantly ($p > 0.05$).

Conclusions: Hypertensive patients required less postoperative analgesic than normotensives patients after laparoscopic cholecystectomy.

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1 Zamir N, Simantov R, Segal M. Brain Res 1980; 184; 299–310.
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A-733

The effects of A1 adenosine receptor agonists, (R)-N^6-(1-Methyl-2-phenylethyl) adenosine (R-PIA) on the antiallodynic morphine tolerance in a rat model of postoperative pain

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Background and Goal of Study: Opioid tolerance is a diminution of analgesic effect or need for a higher dose to maintain the original effect following chronic opioid exposure. Opioid tolerance may be mediated by l-glutamate action. Adenosine receptors, probably of the A1 subtype localized in excitatory amino acid terminals, have been shown to inhibit the release of aspartate and glutamate. The effect of A1 adenosine receptor agonist, (R)-N^6-(1-Methyl-2-phenylethyl) adenosine (R-PIA) on opioid tolerance has not been studied. We investigated the hypothesis that R-PIA prevents and reverses chronic opioid tolerance.

Materials and Methods: Male rats were anesthetized with enflurane. An incision of the plantaris muscle of right hind paw induced mechanical allodynia. Withdrawal threshold to von Frey filament was determined. An intrathecal injection was performed and thresholds were determined. (1) Single intrathecal doses of 3 μg morphine, 20 μg R-PIA, and a combination of 3 μg morphine and 20 μg R-PIA were studied. (2) Rats received 3 μg morphine for 7 days. To evaluate the effect of R-PIA on development of morphine tolerance, R-PIA 20 μg was coinjected with morphine 3 μg for 7 days. To characterize the offset of the effect of R-PIA on morphine tolerance, R-PIA was coinjected with morphine for days 1–3 followed by daily morphine on days 4–7. (3) Morphine 3 μg was given for 4 days. On the following 3 days, R-PIA 20 μg was introduced in combination with morphine.

Results and Discussions: (1) Morphine or R-PIA alone produced antiallodynia. When given together, resulted in supra-additive antiallodynia. (2) Co-administration of morphine with R-PIA blocked the decrease in morphine effect throughout the entire 7 day period. Where R-PIA was co-administered with morphine for days 1–3, maximal antiallodynia with morphine was still observed on day 4, but a subsequent decrease in effect was observed from days 5 to 7. (3) Chronic administration of morphine on days 1–4 resulted in a decrease in antiallodynia. Addition of R-PIA on days 5–7 resulted in a partial restoration of the morphine effect and greater antiallodynia than for morphine alone on days 6 and 7.

Conclusion: This study suggests that R-PIA augments the antiallodynic action of both acute and chronic morphine therapy.

A-734

Auricular acupuncture reduces intraoperative fentanyl requirement during total hip arthroplasty – a randomised controlled study

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Background and Goal of Study: Auricular acupuncture (AA) has been shown to decrease desflurane requirement in healthy individuals [1]. We studied whether the AA of specific points can reduce intraoperative analgesic requirement during total hip arthroplasty (THA).

Materials and Methods: Sixty-four patients scheduled for elective THA were enrolled in this patient-anaesthesiologist-evaluator-blinded study according to inclusion criteria. The patients were randomly assigned to receive AA of specific points (Hip joint, Shenmen, Lung and Thalamus) or a sham procedure (4 non-acupoints on the helix) ipsilateral to surgery site. Permanent press AA needles with the diameter of 0.22 mm and the length of 1.5 mm were placed and fixed with the adhesive tape in the evening before THA. The patients received standardised general anaesthesia, whereas

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end-tidal isoflurane concentration was kept constant within 0.8–1.0 vol.%. The fentanyl was titrated to prevent spontaneous movements during surgery and to maintain the heart rate and blood pressure within 20% of baseline values. Demographic data, intraoperative amount of fentanyl, end-tidal isoflurane, heart rate and blood pressure, body temperature and success of patients blinding were recorded.

Results and Discussions: Fifty-seven patients (30 in AA and 27 in the control group) completed the study. Patients from AA group required 21% less fentanyl during surgery than the controls: 3.9 ± 1.4 vs. 4.9 ± 1.2; mean $\pm$ SD; mcg/kg; $P = 0.005$. Demographic data, isoflurane end-tidal concentrations, duration of anaesthesia, intraoperative cardiovascular parameters, body temperature and patients' opinion concerning the group allocation were comparable in both groups.

Conclusion(s): The study demonstrated that AA reduces intraoperative fentanyl requirement during total hip arthroplasty. Further large-scale investigation of this treatment modality comparing it with standard therapy and placebo acupuncture (non-inserted needle) appears to be necessary.

Reference:

1 Taguchi A. *Anaesthesia* 2002; 57: 1159–1163.

A-735

L-Arginine effects the somatosensory evoked responses of neurones in the rat substantia gelatinosa (SG) independent of changes in nitric oxide (NO) levels

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Background and Goal of Study: The amino-acid Arginine (Arg) is the substrate for nitric oxide synthesis. Any effects of arginine on neuronal activity is thus usually ascribed to an effect in stimulating NO formation. We have developed an electrochemical method (1), to measure extracellular NO levels with a microelectrode (CFM). The method allows for simultaneous recording of extracellular spike potentials from local cells together with the electrochemical signal. As part of the investigation we have applied Arg directly on the surface of the spinal cord above the microelectrode to ascertain whether this procedure would have an effect on NO synthesis.

Materials and Methods: Wistar rats were anesthetized with fentanyl and urethane. The lumbar enlargement of the spinal cord was exposed surgically. Nafion-coated CFM were inserted in the cord (200–400 μm depth). Spikes from cells with low threshold receptive fields on the ipsilateral hindlimb were isolated and counted using a spike discriminator. Needle electrodes were inserted into the skin of the RF and used to deliver trains of electrical pulses (400 pulses at 50 Hz, 5 ms duration).

Results and Discussions: In 20 experiments the electrical stimuli generated a rise in exracellular NO ($7.6 \pm 0{,}24$ μM, Mean $\pm$ SD). Mean spike count during stimulation was 548 ± 42 (Mean $\pm$ SD). After Arg there was no consistent change in NO release. But in 15 experiments (75%) Arg nearly abolished the spike activity in response to electrical stimulation (20 ± 2) (Mean $\pm$ SD). In no case was there any increase in spike activity following Arginine.

Conclusion(s): Our hypothesis is that GABA and Arg can both be taken up into cells by a similar transporter mechanism. A rise in extracellular Arg could reduce the GABA reuptake mechanism, leading to an increased inhibitory tone in the spinal cord. Arginine could thus act as a GABA synaptic modulator as well as being a substrate for NO synthesis.

Reference:

1 Millar J. Methods Mol Biol 1997; 72: 251–66.

Acknowledgement: This work was supported by a grant from the DFG.

A-736

Protocol design: a fentanyl HCl patient-controlled transdermal system (PCTS) vs. IV morphine patient-controlled analgesia for post-surgical pain management in 11 European countries

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Background and Goal of Study: Patient-controlled analgesia (PCA) allows patients to manage their postoperative pain effectively. Common routes of PCA administration are intravenous (IV) and epidural. However, postoperative pain continues to be undermanaged (1). The fentanyl HCl patient-controlled transdermal system (PCTS) provides a new alternative, noninvasive method to manage moderate-to-severe postoperative pain. The aim of this study is to compare the safety and efficacy provided by the PCTS with that of a standard regimen of IV PCA morphine following elective major abdominal or orthopaedic surgery.

Materials and Methods: An international, multicenter, open-label, randomized, active comparator, parallel-group study, with a total target enrollment of 650 patients, in 11 European countries. Treatment with the PCTS (40 μg fentanyl over 10 min; up to 6 doses/h for 24 h) or a standard regimen of IV PCA morphine (bolus doses, up to 20 mg per 2 h; maximum of 240 mg/24 h) begins in the recovery room and continues up to 72 h. The primary efficacy endpoint in this trial is patient global assessment (PGA) of pain control at 24 h. Secondary endpoints include pain control, safety, ease-of-care questionnaires for patients, nurses, physical therapists for all surgery types, and technical failures. The statistical objective is an equivalent proportion of PCTS successes to IV PCA morphine by a 95% two-sided confidence interval for the difference between treatments at 24 h (−10% to 10%).

Results and Discussions: The PGA as defined by the proportion of patients rating each method of pain control as poor, fair, good or excellent will be compared. Analysis of secondary endpoints will determine potential points of differentiation between the two treatments in each patient population.

Conclusion(s): The findings of this study will demonstrate the efficacy and safety of fentanyl HCl PCTS vs IV PCA morphine in the management of postoperative pain in patients who have undergone major abdominal or orthopaedic surgery within 11 European countries.

Reference:

1 Apfelbaum JL, Chen C, Mehta S, et al. *Anesth Analg.* 2003; 97: 534–40.

Acknowledgement: Supported by Janssen-Cilag Ltd.

A-737

Interaction between bupivacaine and glutamate receptor antagonists in spinally mediated analgesia in rats

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Background and Goal: N-methyl-D-aspartate (NMDA) receptor and α-amino-3-hydroxy-5-methylisoxazole-4-propionic acid (AMPA) receptor had a great role in pain mechanism in the spinal cord. We investigated the analgesic interaction between spinally administered bupivacaine and AP-5, a NMDA receptor antagonist, or YM872, an AMPA receptor antagonist using rats.

Materials and Methods: Sprague-Dawley rats with lumbar intrathecal catheters were tested for their thermal tail withdrawal response using the tail flick test and for their paw flinches by formalin injection after intrathecal administration of bupivacaine, AP-5, or YM872. The effects of the combination of bupivacaine and AP-5 or YM872 were tested by an isobolographic analysis using ED_{50} (50% effective dose) values. Eight rats were used in each dose group. Behavioral side effects were also investigated.

