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43rd Annual Congress of the

Canadian Neurological Sciences Federation

VICTORIA, BRITISH COLUMBIA JUNE 17-20, 2008

ABSTRACTS
AND PROGRAM

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ABSTRACTS

CANADIAN NEUROLOGICAL SCIENCES FEDERATION
FÉDÉRATION DES SCIENCES NEUROLOGIQUES DU CANADA

Victoria British Columbia

SOCIETY PRIZE PRESENTATIONS

Canadian Association of Child Neurology – President's Prize
Canadian Neurosurgical Society - K.G. McKenzie Prize in Basic Neuroscience Research
Canadian Neurosurgical Society - K.G. McKenzie Prize in Clinical Neuroscience Research

PLATFORM PRESENTATIONS

Wednesday, June 18, 2008

Thursday, June 19, 2008

POSTER PRESENTATIONS

Thursday, June 19, 2008 - Friday, June 20, 2008

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The Only Meeting of its Kind

The Canadian Neurological Sciences Federation's annual Congress is the largest educational forum in the country for neurologists, neurosurgeons and neurophysiologists. The CNSF recently and successfully re-conceptualized the identity of the Congress, based in large part on members' feedback and suggestions, making the meeting in Victoria, BC, one of the strongest yet, scientifically. We hope you will make every effort to attend this year's Congress in beautiful Victoria. Please make your hotel reservations ASAP at the Empress or Marriott, our official accommodation locations. On line registration is available March 3, 2008.

CANADIAN NEUROLOGICAL SCIENCES FEDERATION
FÉDÉRATION DES SCIENCES NEUROLOGIQUES DU CANADA

Victoria Hosts 2008 Meeting

Victoria is the host city for the 2008 Canadian Neurological Sciences Federation's Annual Congress and is attended by up to 600 neurologists, neurosurgeons and neurophysiologists. Additional delegates include scientists, researchers, neuroradiologists, nurses and technologists in the neurological sciences field. Victoria, the Garden City, is a year-round tourism destination that offers a friendly, safe haven for all visitors. With a clean environment and charming ambience, it is no surprise that Victoria, British Columbia is one of the world's favorite destinations. Victoria has the mildest climate in Canada. The wild beauty of the Pacific coast and the adventure of the great outdoors are within the city limits and ocean and mountain vistas will follow you wherever you go. Shop windows are full of British imports, Native art and the latest trends. Restaurants and cafés serve the freshest cuisine. The harbor is alive with the romance of an era when tall ships moored alongside the wharf and evenings glitter as lights cast their magic from atop the landmark British Columbia Legislative Buildings. For information on the Congress Program and events, sponsorship opportunities or exhibitors order form Packages, please contact: Corporate Development Coordinator, Brett Windle: Tel: (403)229-9544; Fax: (403) 229-1661. E-mail: brett-windle@cnsfederation.org or go to our web site www.cnsfederation.org

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2008 Society Prize Papers

The President's Prize – Canadian Association of Child Neurology

A systematic review of tissue biomarkers of brain injury in term neonatal encephalopathy

V Ramaswamy (Edmonton), J Horton (Edmonton), B Vandermeer (Edmonton), N Buscemi (Edmonton), SP Miller (Vancouver), JY Yager (Edmonton)*

Objective: We undertook a systematic review of biomarkers in human term neonatal encephalopathy to determine if biomarkers that currently exist are clinically useful as predictors of outcome. *Methods:* A search of multiple databases identified 110 publications which met our inclusion criteria including: 1) Newborn >36 weeks, 2) Neonatal encephalopathy as defined by ACOG, and 3) the use of a serum, urine or CSF biomarker. *Results:* Of the 110 publications which met our inclusion criteria, 22 reported outcome beyond 12 months of age. Single reports revealed urine lactate ($p<0.001$), first urine S100 ($p<0.0001$), cord blood IL-6 ($p=0.02$), serum non-protein bound iron ($p<0.001$), serum CD14 cell NFκB activation ($p=0.014$), serum IL-8 ($p=0.03$) and serum ionized calcium ($p=0.001$) were potential predictors of death and/or abnormal outcome. A meta-analysis revealed serum IL-1β ($p=0.04$, $n=3$), serum IL-6 ($p= 0.04$, $n=2$), CSF neuron specific enolase ($p=0.03$, $n=3$), and CSF IL-1β ($p=0.003$, $n=2$) to be putative predictors of abnormal outcome in survivors. *Conclusion:* This analysis reveals that several serum, urine and CSF biomarkers of term neonatal encephalopathy exist with the potential to provide important information regarding long term outcome. Validation of these markers either alone or in combination is urgently required as we move towards the development of viable therapeutic interventions.

K.G. McKenzie Prize in Clinical Neuroscience Research - Canadian Neurosurgical Society

Prospective comparison of quality of life before and after observation, surgery or radiotherapy for vestibular schwannomas

S Di Maio (Vancouver), R Akagami (Vancouver)*

Background: The best management strategy for small to medium vestibular schwannomas (VS) remains controversial between observation, radiotherapy and microsurgery. We undertook a prospective observational cohort study comparing all 3 therapeutic modalities in VS patients, focusing on quality of life (Qol) outcomes. *Methods:* Patients completed the SF-36 survey at regular intervals with a mean follow-up of 31.8 months. 205/264 patients completed questionnaires (77.7% response rate), including 47 observation, 48 radiotherapy and 134 surgery patients (of which 37 had tumours >3cm diameter). Patients allocated to observation had smaller tumours (mean 1.3 cm, $P<0.001$). Radiotherapy patients were older (mean 60.0 years, $P<0.001$). *Results:* There were no baseline Qol differences between observation, radiotherapy and surgery for ≤3cm tumours. Qol remained unchanged for the observation and radiotherapy groups through follow-up. In the surgery (≤3cm tumour) group, a significant improvement in total score and composite mental dimension was observed at 24 months. In the surgery (>3cm tumour) group, there was an early improvement in composite mental dimension at 1.5 months, as well as at 24 months; total score and composite physical dimension were improved at 24 months. *Conclusion:* Based on our current management protocol, VS patients enjoy similar Qol through follow-up after undergoing observation, radiotherapy or surgery.