Results and Discussion: ED_{50} values are shown.

	Tail flick	Formalin phase 1	Formalin phase 2
Bupivacaine (μg)	7.0 (3.5–13.4)	5.6 (1.9–15.4)	3.3 (0.5–8.8)
AP-5 (μg)	5.5 (2.3–10.8)	7.5 (4.0–13.1)	1.5 (0.5–5.9)
YM872 (μg)	1.0 (0.4–2.8)	0.24 (0.08–0.75)	0.2 (0.07–0.7)
Bupivacaine + AP-5			
Bupivacaine (μg)	2.96 (1.50–5.89)	0.89 (0.39–2.06)	0.89 (0.49–1.63)
AP-5 (μg)	2.44 (1.25–4.74)	0.37 (0.16–0.85)	0.37 (0.2–0.67)
Bupivacaine + YM872			
Bupivacaine (μg)	0.90 (0.62–1.31)	0.14 (0.02–1.04)	0.37 (0.03–5.04)
YM872 (μg)	0.13 (0.09–0.19)	0.01 (0.001–0.06)	0.02 (0.002–0.3)

( ): 95% confidence interval.

Behavioral side effects decreased by both combinations compared with each single agent.

Conclusions: Intrathecal bupivacaine and AP-5 or YM872 were synergistically analgesic on thermal and inflammatory pain except for bupivacaine with AP-5 on thermal pain, which had additive effect.

A-738

Safety of high dose intrathecal diamorphine in non-obstetric patients

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Background and Goals: The use of intrathecal diamorphine combined with bupivacaine has been shown to provide effective and prolonged postoperative analgesia following major orthopaedic surgery[1]. It is suggested that

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lipophilic opiates may be safer for intrathecal use because of their shorter life in the spinal fluid phase[2]. We have collected respiratory depression data from 661 patients receiving intrathecal diamorphine up to 1mg for non-obstetric surgery.

Materials and Methods: Over a one-year period, details of naloxone administration were collected from 1732 patients undergoing major non-obstetric surgery, of which 77% was major orthopaedic surgery. Patients received either intraoperative intrathecal diamorphine plus postoperative intravenous patient-controlled morphine analgesia (ITD + PCA) or PCA alone (PCA group). Intrathecal diamorphine dosage varied from 0.1 mg to 1 mg, although the majority of patients received either 0.5 mg (ITD 0.5 + PCA) or 1 mg (ITD1.0 + PCA). The relative risk (RR) for receiving naloxone was calculated for each group, using the PCA group as a control. Where available, relative risk stratified by age above and below 80 years was calculated.

Results and Discussions: Data are shown in the table.

	n	%	Naloxone n	RR	RR<80 yrs	RR $$ 80 yrs
PCA group	1071	62	6	1.00	*	*
ITD + PCA	661	38	3	0.81	0.35	2.29
ITD0.5 + PCA	233	13	1	0.77	0	2.45
ITD1.0 + PCA	298	17	2	1.20	0.72	3.64

*Denotes unavailable data.

Conclusions: The use of intrathecal diamorphine at doses up to 1mg in non-obstetric patients is a safe technique for patients under 80 years of age. Intrathecal diamorphine should be used cautiously in patients 80 years of age and over. Intrathecal diamorphine is no more likely to cause respiratory depression than PCA alone if used appropriately.

References:

1 Milligan KR, Fogarty DJ. *Reg. Anesth.* 1993;18(2):114–7.
2 Moore A, Bullingham R, McQuay H, et al. *Clin. Pharmacol. Ther.* 1984;35(1):40–5.

A-739

Local effect of bupivacaine and amitriptyline infiltration on wound NGF expression after plantar incision in rats

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Background: Local NGF expression increases after plantar incision, contributing to peripheral sensitization and postoperative pain (1). While wound infiltration with bupivacaine (bupi) only provides shortlasting analgesia, we previously demonstrated that local amitriptyline (AMIT), a tricyclic antidepressant which acts as a long-lasting local anesthetic and possess antihyperalgesic effects, potentiates bupi and produces longlasting relief of post-incisional hyperalgesia (2). The present study evaluates whether bupi and/or AMIT effect might be related to modulation of local wound NGF expression.

Materials and Methods: Under halothane anesthesia, adult male Wistar rats underwent a plantar incision (1). Before wound closure, local infiltration (total volume 0.2 mL) was realized with either saline, bupi 0.5% alone or with AMIT 100 μg, or AMIT alone 100 μg (2). Animals (n = 3–4 per group) were killed at day (D)0 (6 h), D1 or D2 after surgery and plantar skin and muscle around the wound harvested to measure tissue NGF (ELISA, Chemicon®). NGF was also measured in normal tissue (Naive group). Statistical analysis used ANOVA and posthoc test, $p < 0.05$ significant.

Results: Incisional NGF levels in Table are mean ± SD (ng/g tissue wet weight). Basal NGF in naive rats was 0.1 ± 0.01 ng/g. Plantar incision significantly increased local NGF secretion at D1 and D2 (Saline group data).

	D0 (6 h)	D1	D2
Saline	0.14 ± 0.05	0.21 ± 0.08*	0.3 ± 0.09*
Bupi	0.23 ± 0.1	0.04 ± 0.01**	0.13 ± 0.04
Bupi AMIT	0.06 ± 0.02**	0.08 ± 0.03**	0.23 ± 0.05
AMIT	0.14 ± 0.11	0.06 ± 0.01**	0.4 ± 0.23

*P < 0.01 with naive rats; **P < 0.01 with Saline group at the same postoperative time.

Discussion and Conclusion: As demonstrated in another model (3), bupi modulates NGF secretion. Temporary reduction of enhanced NGF expression correlates with bupi short-lasting postoperative analgesic effect. Low dose AMIT potentiates bupi effect on NGF expression that might contribute to and partly explain long-lasting postoperative effect of bupi AMIT combination.

References:

1 Zahn et al, J Pain 2004; 5: 157–63.
2 Thomas et al, Eur J Anaesth 2004; 21: A–781.
3 Durieux et al, Anesthesiology 1999; 91: A–856.

A-740

Epidural analgesia: catheter contamination and secure time window

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Background and Goal of Study: Epidural analgesia in surgical patients is not risk exempt. Epidural catheter (EC) tip colonization is up to 28.8% in some series [(1)] and may be associated with significant clinical infection [(1) (2)]. The aim of this study was to evaluate the relationship between microbiological EC contamination and the duration of catheterization in surgical patients.

Materials and Methods: Bacteriological analysis of 104 triple EC cultures was carried out after removal in surgical patients: exit site swabs (CS), semi-quantitative culture of 3 cm of intra-dermis portion (IC) and 3 cm of tip (TC). We recorded the duration of catheterization. Descriptive statistical analysis and Mantel-Haenszel Chi-Square tests were performed.

Results and Discussions: ECs were kept in place for 69 ± 34 hours (range 24–264). A significant correlation was found between the incidence of positive cultures and the duration of catheterization (CS $p = 0.002$, IC $p = 0.027$, TC $p = 0.026$). 64% of positive CS had also a positive IC and TC (decreasing number of colonies forming units from the skin to the tip). Coagulase-negative staphylococci (CNS) was the most prevalent microorganism cultured.

	CS + 44/42%	IC + 32/32%	TC + 24/23%
CNS	36 (65%)	29 (81%)	20 (74%)
Enterobacter	6 (10.9%)	2 (5.55%)	2 (7.42%)
Corynebacterium	5 (9.14%)	2 (5.55%)	–
E. coli	2 (3.64%)	–	1 (3.72%)
Bacillus s.p.	1 (1.82%)	2 (5.55%)	2 (7.42%)
Str. viridans	–	1 (2.35%)	1 (3.72%)
S. marcescens	1 (1.82%)	–	1 (3.72%)
Others	4 (7.68%)	–	–

Conclusions: Contamination of the exit site by normal skin flora and subsequent spreading along the catheter track seems to be the most likely route of ECs colonization. The longer the catheterization, the higher the risk of ECs contamination gets. In surgical patients, ECs have to be removed when no longer needed for pain relief.

References:

1 Simpson RS. Reg Anesth Pain Med. 2000; 25(4): 360–7.
2 Holt HM. J Hosp Infect. 1995; 30: 253–260.

A-742

Safety and innovation: a unique method to manage postoperative pain

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Background and Goal of Study: The noninvasive, iontophoretic, fentanyl HCl patient-controlled transdermal system (PCTS) is therapeutically equivalent to a standard regimen of IV PCA morphine for the treatment of postoperative pain. The PCTS does not require bulky equipment and its preprogrammed nature eliminates the risk of medication errors due to improper programming observed with infusion pumps (1). This analysis assessed the safety of the PCTS in 3 phase III clinical trials.

Materials and Methods: An integrated analysis of safety data from 3 randomized controlled trials (n = 1325) was conducted. The PCTS (n = 714; 40-μg fentanyl over 10 min; up to 6 doses/h) was compared with transdermal placebo (n = 291) or a standard regimen of IV PCA morphine (n = 320; 1-mg bolus, 5-min lockout interval; up to 10 doses/h). Patients were titrated to comfort using IV opioids prior to treatment. Respiratory function was the primary safety measure. Adverse events (AEs) and application site reactions were also assessed. Patients who had at least 1 PCTS applied or IV PCA device enabled were included. Safety data from the initiation of treatment through 24 hours after the last dose were summarized.

Results and Discussions: Frequently reported AEs in PCTS vs placebo and PCTS vs IV PCA morphine studies were: nausea (37.9%; 21.2% and 44.0%; 49.1%), fever (8.6%;10.4% and 20.9%; 20.3%), headache (8.6%; 6.6% and 14.9%; 9.1%), and vomiting (11.8%; 5.7% and 11.1%; 9.4%), respectively. Respiratory AEs were uncommon with the PCTS and IV PCA morphine (hypoxia 4.1% and 3.4% and pharyngitis 2.5% and 1.6%, respectively). Clinically relevant respiratory depression (CRRD) was not observed with the PCTS; however, 1 case was reported with IV PCA morphine. Mild application site erythema was reported with the PCTS (14.1% vs placebo and 2.2% vs IV PCA), whereas pruritus occurred predominately with IV PCA morphine (12.5%).

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Conclusion(s): The PCTS is well tolerated and the incidence of opioid-related AEs was similar to that observed with IV PCA morphine.

Reference:
1 Vicente KJ, et al. *Can J Anaesth.* 2003;50:328–32.

Acknowledgement: Supported by ALZA Corporation.

A-743

Total knee arthroplasty relieves sexual dysfunction due to chronic painful knee disease

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Background and Goal of Study: Sex is an important contributor to quality of life and people are staying sexually more active even during elder age, given motility is not impaired. Total knee arthroplasty (TKA) is a widely accepted surgical procedure relieving pain and improving function. Although the increase in quality of life is well documented, the effect of knee disease and total knee arthroplasty on sexual function have not been surveyed yet.
Materials and Methods: We investigated 171 patients (>19 years) having got TKA within the last 2 years and at least within the last 6 months. Those living in an active sexual relationship were asked to an interview, either personal or on the phone, about the kind and duration of their knee disease, sexual problems due to this, function, pain and sexuality after total knee arthroplasty.
Results and Discussions: From 109 patients we could reach, 48 (21 male, 57 ± 12 years, 27 female, 59 ± 8 years) had sexual partners and were willing and/or able to participate. No inference with knee impairment was seen in 48%, from the 52% (n = 25) with impaired sexual function, in 60% (n = 15) sexual function improved after operation, 8% (n = 2) had only slightly improvement, where 32% (n = 8) had no increase in sexual activity. Main reason (94%) was seen in better function of the knee. Interestingly, the preferred position during sex has not been influenced.
Conclusion(s): Our data show that knee disease often impairs sexual function. Total knee arthroplasty is an appropriate procedure to improve sexual activity and probably quality of life in these patients.

A-744

Pupil dilation response to noxious stimulation during midazolam sedation

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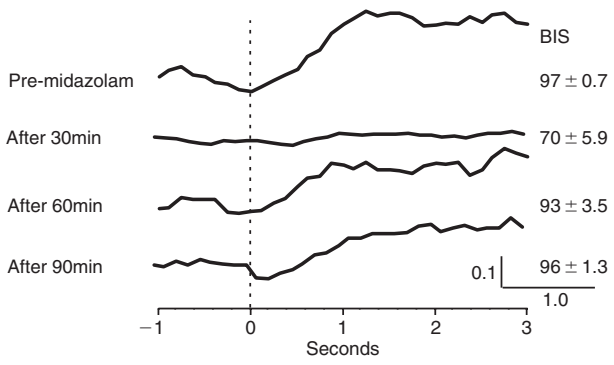
Background and Goal: The pupil dilation response (PDR) to a painful stimulus is a subtle, event-related increase in pupil diameter that occurs following brief noxious stimulation. It varies in amplitude with increasing stimulus intensity. However, diameter of pupil changes by mental activities such as excitement or fear. We made a hypothesis that PDR could be an objective parameter for sedation level, to determine: 1) whether decreases in PDR amplitude to midazolam sedation could be demonstrated; and 2) whether such change would be parallel alternations in BIS.
Materials and Methods: In a double blind trial, twelve healthy, female volunteers ranging in age from 25 to 28 years as subjects participated in this study. Subjects repeatedly experienced a painful electrical stimuli (VAS = 8, ISI = 9~11 sec) delivered to a fingertip to measure PDR, Somatosensory Evoked Potentials (SEP). Sedation was induced with a bolus intravenous administration of midazolam (0.075 mg/kg) to compare PDR, SEP and BIS value before and after the sedation.
Results and Discussions: A PDR for a typical subject is shown in the figure:



Conclusion(s): 1) Amplitude of PDR decreased with midazolam sedation; 2) Amplitude of PDR correlated consistently with BIS. PDR amplitude appears to be a useful approach for the assessment of sedation level.

References:
1 Oka S. JOP 2000; 14: 97–105.
2 Chapman CR. Psychophysiology 1999; 36: 44–52.

Acknowledgement: Sato Fund of Nihon University School of Dentistry (2004) supported this work.

A-745

Preanaesthetic information: do patients benefit?

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Background and Goal of Study: To evaluate the benefits and approval of the information and consent for anaesthesia (IC) by our patients.
Materials and Methods: An opinion questionnaire was designed together with the Epidemiology Department of our hospital consisting of: (A) Demographic data (age, gender, education level: illiterate, primary school, secondary school and university). (B) Benefits of the IC: 1. To get the right amount of support from others in making the choice; 2. To make the choice without any pressure from others; 3. To have enough advice about the options. (C) Disadvantages: 1. Increasing doubts about the operation, 2. Increasing fear of surgical operation. (D) Approval of signing the IC. Population questioned: Spanish speakers, between 18–85 years old, scheduled to undergo an operation. Cut off age: 55 years old. Standard of evaluation: age, gender and education level. The evaluation scale of the answers was: agree, disagree, neither agree nor disagree. All patients had previously received oral and written information about the anaesthetic process. Statistic significance: $p \leqslant 0.05$.
Results and Discussions: A total of 318 questionnaires were given out and 301 (94.6%) were completed. Average age: 52.4 (16.24), 57.5% were women, 52.3% had low studies. It is noteworthy that 2.7% were illiterate people. Patients under 55 years old were educated people ($p = 0.001$). In relation to the benefits of the information given, patients over 55 years old with basic studies had the right amount of support in making their choice ($p = 0.01$) without any pressure from others ($p = 0.02$), but their fear of the operation increased ($p = 0.01$). Patients under 55 years old had increased doubts about the operation ($p = 0.009$). Women showed a high interest in the operation process, but their fear increased ($p = 0.001$). 74.9% of the patients considered it necessary to sign the IC (no statistical differences among variables).
Conclusion: Preanaesthetic information given to patients should be adapted to their age, gender and education level. Young educated patients are more knowledgeable and demand more in-depth information, but that increases their doubts about the operation. We should enphasize the value of the preoperative visit and the importance of good communication skills.

A-746

Preemptive epidural analgesia with bupivacaine and the effects of epidurally added epinephrine for thoracic surgery

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Background and Goal of Study: To determine if preemptive epidural analgesia performed before thoracotomy incision and during the operation reduces postoperative pain, and to compare these effects according to the usage of epinephrine.
Materials and Methods: Sixty patients admitted for thoracic surgery were randomly allocated into three groups (n = 20 each). Group A received 9 ml 0,25% of bupivacaine and 1 ml of sufenta forte (50 μg/ml) via the epidural route prior to skin incision, followed by an infusion of bupivacaine 0,125% and sufenta forte 2 μg/ml at 6 ml/hr. Group B (control) received saline in the epidural. In both groups patients received 9 ml of bupivacaine 0,25% and 1 ml of sufenta forte (50 μg/ml) via the epidural route at the time of the chest closure. In the third group (group C), the same doses of bupivacaine and sufenta forte, identically as in group A, were given to the patients including epinephrine in the epidural mixture (1:200000). The level of statistical significance was pointed at $p < 0,05$.
Results and Discussions: The patients in the group A had lower maximum pain scores in the first 8 hours postoperatively, with less isofluran

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requirements intraoperatively and better pulmonary functions, compared with the control. In the epinephrine group patients had lower pain intensity (for 2–3 scores at VAS) and smaller clinical needs for the rate of the epidural infusion postoperatively than those in the group A. The usage of epinephrine has caused less nausea and easier mobilization.

Conclusion(s): While there was a benefitial effect of the reduced intraoperative anaesthetic requirements, any lasting effect of preemptive analgesia did not extend beyond 8 hours after the operation. Epinephrine, however, has a marked role in pain releif when added to the local anaesthetics and opioids for the epidural analgesia in thoracic surgery.

A-747

Comparison of the postoperative analgesic effect produced by epidural infusion of ropivacaine and fentanyl with and without adrenaline

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Background and Goal of Study: Basic pharmacological research indicates that there is positive pharmacodynamic interaction between adrenaline, ropivacaine and fentanyl during epidural analgesia (1). The objectives of the present study were to evaluate whether adrenaline added to epidural ropivacaine-fentanyl infusion improved pain relief and decreased the incidence of adverse effects (2).

Materials and Methods: A prospective, randomized study was carried out in 28 patients after major orthopedic surgery. Patients were given continuous epidural ropivacaine 2 mg/ml–fentanyl 2.5 μg/ml infusion either with (n = 16) or without (n = 12) adrenaline (2 μg/ml) for postoperative pain relief and observed for three days. Intravenous tropisetron and intramuscular ketoprofen were administered to all patients. Main outcome measures were pain intensity at rest and during activity, evaluated on a 0–10 pain scale where 0 = no pain and 10 = worst possible pain, drug consumption, incidence and severity of adverse effects (i.e. nausea, vomiting, pruritus, drowsiness, respiratory depression, hemodynamic instability, urinary retention, motor blockade). All the data were analyzed using the SPSS for Windows version 10.5 computer program.