K.G. McKenzie Prize in Basic Neuroscience Research - Canadian Neuosurgical Society

Engineered nanoparticles for enhancing therapeutic and cellular responses

BY Kim (Toronto), W Jiang (Toronto), WC Chan (Toronto), JT Rutka (Toronto)*

Background: Nanostructures of different sizes, shapes and material properties have recently been studied for various biomedical applications. The characterization of how these engineered nanoparticles interact with cells and the ability to manipulate these interactions for modulating cellular behaviour provides tremendous opportunities for the development of novel cell-targeted therapeutic and diagnostic platforms. *Methods:* Multivalent engineered nanostructures of different sizes were prepared via direct absorption of monoclonal antibodies through metal affinity binding. We demonstrate using UV-vis spectroscopy, electron microscopy, flow cytometry, confocal microscopy, Western blot and apoptosis analysis that the density and spatial orientation of antibodies on nanoparticle surfaces directly influences their interaction with cells. *Results:* Engineered nanoparticles of well-defined sizes selectively induced membrane-receptor internalization. This in turn, altered the down-stream signalling and subsequent cellular responses. The binding and activation of membrane receptors strongly depended on nanoparticle size. Almost two-fold enhancement in signalling processes, including cell death, was observed using 40-50 nm nanoparticles. *Conclusions:* These findings provide strong evidence that nanoparticles should no longer be viewed as simple carriers for biomedical applications. Nanoparticles can play an active role in mediating biological effects. These results may assist in the design of nanoscale delivery and therapeutic strategies while providing insights into nanotoxicity.

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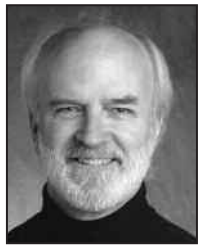

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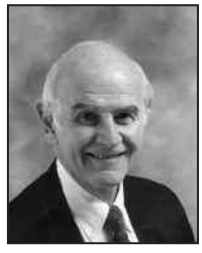

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PLATFORM PRESENTATIONS

CHAIR'S SELECT PLENARY PRESENTATIONS

A-01

Ventromedial frontal lobe damage selectively disrupts preference judgements in humans

A Henri-Bhargava (Montréal), AC Simioni (Montréal), LK Fellows (Montréal)*

Background: The ventromedial frontal lobe (VMF) is involved in decision-making, but its precise function remains unclear. Recent work in monkeys indicates that VMF neurons encode the subjective value of options. VMF damage should therefore impair the ability to consistently choose between options even in simple preference-based decisions. We recently confirmed inconsistent preference judgments after such damage. We sought to replicate this finding in an independent sample, with more sensitive tests of preference judgment across multiple categories of stimuli. *Methods:* Six patients with chronic focal injury involving VMF were compared to 7 patients with frontal damage sparing this region (nonVMF), and 15 demographically-matched control subjects. Subjects were administered five preference judgment tasks requiring choices between 12 stimuli presented two at a time, in every possible combination. The internal consistency of these choices, within category, was the measure of interest. Performance was contrasted with two control perceptual judgments tasks. *Results:* Patients with VMF damage made disproportionately more inconsistent choices in the preference judgments tasks, in all categories tested, than in the perceptual control tasks, compared to either healthy or nonVMF control groups. *Conclusions:* These data are consistent with a critical role for the VMF region in tracking the relative value of options. Damage to this region impairs even the simplest form of value-based decision-making under certainty, and this effect seems to be domain-general.

A-02

A comparison of microvascular decompression and gamma-knife rhizotomy in the treatment of trigeminal neuralgia

J Beiko (Winnipeg), A Kaufmann (Winnipeg)*

Background: Two commonly used surgical procedures for medically refractory trigeminal neuralgia (TN) are gamma knife rhizotomy (GKR) and microvascular decompression (MVD). *Methods:* A retrospective chart review was performed in patients with medically refractory typical TN who underwent their first surgical procedure with either GKR or MVD, in 2003-2005. There was a minimum two-year follow up. *Results:* The study included 28 GKR and 30 MVD patients with mean ages of 66 and 52 years respectively. Excellent results (no pain and no medications) were observed in 28% of GKR and 63% of MVD patients. Good results defined as minimal ongoing pain with or without concomitant medication use was observed in 28% of GKR and 27% of MVD patients. Treatment failure occurred in 43% of GKR and 10% MVD patients, defined as ongoing significant pain, need for a subsequent surgery, or significant complications. Complications included the delayed onset of persisting moderate to severe dysesthesias in 10% of GKR cases, while there were no complications of MVD surgery. *Conclusions:* Excellent and good results at least two years following initial TN surgery were better with MVD than GKR (90% versus 56%). Selection of a surgical treatment for TN should include a thorough accounting of both short-term treatment advantages and long-term results.