Results and Discussions: There were no significant differences between the two study groups with respect to age, sex, ASA-group or surgery performed. The need for ropivacaine ($P = 0.001$) and fentanyl ($P = 0.001$) as well as observed pain scores were significantly lower in the triple epidural mixture group than in the double epidural mixture group. Pain intensity differences at rest were less pronounced. The incidence of nausea, vomiting and pruritus was lower in the triple epidural mixture group ($P = 0.026$). Other adverse effects were not noted in either study groups.

Conclusion(s): Adrenaline (2 μg/ml) improves the pain-relieving effect, facilitates mobilization and decreases the occurrence of adverse effects when added to an epidural infusion of ropivacaine 2 mg/ml and fentanyl 2.5 μg/ml after major orthopedic surgery.

References:

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2 Kokki H. *Acta Anaesth Scand* 2002; 46: 6, 647–654.

A-748

Levobupivacaine for postthoracotomy pain: is epidural catheter more successful than extrapleural intercostal nerve block analgesia?

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Background and Goal of Study: Leobupivacaine, the pure S-enantiomer of racemic bupivacaine, retains similar local anaesthetic properties and efficacy to racemic bupivacaine, but has been shown to have less cardiotoxic potential. We compare its use in two analgesic techniques for posttoracotomy pain.

Materials and Methods: 30 patients undergoing elective lobectomy were randomized to each group. Patients in epidural group (EPI group) received a continuous infusion (5 ml/h for two days) of levobupivacaine 0,125% plus sufentanil 1 mcg/ml through a thoracic epidural catheter inserted preoperatively T5–T9. For patients assigned to extrapleural group (EXT group), just before chest closure, a catheter was placed extrapleurally in a dorsal paravertebral position perpendicular to 3 to 4 intercostal spaces and, after a bolus of 20 ml of levobupivacaine 0,5%, a continuous infusion of levobupivacaine 0,25% at 5 ml/h for two days was started. Each patient had a Patient Controlled Analgesia device programmed to deliver a bolus of morphine 0,6 mg with a lockout of 7 min. Resting and dynamic visual analog pain scale, respectively VASr and VASi (range from 0 to 10) were measured basally, at the end of surgery then hourly up to 4 h and then each 4 h until 48 h. Total morphine consumption was registered.

Results and Discussions: In both groups an effective control of postoperative pain was obtained (always VASr < 4 and VASi < 5). VASi values were lower in EPI group during the first 24 h and mean consumption of morphine was greater in EXT group during the two postoperative day, but these differences were not statistically significant. Two patients of EXT group experienced vomiting and one required a supplemental analgesic (ketorolac 30 mg).

Conclusion(s): The slightly better quality of analgesia in EPI group cannot justify exposing patient to serious complications, albeit rare, of epidural catheter. Extrapleural intercostal analgesia might be a valuable alternative (1), particularly for patients who either do not qualify for epidural analgesia or refuse it.

Reference:

1 M Concha. Analgesia after thoracotomy: epidural fentanyl/bupivacaine compared with intercostal nerve block plus iv morphine. *J Cardiothor Vasc Anesth* 2004; 18(3): 322–326.

Education, Research and Presentation

A-749

Effect of pediatric cardiopulmonary resuscitation course on pediatric resident knowledge

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Background and Goals: Guidelines for resuscitation training have been written in both Australia and the United Kingdom, and an advanced life support group has been formed with the aim of improving the emergency care of patients.[1,2]

We tried to evaluate pediatric residents' knowledge in cardiopulmonary resuscitation before and after Pediatric Advanced Cardiac Life Support course.

Material and Methods: After an examination from all pediatric residents of Tehran University of Medical Sciences ,we divided participants into two groups, non trained group (group 1) and group that had to undergo training (group 2). We scheduled the course for group 2, and a month later, a reexamination from the previous topic was taken from all participants.

Results: The mean of the first examination score in group 1 and group 2 was low and reflecting no significant differences between the groups.

In the reexamination after the Pediatric Advanced Cardiac Life Support course for half of the volunteers, the results showed a statistically significant improvement in group 2 ($P < 0.05$). Data (Mean ± SD and P value) are shown in the Table 1:

	Group 1	Group 2	P value
Mean ± SD of **A1**	5.27 ± 1.24	5.41 ± 1.73	0.766
Mean ± SD of **A2**	4.5 ± 1.65	7.45 ± 0.91	<0.0001
Mean ± SD of **V1**	4.27 ± 1.12	4 ± 1.48	0.495
Mean ± SD of **V2**	4.05 ± 1.74	7.05 ± 1.17	<0.0001
Mean ± SD of **D1**	3.55 ± 1.1	4.1 ± 8 1.73	0.154
Mean ± SD of **D2**	4.68 ± 1.17	6.2 ± 1.23	<0.0001
Mean ± SD of total score in first exam	13 ± 2.39	13.64 ± 2.75	0.418
Mean ± SD of total score in second exam	13.23 ± 2.75	20.45 ± 2.2	<0.0001

A1: Air way management score in first exam; **A2**: Air way management score in second exam; **V1**: vascular access score in first exam; **V2**: vascular access score in second exam; **D1**: Drug information score in first exam; **D2**: Drug information score in second exam.

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Conclusion: We concluded that knowledge of pediatric residents in all the subtitles of cardiopulmonary resuscitation was low, and after pediatric Advanced Cardiac Life Support course, their knowledge enhanced.

References:

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2 Advanced Life Support Group. *Advanced Paediatric Life Support. The Practical Approach*, 2nd edn. BMJ Publishing Group London, 1997.

A-750

Resuscitation of the newborn – a workshop for anaesthetists

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Background and Goal of Study: Anaesthetists have the skills to appropriately resuscitate asphyxiated newborns, but if these skills are used infrequently and in an unfamiliar context, performance may suffer. This workshop, conducted at the Australian Society of Anaesthetists ASM 2004, aimed to review the pathophysiology of neonatal asphyxia, increase familiarity with equipment for newborn resuscitation and to enhance teamwork, communication and performance skills.

Materials and Methods: A didactic presentation was followed by familiarisation with the resuscitation equipment and simulation manikins. Laerdal ALS baby manikins were modified to simulate spontaneous ventilation and to have a palpable umbilical pulse. Both parameters could be varied by the instructor without the candidate's knowledge forcing them to examine and re-examine the manikins as scenarios evolved. Small groups, each with their own instructor, had to work as a team in 3 resuscitation scenarios.

Results and Discussions: Thirty two questionnaires were completed by 27 consultant anaesthetists, two trainees, two general practitioners and one clinical nurse consultant. Thirteen of the 32 had resuscitated a baby in the previous year. Only 8 felt confident of their abilities before the workshop. After the workshop, only one was still not confident. All 32 felt that their skills had improved and would recommend the workshop to their peers. Thirty one thought that they would like to do the workshop again.

Conclusion(s): This workshop using interactive techniques and an augmented manikin was well received and proved effective in improving confidence in newborn resuscitation.

A-751

Undergraduate medical students attitudes toward pain – comparison between the first and the last year students

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Background: The current education in the assessment and management of pain does not provide doctors with the skills needed in the clinical practice (1,2). In our faculty, pain-related topics are taught throughout the study time, but there is no specific written pain curriculum (3). There is a brief intensive course on pain during the 6th study year. The purpose of this study was to compare the first and the last year medical students' attitudes about pain.

Methods: A questionnaire was constructed using attitudes and knowledge described in previous studies (1,3) as well as attitudes concerning use opioids for both chronic and cancer pain. Each item (24) was asked using three different formulations and there were 70 items in the questionnaire (Likert scale 1–7). The students were asked to provide their names. The questionnaire was given to the 6th year students before a brief intensive course on pain. The 1st year students served as a control group. Re-test was made electrically to the 1st year students 2 weeks after the first questionnaire and to the 6th year students one month after the intensive course.

Results and Discussion: Eighty-four 1st year students out of 110 (76.3%) and 78/97 of the 6th year students (80.4%) answered the questionnaire. Internal consistency was acceptable in six of the 24 items (Cronbach alpha >0.6). The re-test from the 1st year students showed good correlation (Spearman Rank, correlation co-efficient mean 0.74). The 6th year students re-test correlated with the pre-course results (Spearman Rank, correlation co-efficient mean 0.76). The 6th year students had strict opinions about pain, while the 1st year students were more neutral with their views. The 6th year students were more concerned about meeting patients with chronic pain (4.63 SD 1.35 vs. 3.67 SD 1.31). The 1st year students were more concerned about risk for opioid addiction in cancer patients (4.11 SD 1.47 vs. 1.22 SD 0.45).

Conclusion: The attitudes are formed during the study time and a brief intensive course did not have an impact.

References:

1 Turner GH, Weiner DK. Pain Med 2002; 3: 240–252.
2 Pöyhiä R, Kalso E. Pain 1999; 79: 121–125.
3 Pilowsky I. Pain 1988; 33: 1–2.

A-752

Generating a learning curve for the Bonfils Intubation Fiberscope. A pilot study evaluating the difference between novice and staff anaesthetists

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Background and Goal of Study: The rigid Bonfils Intubation Fiberscope (BIF) used by experienced anaesthetists is an effective instrument for orotracheal intubation (1) and a suitable alternative for management of the unanticipated difficult airway (2). The goal of this study was to find any difference between residents and staff anaesthetists when performing endotracheal intubation using a BIF by generating a learning curve and to define a minimal case load necessary to master this technique.

Materials and Methods: After ethics committee approval four novice anaesthetists (R) and three staff anaesthetists (S) performed 40 intubations with a BIF in elective surgical patients. All participants were naive for this method. Exclusion criterions were ASA $>$II, Arne-score for preoperative assessment for difficult intubation >11, and age <18 years. Anaesthesia was induced with Fentanyl 1,5 μg/kg, Propofol 2 mg/kg, and Rocuronium 0,6 mg/kg. Intubation was attempted after 120 sec. Successful intubation was defined as duration of the procedure $\leqslant 80$ sec, and less than three attempts.

Results and Discussions:

Table. Learning Bonfils Laryngoscopic Intubation.

	N	CI lower 95%	MEAN	CI upper 95%
Success rate after 20 attempts				
R + S	7	0.708	0.786	0.851
S	3	0.715	0.8333	0.917
R	4	0.6406	0.75	0.8401
Success rate after 40 attempts				
R + S	7	0.77	0.817	0.86
S	3	0.81	0.88*	0.93
R	4	0.68	0.75*	0.82

*P 0.002 (N: number; CI: confidence interval).

Conclusion(s): Staff anaesthetists had a statistically significant better overall success rate than residents and learned faster. The overall success rate after 40 attempts was 81.7% for both groups. Our findings suggest that a higher case load ($>$40 attempts) may be necessary to master this intubation method with a high success rate ($>$95%).

References:

1 Halligan M, et al. Anaesthesia 2003; 38: 1087–90.
2 Rudolph C, et al. Anaesth Reanim 1996; 21: 127–30.

A-753

Success rate of intubating with the Bonfils Intubation Fiberscope. A pilot study to evaluate the difference between novice and staff anaesthetists

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Background and Goal of Study: The Cumulative Sum Method (CUSUM) is recommended as a statistical method for measuring individual performance in medicine (1,2). Therefore, learning of endotracheal intubation with a Bonfils Intubation Fiberscope (BIF) was studied using this technique. It is possible with this technique to visualise learning progress.

Materials and Methods: After ethics committee approval four residents and three staff anaesthetists were included to perform 40 intubations with a BIF. All persons involved in the study were naive for the BIF intubation technique. Exclusion criterions were ASA $>$II, Arne-score for preoperative assessment for difficult intubation >11, and age <18 years. Anaesthesia was induced with Fentanyl 1,5 μg/kg, Propofol 2 mg/kg, and Rocuronium 0,6 mg/kg. Intubation was carried out after 120 sec. Successful intubation

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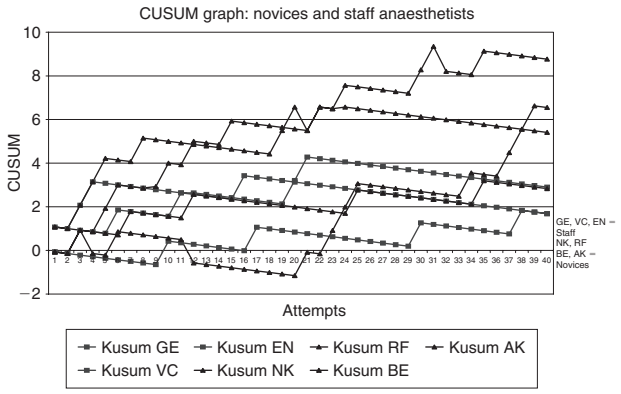
was defined as duration of the procedure ⩽80 sec, and less than three attempts. The following assumption were made for the calculation of the CUSUM value: acceptable failure = 0,05 and unacceptable failure 0,1 (alpha 0,05; beta = 0,1).

Results and Discussions: CUSUM plots for all trainees are shown in the graph. Overall success rate of residents an staff was 81,7% (95% confidence interval 0.77–0.86).



Conclusion(s): Using the CUSUM technique a conclusive number for definition of the minimal case load for BIF was not possible within 40 attempts. Therefore alternative methods for the generation of valid learning curves must be considered.

References:

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2 Lim TO, et al. Int J Qual Health Care 2002; 14: 251–258.

A-754

The European Diploma in anaesthesiolgy and intensive care, and the in training assessment as tools of training evaluation: ten years of experience

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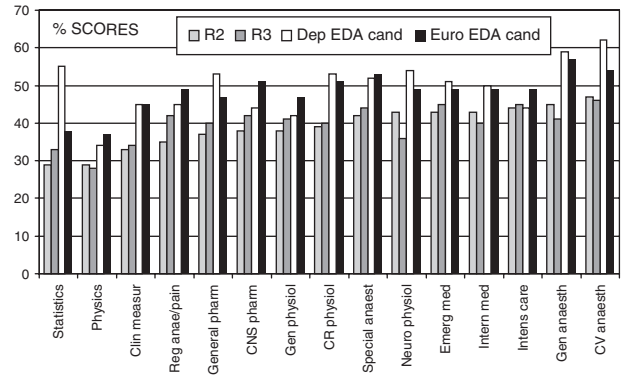
Background and Goal of Study: Exams are recognised tools for assessing theoretical knowledge acquisition and can also be used as a training program evaluation. The European Diploma of Anaesthesia (EDA) was introduced in 1984 as a comprehensive test of knowledge of anaesthesia, critical care and pain management and it has become an international European standard. Our objective was to determine if there is a pattern of knowledge acquisition related with the year of training and also we wanted to compare our results with the European average.

Materials and Methods: From 1994 to 2004, 29 residents (8 second year (R2), 21 third year (R3)) presented to the in training assessment of EDA exam. Also, 18 candidates presented to the EDA part I. We compared the detailed results among the different stage of training. Scores of European and our department EDA candidates were graphically compared.

Results and Discussions: There is a lack of progression in knowledge acquisition between R2 and R3 and the bulk of knowledge was obtained just before the EDA part I. When the scores of the European and our EDA candidates are graphically plotted, similar detailed results are observed.



Conclusions: a) the greatest part of the knowledge is reached during the last year of training, b) our department EDA candidates reach the mean European level of theoretical concepts, c) the EDA part I and the In Training exams are helpful tools for the evaluation of knowledge progression.

A-755

Simulator-based training increases students self-perceived anaesthesia competencies

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Background and Goal: Simulator-based training for medical students has been introduced into the curriculum to teach basic anaesthesia skills. The goal of our study was to evaluate this teaching-program.

Materials and Methods: 177 students participated in two one-hour simulation sessions introducing them to basic anaesthesia skills using a full-scale human patient simulator. To evaluate the training, two outcome criteria were used (1). First, students' reactions to the training were assessed by questionnaire items concerning the simulator training's perceived value. Second, student learning was assessed by collecting questionnaire data on students' self-perceived anaesthesiology competencies (concerning diagnosis, airway management, drug knowledge and administration, and communication competencies). Students rated their level of agreement with the items on a 6-point Likert scale (from 1 = strong agreement/high competency, to 6 = strong disagreement/low competency).

Results and Discussions: The reaction data showed that the participants considered the training relevant ($M = 1.55$; $SD = 0.80$), the simulator to be an appropriate learning tool ($M = 1.65$; $SD = 0.85$) and that they were overall satisfied with the training ($M = 1.78$; $SD = 0.93$). For the learning data, the conducted repeated measurements MANOVA yielded a significant overall effect for time of measurement ($p < .001$), indicating that the training led to an increase in students' self-perceived anaesthesia competencies. Univariate results are reported in the table.

Competency scale (n = 175)	Pre *M/SD*	Post *M/SD*	*p*
Diagnosis	3.83/.85	3.40/.92	<.01
Airway management	4.23/1.00	2.91/.86	<.01
Drug knowledge/administration	4.78/.95	3.50/1.03	<.01
Communication	3.45/.84	2.85/.81	<.01

Control group data and more objective measures should be collected in the future.

Conclusion: Students consider simulator training as appropriate and their basic anaesthesia competencies increase.

Reference:

1 Kirkpatrick DL. Evaluating training programs: The four levels San Francisco: Berret-Koehler, 1994.

A-758

Comparison of the stress induced by simulation-based training to stress during actual induction of anesthesia in the operating room

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Background and Goal of Study: Full-scale medical simulation is used for training and evaluation of anesthesiologists. The realistic properties of simulation-based training are commonly assessed by subjective questionnaire filled in by the trainee. The development of more objective parameters may improve the evaluation of simulation-based training. The aim of the present study was to compare the stress response, as reflected by the heart rate (HR) and by subjective questionnaire, during simulation-based training, and during the actual induction of anesthesia in the operating room (OR).

Materials and Methods: The HR of 14 junior anesthesia residents was measured continuously during 2 hours of a simulation-based training that included 5 scenarios (esophageal intubation, bronchospasm, malignant hyperthermia, anaphylaxis and pediatric resuscitation). Questionnaires for stress levels were filled by the participants before training, between the

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second and third scenarios, and at the end of training. The same parameters were assessed during the actual induction of anesthesia in the OR.

Results and Discussions: The baseline HR values before the simulation-based training and before induction in the operating room were similar (97 ± 16 and 93 ± 14, respectively). The maximal HR values during the performance of first (112 ± 16) and second (105 ± 18) scenarios were significantly higher than baseline measurements. Maximal HR during the third, fourth and fifth scenarios were not different from baseline values (102 ± 13, 99 ± 13 and 99 ± 13, respectively). The HR during the induction of anesthesia was 113 ± 15, higher then baseline values. The subjective stress score was not changed during the simulation-based training and was 4.8 ± 1.9 before training, 5.1 ± 2.1 during the training and 4.2 ± 1.9 at the end of training (all values are on a Likert scale of 1 to 8). The subjective stress during the induction of anesthesia was significantly lower (3 ± 1.3).