A-03

Clazosentan to overcome neurological ischemia and infarction occurring after subarachnoid hemorrhage (CONSCIOUS-1): randomized, double-blind, placebo-controlled phase 2 dose-finding trial

R Macdonald (Toronto), N Kassell (Charlottesville), S Mayer (New York), D Ruefenacht (Geneva), P Schmiedek (Mannheim), S Weidauer (Frankfurt), A Pasqualin (Verona)*

Background and Purpose: This randomized, double-blind, placebo-controlled, dose-finding study assessed efficacy and safety of 1.5 and 15mg/hour intravenous clazosentan, an endothelin receptor antagonist, in preventing vasospasm after aneurysmal subarachnoid hemorrhage (SAH). *Methods:* Patients (n=413) were randomized to placebo or clazosentan beginning within 56 hours and continued up to 14 days after initiation of treatment. The primary endpoint was moderate or severe angiographic vasospasm based on centrally read, blinded evaluation of digital subtraction angiography at baseline and 7-11 days post-SAH. A morbidity/mortality (M/M) endpoint, including all-cause mortality, new cerebral infarct from any cause, delayed ischemic neurological deficit (DIND) due to vasospasm or use of rescue therapy within 14 days, was evaluated by local assessment. Clinical outcome was assessed by the extended Glasgow outcome score at 12 weeks. *Results:* Moderate or severe vasospasm was reduced in a dose-dependent fashion from 67% in the placebo group to 23% in the 15mg/hour clazosentan group (risk reduction; 65%, 95% confidence interval [CI] 47-78%, $p<0.0001$). No significant effects were seen on secondary end points. Post-hoc analysis using a centrally assessed M/M endpoint that included only cerebral infarcts and DIND due to vasospasm showed a trend towards improvement with clazosentan (risk reduction; 28-37%, NS). Clazosentan was associated with increased rates of pulmonary complications, hypotension and anemia. *Conclusions:* Clazosentan significantly decreased moderate and severe vasospasm in a dose-dependent manner and showed a trend for reduction in vasospasm-related M/M in patients with aneurysmal SAH when centrally assessed. Overall the adverse effects were manageable and not considered serious.

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A-04

Prospective comparison of quality of life before and after observation, surgery or radiotherapy for vestibular schwannomas

S Di Maio (Vancouver), R Akagami (Vancouver)*

Background: The best management strategy for small to medium vestibular schwannomas (VS) remains controversial between observation, radiotherapy and microsurgery. We undertook a prospective observational cohort study comparing all 3 therapeutic modalities in VS patients, focusing on quality of life (Qol) outcomes. *Methods:* Patients completed the SF-36 survey at regular intervals with a mean follow-up of 31.8 months. 205/264 patients completed questionnaires (77.7% response rate), including 47 observation, 48 radiotherapy and 134 surgery patients (of which 37 had tumours >3cm diameter). Patients allocated to observation had smaller tumours (mean 1.3 cm, P<0.001). Radiotherapy patients were older (mean 60.0 years, P<0.001). *Results:* There were no baseline Qol differences between observation, radiotherapy and surgery for ≤3cm tumours. Qol remained unchanged for the observation and radiotherapy groups through follow-up. In the surgery (≤3cm tumour) group, a significant improvement in total score and composite mental dimension was observed at 24 months. In the surgery (>3cm tumour) group, there was an early improvement in composite mental dimension at 1.5 months, as well as at 24 months; total score and composite physical dimension were improved at 24 months. *Conclusion:* Based on our current management protocol, VS patients enjoy similar Qol through follow-up after undergoing observation, radiotherapy or surgery.

A-05

Disability and survival outcomes of multiple sclerosis in Saskatoon, Saskatchewan.A thirty year natural history study

*WJ Hader (Saskatoon)**

Background: A Saskatoon, Saskatchewan, population-based cohort prevalent group of 150 clinical definite patients, on 1 January 1977, was followed for thirty years.
Objectives: To outline the clinical characteristics, compare the levels of disability at 15, 25, 35, 45 years after onset, and to estimate the duration of disease and survival. *Methods:* Clinical records were maintained,with cohort review each decade for thirty years. The levels of disability according to the Kurtzke Extended Disability Status Scale and survival times were recorded. SPSS and Kaplan-Meier methods were used for analysis. *Results:* On 1 January, 2007, 39 (26%) patients were living, 105 (70%) deceased, and 6 (4%) unable to locate. The disabilities compared between 1977 and 2007, indicates at 15 and 45 years after onset,the EDSS ≤2.5 was 33.3% and 8%, mild 3-5.5 was 17.3% and 2.7%, moderate 6-7.5 was 26.6% and 4.7%, severe, 22.7% and 10.7%. The median survival time after onset is 33 years for men and 38 years for women. The median duration of life was 69.1 years for men and 68.5 years for women. *Conclusions:* MS is a progressive disorder and long-term survival is associated with moderate to severe disability and decreased life expectancy in this natural history study.

A-06

The STASCIS study: initial one year results of a prospective, multicenter trial to evaluate the role and timing of decompression in patients with cervical spinal cord injury

MG Fehlings (Toronto), A Vaccaro (Philadelaphia), B Aarabi (Baltimore), M Dvorak (Vancouver), C Shaffrey (Charlottesville), E Massicotte (Toronto), C Fisher (Vancouver), R Rampersaud (Toronto), S Lewis (Toronto)*

Background: The purpose of this study was to evaluate the role and timing of decompressive surgery on neurologic outcome in patients with cervical SCI. *Methods:* Patients with a subaxial cervical SCI and cord compression were entered into prospective, multicenter, cohort study. Patients were stratified into "early" (<24 hours) or "delayed" (>24 hours) decompression groups. Outcomes were assessed using ASIA standards at 6 months and 1 year post injury. *Results:* To date, 151 patients (mean age 41.6±17.3) have been enrolled. The distribution of SCI severity included: ASIA A (44.1%), B (14.5%), C (20.4%) and D (21.1%). There were no significant differences in age, gender, ASIA level or medical comorbidities between the early and delayed groups. To date, 6 month and 1 year follow-up has been obtained in 95 and 31 cases respectively. At one year follow-up, 25% of the patients in the early decompression group had a ≥ 2 grade improvement in the ASIA score compared to 0% in the delayed group (p=0.009). *Conclusions:* These initial results suggest that decompression at 24 hours may be associated with improved neurological recovery at one year follow-up. Further recruitment of patients with long term follow-up is required to validate these initial promising results.

General Neurology I

B-01

Rett Syndrome: a standard model in neuroscience?