Conclusion(s): Compared to the actual induction of anesthesia in the OR, simulation-based anesthesia training is a stressful situation as indicated by a similar increase in HR and by higher subjective stress scores. Adaptation to the simulative environment may account for the decrease in HR during consecutive scenarios.

A-759

The PDA: a powerful and portable teaching tool

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Background and Goal of Study: Teaching endotracheal intubation (EI), central venous accesss (CVAc), regional blocks (RB) and echocardiography (E) demands visual didactic aids (books, "dummies", electronic video display tools) that are difficult to take to the operating theaters. A personal digital assistant (PDA) is an easily portable device that can store data, images and videos. A successful study was done to convert the PDA into a didactic tool.

Materials and Methods: The materials used were a Palm Pilot 515 (PDA), an IBM compatible PC, a video capture card (VCC), a VCR player, an image editor (IE), and an image and video converter.

A set of pictures related to EI, CVAc, and RB were stored in the PDA. The pictures were either downloaded from the Internet, or scanned, or produced personally by digital photography. The pictures were formatted with an IE program to obtain images of adequate size (160 × 160 pixels) and color depth (256 colors) clear to read in the PDA screen. JASC Paint Shop Pro and Microsoft Paint make this process easy and fast. Firepad Picture Viewer (FPV) converted the images to *.pdb files and displayed them in the PDA screen. E files were stored and displayed using also FPV. A VCC (All-in-Wonder 128 PRO) and a VCR made it possible to save echocardiographic video tapes as *.avi files.[1] Video for Windows, a simple but very effective video editor, was used to crop and resize the *.avi files. The FPV converted the *.avi to *.pdb files quite easily. The same program displayed the videos in the PDA screen with accuracy.

Results and Discussions: The production, storage and display of the didactic material needed for teaching EI, CVAc, RB and E were possible with the tools described above. The funds and time invested were modest and the level of computer expertise was easy to achieve. The ability to illustrate with pictures the procedures at hand facilitated teaching and learning.

Conclusion: An easy to achieve level of computer expertise and a modest monetary investment can provide anesthesiologists with a PDA programmed to enrich their teaching experience.

Reference:

1 León-ruiz EN: PDAs as Echocardiography TAs. Anesth Analg 2002; 93, SCA 1.

A-760

Dresdner integrated problem-based learning: DIPOL® course emergency medicine – injuries – intensive care medicine. Anaesthesiology as part of interdisciplinary undergraduate education

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Background and Goal of Study: As of October 1st 2003 a new government initiated legislative basis for undergraduate medical education in Germany was passed. This resulted in substantial changes in the structure of the medical curriculum and in heightened teaching load in particular. These changes have to be implemented in each German faculty's undergraduate program.

Materials and Methods: The Carl Gustav Carus Faculty of Medicine of the Technical University Dresden already started to establish an interdisciplinary reform curriculum in 1998. Since then a hybrid model of traditional lectures, seminars, practical and problem based learning courses has been implemented for all courses in undergraduate medical training (**D**resdner **I**ntegrated **Pro**blem-based **L**earning: DIPOL®).

Results and Discussion: The course concept and evaluation results of the 2003 "Emergency Medicine – Injuries – Intensive Care Medicine" course are presented. The results show that the course was very well received by students and tutors. 95% of the students passed the theoretical and practical exams.

Conclusions: Next to a description of the Dresden DIPOL® concept we report a course covering Anaesthesiology and Intensive Care Medicine that conforms with the new German federal law. The evaluation results demonstrate that students and tutors accept the new curriculum. A continuous further evaluation is an essential part of quality control and is necessary for the further development of a new curriculum.

A-762

Training and education tool for muscle relaxant administration regimes

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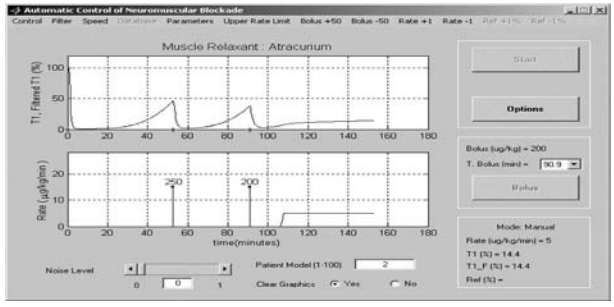
Background and Goal of Study: Development of a package to be used as an advanced tool for education and training purposes of drug administration regimes.

Materials and Methods: The package has been developed in MATLAB language, using the current features on graphic user interfaces, and may be used as an advanced simulation tool for the test and comparison of fairly different trial situations, under a variety of circumstances and muscle relaxant drugs, namely atracurium, cisatracurium, rocuronium and vecuronium. The software incorporates randomly generation of pharmacokinetic/pharmacodynamic models driven by simulated drugs administration regimes (bolus and/or continuous infusion). The package also incorporates several control strategies[1] and it can be also used for the automatic control on patients undergoing surgery[2]. In order to provide a wide broad of situations, the friendly user interface and the toolbar enables/disables a variety of different options namely those related with operating mode, reference level, control strategies and the filtering methods.

Results and Discussions: The figure illustrates a graphical environment of a simulated case under manual control strategy.



Conclusion(s): The special features of this package give to the clinical staff a powerful tool, providing a variety of test situations namely a good insight on drug models and control strategies.

References:

1 Control Eng Pract, 1998, 6:1225–1231.
2 EMBEC02, Vienna, Austria, 664–665.

Acknowledgement: Portuguese Foundation for Science and Technology.

Patient Safety

A-763

Immediate reactions following contrast media injection: results of a 3-year multicenter survey

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Background and Goal of Study: The aim of this 3-year (2001–2003) prospective multicenter study was to classify immediate reactions to iodinated contrast media (ICM) by using clinical data and skin tests.
Material and Methods: The following data were collected: name of injected ICM, gender, age of patients, time delay between injection and reaction, clinical signs classified according to the Ring and Messmer severity scale[1], treatment of the reaction, pretreatment before injection. Reactions were considered as IgE-mediated allergic hypersensitivity (anaphylaxis) where suggestive clinical symptoms and positive intradermal tests (IDT) with the culprit ICM were observed (Group I) or non-allergic hypersensitivity reactions where clinical signs were suggestive, but IDTs were negative (Group II).
Results and Discussion: 26 patients were classified, 19 patients (73.1%) entered Group I, non-ionic ICM were involved for 79% of them. Seven patients entered Group II (26.9%), all had received non-ionic ICM. In both groups, a female predominance was observed. The mean age was similar in both groups. The reactions occurred less than 5 minutes after injection in 75% of the cases in Group I and in 66.6 % in Group II. Cutaneous signs were present in 95% of the patients of group I and in all the patients of group II, whereas cardiovascular signs (52.6%) and life-threatening reactions (36.8%) were seen only in Group I. Intravenous sympathomimetic drugs were injected for treatment in 29.4% of patients in Group I, but not in Group II. Corticosteroids and/or anti-H_1 were administered to 70.6% of patients of Group I and to 60% of Group II. Reactions occurred despite pre-treatment in 50% of patients of Group I. Our results indicate that allergic hypersensitivity is the most frequent and clinically severe mechanism involved in immediate reactions to ICM and occur despite pre-treatment. Reactions are more numerous with non-ionic ICM reflecting probably the actual market use.
Conclusion: According to our results, anaphylaxis appears frequently responsible for immediate reactions following ICM injection. Patients who develop an immediate reaction following ICM injection should undergo allergological assessment. If the injected ICM gives a positive IDT, it should be definitively discarded.
Reference:
1 Lancet 1977; i: 466–9.

A-764

Preferred head position in Great Britain during rapid sequence induction of general anesthesia for patients with increased risk for aspiration: an e-mail survey

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Background and Goal of Study: There has been hardly a consistent recommendation regarding the optimal head position during induction of general anesthesia in an effort to reduce aspiration risk. Among the scanty literatures two positions are recommended for different reasons: head-up and head-down. Proponents of the former argue that head-up position reduces aspiration risk from passive regurgitation by facilitating the gravitational force working in favor of the stomach. Proponents for the head-down position, on the other hand, point out that the risk is reduced, if and when active vomiting occurs, by draining the vomitus away from the trachea and out of the mouth for evacuation. Dr. Sellick who invented the famous Sellick Maneuver had recommended this position in his original paper (1). An E-mail question survey was sent out to 360 anesthesiologists in Great Britain to determine the preferred head position during rapid sequence induction for patients with increased aspiration risk.
Materials and Methods: The one-question survey elicited the respondents to choose one of the three possible positions: head-up, flat, or head-down. We did not select those who are with non-M.D. degrees or in residency training.
Results and Discussions: Among 154 responses (43% response rate), 132 (86%) indicated that they keep the patients' head position flat; 16 (10%) indicated they raise the head up, 4 (3%) indicated they keep the head down and the remaining 2 (1%) were unclear. There was an overwhelming preference of the head position to be flat during rapid sequence induction for patients with increased aspiration risk. A similar result was obtained in a previous study in the US (2). It is interesting to note that no current major US textbooks in anesthesiology explicitly recommend flat head position as the optimal position to reduce the risk for aspiration.
Conclusion(s): The majority of anesthesiologists in Great Britain does not raise or lower the heads in relation to the patients' feet when they perform rapid sequence induction. Patient's head position does not seem to be a major factor in an effort to reduce the risk of aspiration during induction of general anesthesia.
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A-765

Survey among Spanish anesthetists to evaluate the use of temperature monitoring and the application of methods to prevent hypothermia

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Background and Goal of Study: Non therapeutic intraoperative hypothermia has been related to a high incidence of complications (cardiovascular morbidity, coagulation impairment and postoperative infections)[1–3]. We performed a survey among Spanish anesthetists to evaluate the use of temperature (T) monitoring and the application of methods to prevent hypothermia in the operating theatre.
Materials and Methods: A survey was carried out in 70 hospitals of different characteristics (public, teaching and private) around Spain. A thousand questionnaires were distributed and 623 were completed. There were six main topics: A) Frequency of T monitoring. B) Professional who decided to monitor T. C) Surgical/patient criteria for monitoring T. D) Location of T monitoring. E) Method of prevention used in the operating theatre, if any. F) Attitude towards warming transfusion blood.
Results and Discussions: A) T was not monitored in any case by 43.5% of anesthetists (75% of them stated they no had means of performing it), 45.3% of anesthetists performed it in less than 50% of procedures and 9.6% assured that they monitor T in over 50% of patients. B) Decision to monitor T was taken in 87.6% of cases by the anesthetist, in 4.1% by surgeon, 1.3% by perfusionist and 1.1% by nurse. C) Criteria for T monitoring (multiple choice): 75% was length of surgery (51% $>$3 hrs, 49% $>$2 hrs), 26.4% patient's age, 12.7% potential blood loss, 8.7% suspicion of malignant hyperthermia. D) Location of T monitoring: pharyngeal or esophagus 56.7%, bladder 13.6% and rectal 7.9% of cases. E) Method of prevention of used in the operating theatre: Fluid heater 28.1%, air warming blanket 24.6%. F) 76.1% of anesthetists always warmed transfusion blood, 18.3% only warmed blood in case of transfusing more than 2 blood units, and 5.5% never warmed blood.
Conclusions: T is not integrated in routine intraoperative monitoring. A large number of anesthetists do not have the proper apparatus to measure it. However, availability does not guarantee its use. Potential consequences of hypothermia are underestimated by many anesthetists.
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2 Kasai T. Anesth Analg 2002;95:1381–3.
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A-766

Internal jugular vein cannulation – comparison of central approach (palpation method) and posterior approach (non-palpation method)

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Background and Goal of Study: To compare the two approaches for internal jugular vein cannulation in patients undergoing renal transplant.
Materials and Methods: Sixty Hundred patients scheduled for kidney transplant were included in this study. Internal jugular vein cannulation was

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performed either by central approach or posterior approach. Number of attempts, cannulation time and incidence of complications were recorded.
Results and Discussions: Successful cannulation with few attempts was more in posterior approach (93.8%) than in conventional central approach (87.5%) and cannulation procedure time was also shorter in posterior approach (413.87 ± 88.02) than central approach (319.62 ± 69.58). Incidence of complications e.g. arterial puncture were less in posterior approach (7/80) compared to central approach (18/80).
Conclusion(s): Internal jugular vein cannulation by posterior approach (non-palpation method) is superior to central approach (palpation method) in terms of number of attempts, speed of cannulation and risk of arterial puncture.

A-767

The training of the automated anaesthesia record keeper with high fidelity human patient simulator for novice residents

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Background and Goal of Study: In Hamamatsu University Hospital, we made up an automated anaesthesia record keeper (AARK) and it has been applied to all operations since 1994. It is also connected to a network which allows them to use a billing system after the operation. Although it is useful, it is hard to use correctly for novice residents. We have been using the HPS (High fidelity human patient simulator, METI, Florida, USA) for the education of residents and medical students. Recently, we started to make novice residents train with the AARK connected to the HPS system with the training of general anaesthesia.
Materials and Methods: We had already found out the common mistakes in the billing reports which novice residents tended to make. We compared the before rates and after rates of billing reports with mistakes at the commencement of this training. We also evaluated the efficiency of this training in some situations, for example, quickness to input the data in a certain situation, the times to correct the mistakes by themselves.
Results and Discussions: The rate of the billing reports with mistakes decreased significantly ($P < 0.05$). In all situations, we evaluated a large improvement in their performances of using AARK.
Conclusions: The training of the AARK with the HPS system was effective in order to decrease the common mistakes which novice residents tended to make. This training also improved their performances of using AARK.
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A-768

Making sure of patients identity and side of surgery: the results of an audit on the triple check

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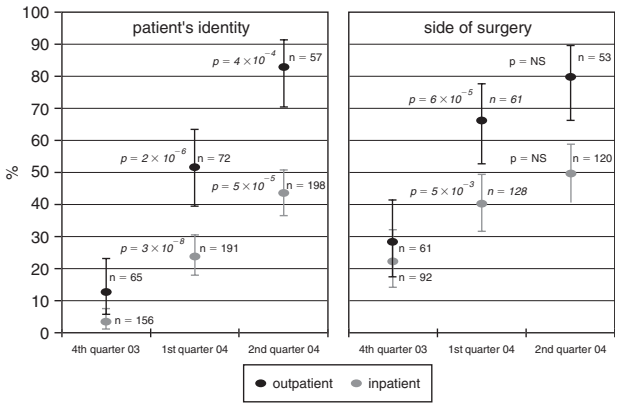
Background and Goal of Study: Checking patient's identity and side of surgery is nowadays a formal recommendation.[1] However, efficient prevention of errors demands an explicit method of checking, dependent on patient participation as well as a high compliance of clinicians. To achieve this objective, we audited the compliance to our "triple check", an explicit method to ensure patient's identity and side of surgery.
Materials and Methods: "Triple check" was developed by a group of surgeons, intensive care specialists and anaesthesiologists. Patients were asked for first and last names, date of birth and side of surgery. Then these data were compared to data present on patient's wristband, and the mark of surgical side respectively, with information available on operating room schedule and in patient's record. The audit was conducted between October 2003 and June 2004 via direct observation in both outpatient and inpatient operating rooms.
Results and Discussions: Between first and second quarters, compliance to the "triple check" significantly increased in all settings for patient's identity and side of surgery checks. Between second and third quarters, it increased only for patient's identity check. Non compliance was usually due to absence of wristband or mark of side, patients seen on the day prior to surgery and reluctance to ask patients directly.



Conclusions: Explicit definition of a method of checking patient's identity and side of surgery is necessary. Our audit fostered this rigorous check but showed this can be limited by systemic and behavioural issues.
Reference:
1 JCAHO. Universal Protocol for Preventing Wrong Site, Wrong Procedure, Wrong Person Surgery, 2003.

A-769

Extended-release epidural morphine does not increase risk of delayed respiratory depression

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Background and Goal of Study: The incidence of delayed respiratory depression with epidural morphine sulfate reportedly ranges from 0.09%–0.74%, and as high as 2.0% with intravenous (IV) patient-controlled analgesia (PCA) (1–3). DepoDur™ is a single-dose, extended-release formulation of morphine sulfate recently approved in the United States for the control of postoperative pain. This analysis assessed whether the extended duration of analgesia (up to 48 hours) increased the rate of delayed respiratory depression relative to IV PCA or standard epidural morphine sulfate.
Materials and Methods: Respiratory depression was monitored in 7 phase II or III trials among patients administered single-dose epidural DepoDur (5, 10, 15, or 20 mg), standard epidural morphine sulfate 5 mg, or IV PCA. Adverse events (AEs) potentially related to respiratory depression (respiratory depression, hypoxia, hypercapnia, dyspnea, apnea, and hypoventilation) at >2 h and <48 h postoperatively and requiring intervention with opioid antagonists were counted as delayed respiratory depression.
Results and Discussion: Of the 605 patients administered recommended doses of DepoDur (≤20 mg for 510 patients <65 y of age and ≤15 mg for 95 patients ≥65 y of age), 19.2% had AEs potentially related to respiratory depression. For the 230 patients treated with IV PCA or standard epidural morphine sulfate, the overall rates of respiratory AEs were 52.7% and 12.4%, respectively. Twenty-two patients administered DepoDur met the criteria for respiratory depression, with the majority of events occurring <2 h following surgery; 6 patients (1%) experienced delayed respiratory depression, which occurred at 6.3, 7.1, 7.6, 10.4, 14.2, and 14.5 h after DepoDur administration.
Conclusion(s): Although DepoDur provides up to 48 h of pain relief that is consistent with a continual release of morphine into the epidural space, the incidence of delayed respiratory depression is similar to the rates reported previously for standard epidural morphine sulfate.(1–3).
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Acknowledgments: This presentation was supported by SkyePharma, Inc. and Endo Pharmaceuticals Inc.

A-770

Methicillin resistant staphylococci rapidly colonize the skin following cefazolin prophylaxis

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Background and Goal of Study: Preoperative antibiotic administration reduces postoperative wound infection after clean surgery (1). This prophylaxis

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also changes skin flora and helps emerging resistant bacterial strains. Postoperative infections caused by drug resistant pathogens are more difficult to treat and are associated with higher morbidity and mortality. In this study we examined the effect of perioperative cefazolin prophylaxis on the occurrence of methicillin resistant staphylococci in the skin flora.

Materials and Methods: Twenty male patients scheduled for cardiac surgery were included in the study. Age 56 ± 7 years. The first sample was obtained before the intravenous administration of 1g cefazolin (Totacef®, Bristol-Myers Squibb, USA). Other samples were taken following the surgery daily for a week.

Bacterial samples were taken with contact Rodac Petri plate (Neomed, Italy) from the chest. We also used plates containing cefazolin (30 $\mu g\,mL^{-1}$) to select the resistant strains. The plates were incubated for 24 hours at 37°C and the colony forming units (cfu) were counted. The method is described in details elsewhere (2). Methicillin resistance encoding gene (*mecA*) in cefazolin resistant coagulase negative staphylococci (CNS) was amplificated by PCR and detected by agarose electrophoresis.

Statistical method: chi-square test.