*PM Macleod (Victoria)**

The postnatal neurodevelopmental disorder, Rett syndrome (RTT) is one of the most common genetically determined disorders responsible for a progressive disabling neurodevelopmental phenotype. RTT is caused by mutations in the gene encoding the methyl-CpG binding protein 2 (MeCP2), a transcriptional repressor involved in chromatin remodeling and is central to development, imprinting, transcriptional regulation, chromatin structure, the modulation of RNA splicing and overall genomic stability.
Other neurodevelopmental disorders, such as autism, Fragile X syndrome, and Angelman syndrome manifest during early postnatal neural development. Emerging evidence suggest that these disorders share common underlying defects in neuronal morphology, synaptic connectivity and brain plasticity.
Recent studies demonstrate disease reversibility in RTT mouse models, suggesting that the neurological defects in MECP2 disorders are not permanent and there is the potential for restoring neuronal function in RTT patients. Determining the molecular mechansims of RTT is likely to contribute to the understanding of the pathogenesis of a broader class of neuropsychiatric disorders.
The objectives of this presentation are to provide an update on the expanded phenotype of individuals with an RTT mutation and to suggest a possible route to a therapeutic intervention.

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B-02

Radiologic diagnosis of Posterior reversible encephalopathy syndrome (PRES): Pictorial review

JJ Shankar (Ottawa), S Chakraborty (Ottawa), T Nguyen (Ottawa), MD Santos (Ottawa), C Lum (Ottawa)*

Background: Posterior Reversible Encephalopathy Syndrome (PRES) is an increasingly recognized clinicoradiological entity characterized by headache, confusion, visual disturbances, seizures and characteristic computed tomographic (CT) and magnetic resonance (MR) imaging findings. It is associated with a multitude of diverse clinical entities. PRES is often unsuspected by clinicians, so radiologists may be the first to suggest the diagnosis. As this diagnosis has important therapeutic and prognostic implications, radiologists should be aware of the spectrum of imaging findings in PRES. *Methods:* We retrospectively reviewed our cases of PRES and analysed various CT and MRI features in these patients. CT scan and MRI with Diffusion weighted images were acquired in these patients. *Results:* Classic CT findings are those of bilaterally symmetric low attenuation in the posterior parietal and occipital lobes, whereas MR imaging demonstrates hyperintensity on T2-weighted images in the same distribution. RPLS can be due to vasospasm with resulting ischemia within the involved territories, or due to breakdown in cerebrovascular autoregulation with ensuing interstitial extravasation of fluid. Diffusion MR imaging can discriminate these two possibilities, as the cytotoxic edema of cerebral ischemia demonstrates decreased water mobility, whereas vasogenic edema due to cerebrovascular autoregulatory dysfunction results in increased water mobility. *Conclusion:* This article reviews the radiologic findings and diagnostic pitfalls of posterior reversible encephalopathy syndrome.

B-04

Extraocular manifestations of mitochondrial disease in patients with chronic progressive external ophthalmoplegia: A series of 40 patients

G Pfeffer (Vancouver), S Sirrs (Vancouver), HD Vallance (Vancouver), NK Wade (Vancouver), PJ Waters (Vancouver), VA Wong (Vancouver), MM Mezei (Vancouver)*

Background: Chronic progressive external ophthalmoplegia (CPEO) is a mitochondrial disorder frequently associated with extraocular manifestations of mitochondrial disease. A greater understanding of the prevalence of extraocular manifestations in CPEO would assist in earlier identification of these patients and improved management. *Methods:* Chart review of 40 patients assessed in the Adult Metabolic Diseases Clinic in Vancouver, with a clinical diagnosis of CPEO of mitochondrial etiology. *Results:* Most patients had multiple extraocular manifestations of mitochondrial disease, averaging 4.6 (range 0-10). The most common associated features were skeletal muscle weakness and/or exercise intolerance (67.6%), gastrointestinal disorder (59.5%, commonly dysphagia), sensorineural hearing loss (48.6%), and migraine headaches (40.5%). Sensory polyneuropathy was present in 40.5% of patients, which was often subclinical. Pigmentary retinopathy was present in 8.1% of patients. Correct diagnosis was delayed, occurring at a mean of 13.2 years after the initial onset of symptoms. *Conclusions:* CPEO may be associated with more extraocular manifestations than has been previously reported. Gastrointestinal disorders, migraine and sensory polyneuropathy occurred at frequencies much higher than previously reported. Pigmentary retinopathy was far less common than previously reported. Clinicians should have high suspicion and low threshold to investigate extraocular manifestations, as these coexistent conditions impact on patient management and outcome.

B-05

Hypogonadism is common in men with myopathies

TM Al-Harbi (Hamilton), L Bainbridge (Hamilton), MJ McQueen (Hamilton), M Tornopolsky (Hamilton)*

Background: Hypogonadism has been described in patients with myotonic muscular dystrophy type 1 (DM1) but has not been evaluated in other myopathies. *Methods:* We measured total and free serum testosterone levels in 59 men with; DM1 (N = 12), facioscapulohumeral muscular dystrophy (N = 11), dystrophinopathy (N = 12), metabolic myopathy (N = 7), and inclusion body myositis (N = 17) and compared these to the normal reference interval. *Results:* Thirty-two of the 59 participants (54 %) had low total testosterone, 23 (39 %) had low total and free values, and five (8 %) had low free with normal total levels. There were no significant differences in the prevalence of hypogonadism between those with DM1 and the other groups even after considering age as a confounder. *In conclusion:* Hyopgonadism is common in men with myopathies, and with the importance of testosterone in the maintenance of muscle mass, treatment of hypogonadism should be considered.

B-06

Progressive Encephalopathy with oEdema, Hypsarrhythmia and Optic atrophy (PEHO) syndrome - a condition with genetic and clinical heterogeneity

M Chitre (Chitre), A Parker (Cambridge), G Woods (Cambridge)*

Background: PEHO syndrome is a rare progressive infantile encephalopathy with probable autosomal recessive inheritance. We report from our study into the genetic linkage of this condition. *Methods:* Clinical features and preliminary genetic findings of the children recruited in this national study were reviewed. Diagnosis was based on clinical features described in the literature. Patients with similar features, but without the typical neuroimaging or ophthalmology findings were described as PEHO-like. *Results:* Of the 13 children (M:F - 6:7), 4 had PEHO syndrome and 9 were PEHO-like. Two families had affected sib ships, one with 4 siblings and another with 3 siblings. Five children were born to consanguineous parents (not from the multi-affected sib ships). There was variability of clinical features and radiological findings. Consistent findings included progressive microcephaly, hypotonia, optic atrophy, pear shaped facies, narrow forehead and oedema of extremities. All children developed intractable seizures during infancy. Nine (64%) showed hypsarrhythmia on EEG. Six (46%) children had cerebellar atrophy. All children followed a similar neurodegenerative course with severe learning difficulties. Eleven (73%) children died. Six children, including the 4 with classical PEHO features showed a striking sleepiness in the initial 2 years of life. The condition involves more than a single gene locus. Further genetic studies are ongoing. *Conclusions:* Children with PEHO and PEHO-like syndrome show clinical and genetic heterogeneity. Both may co-occur in families.

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B-07

Evaluating an organized approach to palliative care in patients with devastating stroke

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Background: Approximately 20% of patients will die following acute stroke. A recent survey of stroke care guidelines found that palliation was rarely mentioned. When mentioned, guidelines varied; none examined the efficacy or results of any such process. The role of the patient's family in decision making and in conflicts with staff has not been evaluated. We sought to formally evaluate the use of palliative care guidelines on our acute stroke unit (ASU). We hypothesized that an organized approach to management of patients with devastating stroke leads to better end of life care. *Methods:* We retrospectively examined records of 104 patients who died on our ASU over a two year period to determine if existing palliative guidelines were reflected in clinical practice, and to identify conflicts that arose. We collected data on medical and nursing care, palliative decisions, medication use, and conflicts, and compared these to the ASU's existing palliative care guidelines. Descriptive statistics and qualitative analysis were used to examine the entire process of palliation. *Results:* Of patients on the ASU, 16% died during hospitalization. The median age was 80 years; 60.5% were female. Most had large strokes (33.7%) or hemorrhages (26.0%). All patients received routine nursing and comfort care prior to death. 9.6% of patients were receiving active treatment at the time of death; 90.4% of patients who died were palliated. Median time from admission to reach a decision to palliate was 3.6 days; median time from admission to death was 8.5 days. Most had vital signs (94.7%), investigations and diagnostic imaging (88.3%) and non-palliative medications (95.7%) stopped, and had nasogastric feeding (96.8%) and intravenous fluids (87.2%) withdrawn. Most patients had pain treated with morphine (93.6%) and bronchial secretions managed in part with scopolamine (81.9%). Most families had no conflicts with staff; of those who did, conflicts were based upon hydration and feeding (45.7%), doubts about palliative care (27.8%) and patient comfort (18.2%). *Conclusions:* Death from acute stroke is common. These patients are older, have larger strokes and live for only a few days. In our experience, a formal approach to palliation results in timely decisions regarding end of life care with relatively few conflicts. Further work to address the specific concerns of families is needed.

B-08

Markers of essential thrombocythemia in cerebral venous thrombosis

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Background: Essential thrombocythemia (ET) is a myelo-proliferative syndrome characterized by thromboembolism, sustained thrombocytosis otherwise unexplained with blood platelet counts >600 x 10^9/L, and clonal megakaryocytic proliferation (WHO diagnostic criteria). In 50% of ET, mutant Jak2 allele is present. ET rarely presents with cerebral venous thrombosis (CVT). Treatment of CVT due to ET consists of antiproliferative and antithrombotic therapy. Diagnosis of ET is therefore crucial but challenging when CVT precede thrombocytosis. Our goal was to identify markers of ET in CVT, including extensiveness at presentation (primary hypothesis). *Methods:* From a prospective stroke unit database, we identified individuals admitted for CVT between 2000-08 and 2007-12, reviewed medical charts, and used the WHO criteria to diagnose ET. A neuroradiologist blindly reviewed brain imaging studies, attributing one point per thrombosed sinovenous structure (maximum extensiveness score = 10). We compared discrete and continuous variables between groups with (cases) versus without ET (controls). *Results:* At CVT presentation, 1/2 cases and 2/24 controls had had previous venous thromboembolism (p=0,222), 1/2 cases and 6/24 controls had altered consciousness (p=0,474), and mean CVT extensiveness scores were 4.50 in cases and 2.83 in controls (p=0,061). Platelet count was normal in all participants at presentation and increased in 2/2 cases within the next 3 and 22 months. 1/2 cases and 0/20 controls had mutant Jak-2 gene. Venous thromboembolism recurred despite adequate anticoagulation in 2/2 cases before antiproliferative therapy was initiated and in 0/23 controls (p=0,003). Mean clinical follow-up duration was 52 months in cases and 27 months in controls (p=0,16). *Conclusions:* ET can present with CVT without apparent thrombocytosis at presentation. In ET, CVT tends to be more extensive at presentation and can recur despite adequate anticoagulation. These latter findings, if otherwise unexplained, may be clues to underlying ET and warrant bone marrow aspiration and Jak2 testing.