Results and Discussions: Two patients had methicillin resistant (also cefazolin resistant) coagulase negative staphylococci before surgery. By the end of the study 17 of 20 patients had methicillin resistant CNS on the skin (Table 1).

Table 1. The occurrence of methicillin resistant CNS on the skin.

Sample collection	Before surgery	Post operative days 1	2	3	4	5	6	7
mecA$^+$CNS carriers	2	3	9	13	13	16	17	17

The occurrence of methicillin resistant CNS was significantly increased from the second the postoperative day ($p < 0.05$).

Conclusion(s): Our results suggest that methicillin resistant CNS strains rapidly colonize the skin following cardiac surgery where cefazolin prophylaxis was used. It is known that *mecA* gene can be transferred from CNS to Staphylococcus aureus (3). The use of other prophylactic agents than cephalosporins worth considering.

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A-771

Simulators as a method to evaluate SOP

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Background and Goals: Standard operating procedures (SOP) are often evaluated by questionnaires (QUES). If methodical errors like social desirability occur, described behavior may differ from applied practice (1). Evaluation of participants of simulation (SIM) sessions enables to focus on practical behavior. We evaluated a standard situation in anesthesia, the rapid sequence induction (RSI) by QUES and SIM.

Materials and Methods: 84 anesthesiologists were asked by QUES (n = 42) or studied by a SIM-session (n = 42) how to manage an intubation on a patient (ASA I) with acute appendicitis with severe nausea and emesis. Their answers and simulator-performance were scored by a protocol including seven procedures to prevent aspiration based on a former inquiry (2). Each item was scored with one point.

Results: Quantitative scores of QUES and SIM evaluation of RSI were equal with 4.8 ± 0.9 and 5.0 ± 1.1, respectively (TTest, p = 0.11). General accepted precaution like pre-oxygenation (QUES 95% vs. SIM 93%) and Cricoid-pressure (83% vs. 92%) occurred on a similar base and resembles with current literature (2). Qualitative differences like "no positive pressure ventilation before tube is blocked" (45% vs. 85%) or "performance of a fast RSI" (23% vs. 88%) are probably due to clinical routine and maybe not worth mentioning in QUES. This underlines the differences between both evaluations tools.

Conclusions: QUES and SIM are powerful tools to evaluate standard procedures like RSI. But SIM probably more portrays the applied practice. Combining those two tools may create more reliable evaluations and will help acquiring new practicable SOP to increase patient safety.

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A-772

Effect of surgeons work pattern on overnight emergency operating activity

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Background and Goal of Study: The European working time directive (EWTD) has forced a change in work patterns for junior doctors. The CEPOD report recommends that only life or limb saving surgery should be undertaken overnight. We hypothesized that the number of non-urgent surgical cases during the night may increase if surgeons worked fewer hours on a shift pattern. This would be contrary to CEPOD guidelines. Our goal was to determine the effect of a trial of shift work on surgical activity at night.

Materials and Methods: We prospectively recorded activity in our emergency operating theatres from 00:00 to 08:00 hours for 21 weeks, divided into three 7 week periods. OC 1 was normal on call work, S was when surgical trainees worked night shifts, OC 2 was return to on call work. Data were collected from theatre logbooks. Start and finish of anaesthesia, operating surgeon, surgical specialty and anaesthetist were all recorded. During the study period only general surgical trainees altered their work pattern. Data were analysed using Kruskal-Wallis, ANOVA and Mann-Whitney U tests.

Results and Discussions:

Study Period	Total operations in 7 weeks (no.)	Median (range) surgery duration (min) per night
OC 1	20	0 (0–270)
S	23	0 (0–360)
OC 2	10*	0 (0–210)*

*$p < 0.05$.

Conclusion(s): During the period OC2 there was a significant decrease in both number and duration of surgical procedures, compared to S and OC 1. Contrary to our hypothesis surgical activity did not increase significantly during the shift study period. Rather, the experience of shift working appears to decrease surgeons operating activity on subsequent return to a 24 hour on call pattern.

A-773

Quality and quantity of non-technical skills correlate with quality of medical treatment in simulated critical incidents

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Background and Goal of Study: The use of patient simulators for training of non technical skills (NTS), e.g. communication, leadership and planning in anaesthesia is increasing. We investigated whether quality and quantity of NTS correlated with quality of medical treatment in simulated critical situations.

Materials and Methods: After informed consent 42 anaesthesiologists were randomly assigned to two different training groups (TG1 vs. TG2). Both groups were homogenous for age, sex and professional experience. In a first session trainees had to treat a patient for malignant hyperthermia alone to get used to the simulated environment. In a following training of 3 hours, participants had to manage two simulated cases in teams of 2 (pulmonary embolism and myocardial infarction). Each case was followed by video-based debriefing. Debriefing for TG 1 was focussing on technical medical aspects of the cases while TG 2 was debriefed for NTS additionally. After one week each trainee had to manage a trauma patient with pneumothorax and head injury alone. The performance in this scenario was videotaped and evaluated scoring quality of medical treatment (QMT) and NTS (1). We also scored frequency of showing NTS (F).

Results and Discussions: Table 1 shows total scores for both groups in the trauma scenario (Mean ± SD).

Scoring system	TG1(n = 22)	TG2 (n = 20)	*p*
QMT	45.4 ± 8.6	44.1 ± 8.7	0.876
NTS	43.5 ± 10.6	40.8 ± 9.4	0.412
F	137.5 ± 36.5	125.1 ± 27.4	0.016*

TG1 showed a significantly higher frequency of NTS. Different training formats had no influence on QMT or NTS.

Correlation of NTS and F was highly significant ($r = 0.59$, $p < 0.01$) and was also highly significant for NTS and QMT ($r = 0.727$, $p < 0.01$) over both groups. This might show that NTS need to be frequently used to produce a high NTS performance and a high quality of medical treatment.

Conclusion(s): Highly significant correlations of NTS with F and QMT were shown. Simulator training concepts might consider this finding to support trainees in using NTS more frequently.

Reference:

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A-774

Modular NTS training is not superior to technical simulator training

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Background and Goal of Study: Commercial non-technical skill (NTS) trainings are offered by many simulator centres. Positive effects on crisis management performance are advertised. The study's goal was to test the effectiveness of a modular NTS training of several hours in a controlled laboratory environment.

Materials and Methods: Two homogeneous groups absolved simulator training sessions of two different designs. Afterwards they were compared to each other for four crisis management categories using a behavioural marker-system (1). The NTS trainees were shown examples of good crisis management on videotapes, they were explicitly taught relevant strategies and their actions were thoroughly reviewed in video-based debriefings after the simulation sessions. Good communication in crisis situations represented a main focus because of its special suitability for teaching these skills and for assessing them via videotapes of the simulation sessions. The technical training (TT) group passed through two simulation sessions and received technical medical debriefings.

Results and Discussions: Analysis of variance was conducted for resource management, planning, leadership and communication. None of the four crisis management categories showed a significant superiority of the NTS group. In contrast, the TT group scored better in all of the four measurements. Especially for communication skills this result is surprising. The simulation experience per se might have a stronger effect on performance than explicit NTS-training components.

Management categories	NTS (N = 20) M/SD	TT (N = 22) M/SD	p
Resource management	8.90/2.15	9.27/2.75	0.629
Planning	12.95/3.33	13.64/2.85	0.476
Leadership	10.50/2.86	10.73/3.49	0.820
Communication	8.45/2.67	9.82/2.72	0.108

Conclusion(s): Positive effects on crisis management performance via an intensive modular NTS training could not be demonstrated. Technical simulator training led to very similar or even better results.

Reference:

1 Fletcher G. Anaesthetists' Non-Technical Skills (ANTS): evaluation of a behavioural marker system. Br J Anaesth 2003; 90: 580–588.

A-775

Simulator training is highly effective independently from explicitly teaching non-technical skills

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Background and Goal of Study: It is widely assumed that emphasizing the role of non technical skills (NTS) during debriefing sessions is essential for effective simulator training (1). We studied self-percieved competencies of anaesthesiologists before and after simulator training with or without emphasizing NTS.

Materials and Methods: After informed consent 42 anaesthesiologists were randomly assigned to two different training groups (TT vs. NTS). Self-percieved competencies of participants regarding crisis management were assessed by questionnaires given before (PRE) and after completion of training (POST) and 8 weeks after training (TRANSFER). Items were rated on a 6-point Likert scale (1 = low, 6 = high competency). All trainees received 5 hours of simulator training dealing with 4 identical critical incidents and were debriefed using videotapes of the actual scenarios. Debriefing for TT group was focussed on medical aspects of treatment. Debriefing of the NTS group additionally emphasized the importance of acute crisis resource management skills for critical situations in anaesthesia. The mean value of all questionnaire items was calculated to compare self-perceived competencies at PRE, POST and TRANSFER.

Results and Discussions: Self-perceived competencies of trainees (Mean ± SD) on a Likert Scale are shown in table.

Time	TT (n = 22)	NTS (n = 20)
PRE	3.53 ± 0.64	3.65 ± 0.67
POST	4.03 ± 0.43	4.15 ± 0.73
TRANSFER	4.38 ± 0.44	4.31 ± 0.51

Self-perceived competencies were significantly increasing from PRE to POST (ANOVA $p < 0.01$) and from POST to TRANSFER (ANOVA $p < 0.01$) for both groups. Effects were not significantly different between groups, so different debriefing strategies had no significant influence on efficacy of training.

Conclusion(s): We could demonstrate a significant increase in self-perceived competencies of crisis management immediately after simulator training and 8 weeks later. Simulator training itself with video-based debriefing was proven an effective training tool independently from emphasizing NTS during debriefing.

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