B-09

Engineered nanoparticles for enhancing therapeutic and cellular responses

BY Kim (Toronto), W Jiang (Toronto), WC Chan (Toronto), JT Rutka (Toronto)*

Background: Nanostructures of different sizes, shapes and material properties have recently been studied for various biomedical applications. The characterization of how these engineered nanoparticles interact with cells and the ability to manipulate these interactions for modulating cellular behaviour provides tremendous opportunities for the development of novel cell-targeted therapeutic and diagnostic platforms. *Methods:* Multivalent engineered nanostructures of different sizes were prepared via direct absorption of monoclonal antibodies through metal affinity binding. We demonstrate using UV-vis spectroscopy, electron microscopy, flow cytometry, confocal microscopy, Western blot and apoptosis analysis that the density and spatial orientation of antibodies on nanoparticle surfaces directly influences their interaction with cells. *Results:* Engineered nanoparticles of well-defined sizes selectively induced membrane-receptor internalization. This in turn, altered the down-stream signalling and subsequent cellular responses. The binding and activation of membrane receptors strongly depended on nanoparticle size. Almost two-fold enhancement in signalling processes, including cell death, was observed using 40-50 nm nanoparticles. *Conclusions:* These findings provide strong evidence that nanoparticles should no longer be viewed as simple carriers for biomedical applications. Nanoparticles can play an active role in mediating biological effects. These results may assist in the design of nanoscale delivery and therapeutic strategies while providing insights into nanotoxicity.

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General Neurosurgery II

C-01

Prospective surveillance of complications in a pediatric neurosurgery unit

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Background: Complications of specific Pediatric Neurosurgical procedures are well recognized. However, focused surveillance on a specific unit, for all procedures, may lead to better understanding of the most important complications, allowing targeted strategies for quality improvement. *Methods:* We prospectively collected the morbidity and mortality events on a large pediatric neurosurgical unit over a two year period. Morbidity was defined as any significant adverse outcome or death, (for obstructive shunt failure, any readmission within 30 days). Multiple and unrelated complications in the same patient were recorded as separate events. *Results:* There were 1082 surgical procedures performed. 177 adverse events occurred in 147 patients (14%). The commonest complications were cerebrospinal fluid (CSF) leak (18%), a new neurological deficit (15%), early shunt or endoscopic third ventriculostomy obstruction (15%), and shunt infection (14%). Meningitis occurred in 12% of procedures - 58% of shunt infections, 13% of CSF leaks, and 10% of wound infections. 64% of adverse events required a second procedure, most commonly an external ventricular drain or shunt revision. *Conclusions:* Complications in Pediatric neurosurgical procedures are common, result in significant morbidity, and more than half the time, require a repeat surgical procedure. Targeted strategies to prevent common complications, such as shunt infection, or CSF leaks, might significantly reduce this burden.

C-02

Obesity and neurosurgery

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Objective: Obesity has been linked to increased morbidity and mortality after some surgical procedures. The purpose of this study was to determine if obesity affects outcome after general neurosurgery and aneurismal subarachnoid hemorrhage (SAH). *Methods:* 3 datasets were analyzed, including a retrospective review of 404 patients undergoing general cranial and spinal neurosurgical procedures, a prospective collection of 100 patients with aneurismal SAH and data from 3567 patients with aneurismal SAH entered into randomized clinical trials of tirilazad. Outcome was assessed by mortality and postoperative medical and neurological morbidity for the first 2 datasets and by the Glasgow outcome score (GOS) for the tirilazad dataset. Numerous prognostic factors, including body-mass index for the first 2 datasets and body weight for the tirilazad dataset, were tested for their effect on these outcomes using multivariable logistic regression. *Results:* For patients undergoing general cranial and spinal neurosurgery, independent predictors of morbidity and mortality were age, American Society of Anesthesia class, disseminated malignancy, emergency surgery and increased duration of surgery. Body mass index was not significant. For patients with aneurismal SAH, outcome on the GOS was associated with age and admission Glasgow coma score but not body mass index. In the tirilazad dataset, multiple factors were associated with outcome on the GOS but as with the other 2 datasets, body weight had no relationship to outcome. *Conclusion:* Obesity has less effect on outcome of patients with neurosurgical disease and aneurismal SAH than it does on other types of surgery.

C-03

The adult hydrocephalus clinic: a paradigm shift for management of adult hydrocephalus patients

*M Hamilton (Calgary)**

Background: The population of adult patients with hydrocephalus is increasing as diagnostic and therapeutic techniques enhance identification and survival of treated patients. Hydrocephalus patients are usually assessed and cared for by individual physicians in an unstructured and unfocused clinic environment. *Methods:* In 2001, the University of Calgary Adult Hydrocephalus Clinic was established with the goal to standardize and enhance the care for patients with hydrocephalus. Investigative and management protocols were established. A patient database was initiated. *Results:* In 2007 there are 350 patients followed in the Adult Hydrocephalus Clinic. This population includes patients who initially had a diagnosis of hydrocephalus as a child, adults with acute/subacute hydrocephalus, patients with long-standing overt ventriculomegaly in adults (LOVA), and patients with idiopathic Normal Pressure Hydrocephalus (iNPH). Approximately 8% of the patients have had no treatment for their hydrocephalus and are being monitored with clinical and neuropsychological evaluations. Treatment modalities for treated patients have included shunting and endoscopic third ventriculostomy (ETV), the later of which accounts for 100 patients, including 25 previously shunted patients. Approximately 95% of patient complaints related to their hydrocephalus are investigated on an outpatient basis, avoiding Emergency Room utilization. *Conclusion:* This approach to focus the care of adult patients with hydrocephalus in a specialty clinic represents an important evolution. Patients have the opportunity to experience a standardized approach for investigation and management. This clinic provides opportunities to better understand the natural history of patients with untreated hydrocephalus, and to evaluate the investigative strategies for patients with a potential diagnosis of idiopathic NPH. A Canadian Adult Hydrocephalus Network is envisioned as the next step to further advance care of this patient population.

C-04

Predictability of the response to microvascular decompression using the FIESTA protocol

JD Pearl (Montréal), DJ Sirhan (Montréal), D Tampieri (Montréal)*

Background: Recent advents in imaging have permitted detailed anatomical correlation of the cerebello-pontine angle's nervous and vascular structures. This is especially relevant for patients with Trigeminal Neuralgia (TN). By visualizing the interaction between vessel and nerve, a predictive response can potentially be formulated. Microvascular decompression (MVD) allows delicate

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separation of offending vessels from the trigeminal nerve resulting in lasting relief in appropriate patients. Duration of symptoms, typical presentation and nature of the compressive vessel all play a role in outcome. Previous work has shown that the 3-D FIESTA imaging sequence is an excellent option for visualizing the trigeminal complex and vasculature. Using a retrospective analysis, we sought to determine the predictability of the response to MVD as a function of the FIESTA protocol. *Methods:* We randomly selected 100 patients with TN that had undergone a MVD in the last 12 years. Surgery involved a standard retrosigmoid approach as popularized by Janetta. Patients with Atypical Neuralgia and those for which the imaging was unavailable were excluded. We studied the degree of radiological nerve compression and separated the cases into severe, moderate and mild nerve deformation. Symptomatic relief was stratified according to the Barrow Neurological Institute's grading scheme. *Results:* In scans judged to be superior in revealing the anatomy of the CPA, the majority of patients (10/19) showed a BNI Grade I response. The remaining patients had a Grade II (5/19) or III response (4/19).Of 19 scans, 12 were judged to show severe kinking, 1 was assigned a moderate grade and 6 demonstrated mild kinking. There appeared to be a trend toward clinical response according to degree of nerve "deformation." *Conclusion:* Our preliminary results suggest that FIESTA imaging may be a useful tool when predicting the outcome of MVD in patients suffering from Trigeminal Neuralgia. Varying degrees of kinking may be quantified and allow for prognostication using FIESTA. Further study with an increased sample size is necessary for more robust data-outcome analysis.

C-05

Shunt dependent hydrocephalus following aneurysmal subarachnoid hemorrhage: analysis of incidence, revision rates, and long term outcome using Ontario provincial administrative data

CJ O'Kelly (Toronto), MC Wallace (Toronto)*

Background: Chronic hydrocephalus complicates a significant proportion of patients suffering an aneurysmal subarachnoid hemorrhage (SAH). Estimation of the true magnitude and impact of this problem is hampered by poor follow-up in clinical series. In addition, the long term impact of this condition in terms of the need for shunt revision and survival has not been fully studied. *Methods:* Ontario provincial administrative databases were used to generate a cohort of all adult SAH patients undergoing aneurysm repair between 1995 and 2004. The databases were used to track the occurrence and timing of CSF diversionary procedures and all-cause mortality during the time period. Surrogate measures of aneurysm location and size, patient age, clinical grade, and co-morbidity (Charlson index), and method of aneurysm occlusion were also recorded for inclusion in multivariate analyses. *Results:* Overall, 3120 patients were included in the cohort. A ventricular shunt was place in 584 patients (18.7%). In multivariate analysis, age ($p<0.0001$) and Charlson index ($p<0.001$) were significant predictors of shunt insertion ($p=0.08$), while hydrocephalus on presentation demonstrated a trend towards significance. Shunt revision procedures and mortality are summarized using survival analysis *Conclusion:* Chronic hydrocephalus remains a significant problem following aneurysmal SAH. The long term burden on patients with respect to revision and overall survival deserves further study.

C-06

Sciatica in a phantom limb - case report and review of the literature

D Louw (Edmonton), R Betzner (Edmonton), M Mrazik (Edmonton)*

Background: Phantom limb pain has protean manifestations, but its signature is the presence of pain in a non-existent limb (perhaps best called 'real' pain in a 'virtual' limb). The limb may be absent either on a congenital or traumatic basis. *Methods:* A 35 year-old male with a ten-year history of stable phantom pain from an above knee amputation on the left presented with new onset back and left buttock pain. In addition, there was severe cramping pain in the left 'calf'. Clinical assessment of nerve root tension signs was difficult, and an MRI was requested. *Results:* The MRI demonstrated a far lateral L4-5 disc protrusion with a posteriorly displaced and compressed L4 root in the foramen. *Conclusions:* Phantom limb pain may mask new pathologies projecting pain into the 'virtual' limb. Conversely, any change in a stable pain pattern should alert the clinician to re-examine and investigate the patient.

C-07

Intraoperative MRI: experience with 950 cases

JJ Kelly (Calgary), GR Sutherland (Calgary), JK Saunders (Winnipeg), I Latour (Calgary)*

Objective: Intraoperative MRI (iMRI) was introduced to neurosurgery a decade ago. In the late 1990's, the University of Calgary, in collaboration with the National Research Council, developed an iMRI system based on a movable 1.5T magnet. This report based on 950 patients critiques the technical, clinical and economic value of iMRI. *Methods:* From 1998 to 2008, the University of Calgary iMRI system and its upgrade were used prospectively as an adjunct to surgery in 950 patients. Surgical planning imaging was obtained after induction of anesthesia and patient positioning, interdissection imaging at various stages of surgical dissection and quality assurance imaging following wound closure but prior to emergence from anesthesia. *Results:* Surgical planning imaging updated diagnostic studies, enhanced craniotomy placement and optimized target trajectory when coupled to surgical navigation. In 5 patients surgery was aborted as the images showed lesion resolution. Based on interdissection images, unsuspected residual tissue was identified and resected in up to 20% of cases. Quality assurance imaging confirmed that surgical objectives were achieved and allowed assessment of acute complication. Intraoperative MRI increased OR time by about 30 min per imaging study. In 31 patients, intraoperative images were not acquired due to technology failure. *Conclusions:* Notwithstanding expenses related to technology purchase, installation and maintenance, iMRI is a valuable adjunct to surgery. The economic impact would be reduced by iMRI systems designed to allow sharing of the technology between surgery and radiology.

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C-08

The paediatric neurosurgical implications of achondroplasia

JA King (Toronto), JT Rutka (Toronto)*

Background: Achondroplasia is the most common form of human dwarfism. The paediatric neurosurgeon is occasionally required to treat achondroplastic children with hydrocephalus, craniosynostosis, cervicomedullary compression and spinal canal stenosis. We aim to review the experience of neurosurgery in achondroplastic children at The Hospital for Sick Children over the last 50 years. *Methods:* The medical records and neurosurgery database at The Hospital for Sick Children were searched to identify all achondroplastic children undergoing at least one neurosurgical procedure from 1956 to the present. *Results:* 43 children were identified to have undergone at least one neurosurgical procedure. A total of 90 procedures were performed, of which 65 were for CSF diversion, 5 for spine, 4 for craniosynostosis, 12 for cervicomedullary compression and 5 classified as miscellaneous. These procedures are analysed and presented with particular reference to surgical complications and the change in surgical approach to these patients over the five decades. *Conclusions:* CSF diversion for achondroplastic patients is frequently complicated and requiring of multiple procedures. In response to this and a shift in approach, rates of shunt placement in achondroplastic children appear to be decreasing. In contrast, with improvements in imaging, surgery for craniocervical and spinal pathologies is being performed more frequently.

C-09

Shunt series: an institutional review

M Vassilyadi (Ottawa), Z Tataryn (Manhattan), K Udjus (Ottawa)*

Background: Shunt series are frequently ordered to assess the integrity of shunt systems in children with shunt-dependent hydrocephalus. An audit was performed at the Children's Hospital of Eastern Ontario to assess their utilization and necessity. *Methods:* The medical records of children with hydrocephalus and shunts were reviewed. Positive or negative shunt series were correlated with the subsequent requirement of a shunt revision and statistical analysis performed. *Results:* A total of 3416 shunt series were performed on 394 children with a follow-up between 3 weeks and 19 years. There were 701 shunt surgeries; of these, 99 (14%) had a positive shunt series that indicated a visual problem with the integrity of the shunt. There were 2981 negative shunt series and 16 positive studies with no subsequent shunt surgery. The median patient age with a shunt fracture was 11 years. The time interval between shunt surgery and the identification of a shunt fracture had a bimodal distribution with a median of 8.5 years. 2.8% of the shunt series revealed a fracture. *Conclusions:* The incidence of shunt fractures is very low and there is a minimum benefit from performing routine shunt series. This study supports with descriptive statistics the reduction of shunt series.

Trauma and Critical Care

D-01

Predictive value of age at time of injury and comorbidity indices for in-hospital mortality and length of hospitalization in patients with acute spine trauma

JC Furlan (Toronto), D Kattail (Toronto), MG Fehlings (Toronto)*

Background: This retrospective cohort study was undertaken to evaluate whether age at time of spinal cord injury (SCI) and comorbidity indices are predictors of in-hospital mortality and length of stay in the acute care facility. *Methods:* All consecutive patients with acute spine trauma who were admitted to our institution from 1995-2000 were included. Comorbidity indexes included Charlson Comorbidity Index (CCI) Cumulative Illness Rating Scale (CIRS) wand number of ICD-9 codes (ICD9). Data were analyzed using Fisher's exact test, Mann-Whitney U test, and logistic, linear and Cox regression analyses. *Results:* There were 184 males and 77 females with mean age of 49.7 years (15 -96 years). Most patients had spine trauma without SCI (127/261) or mild SCI (86/261) at cervical (166/261). In-hospital mortality rate was 4.6%. In-hospital mortality was significantly associated with age (hazard ratio [HR]=3.503, p=0.0011), CCI (HR=1.659, p<0.0001), ICD9 (HR=1.317, p=0.0055) and CIRS (HR=1.174, p=0.0008). Mean length of stay (LOS) was 23 days (1-852 days). After controlling for potential confounders (sex and severity, level and cause of SCI), LOS was not significantly associated with the patient age (p=0.862), ICD9 (p=0.314) or CIRS (p=0.251), but LOS was directly correlated with CCI (p=0.042). *Conclusions:* Our results suggest that age and all 3 co-morbidity indexes are potential predictors of in-hospital mortality after acute spine trauma. However, only CCI showed potential predictive value for the LOS in the acute care SCI facility.

D-02

Factors associated with the need for mechanical ventilation and the occurrence of extubation failure in patients with traumatic spinal cord injury

JC Furlan (Toronto), D Kattail (Toronto), ND Ferguson (Toronto), MG Fehlings (Toronto)*

Background: Respiratory dysfunction is a key complication after spinal cord injury (SCI). In patients with SCI, we sought to determine factors associated with the need for mechanical ventilation, and the occurrence of subsequent extubation failure. *Methods:* From 502 consecutive patients with acute spine trauma admitted from Dec/1995-Sep/2007, we selected all cases at risk for mechanical ventilation. Severity of SCI was assessed using ASIA Impairment Scale (AIS). Pre-existing medical comorbities were assessed using Charlson Comorbidity Index (CCI). Potential predictors of intubation and extubation failure included age, sex, CCI, AIS, level and cause of SCI. *Results:* There were 113 patients with acute cervical (85%) or thoracic SCI (82M, 31F; ages 17-96 years, mean of 54). Most patients sustained moderately severe SCI (AIS C/D: 76%) following fall (43%) or MVA (34.5%). Patients who required mechanical ventilation (n=14) had significantly more severe SCI (p<0.001) than patients without mechanical ventilation. Extubation failure occurred in 3 patients. Patients who experienced extubation failure had significantly more severe SCI (p=0.013) than

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patients who were successfully extubated. *Conclusions:* Our results indicate that 12% of SCI patients require mechanical ventilation of whom 21% experience extubation failure. AIS grade A (motor and sensory complete SCI) is a risk factor for mechanical ventilation and for extubation failure after a successful spontaneous breathing trial.

D-03

Predictors of early seizures in acute traumatic brain injury

SA El-Zuway (Hamilton), D Jichici (Hamilton), BW Lo (Hamilton), F Farrokhyar (Hamilton), R Petrovic (Hamilton), R Elzuway (Hamilton)*

Background: Epilepsy occurs in 3-5% of patients post traumatic brain injury (TBI). Currently, there is no evidence that treatment of early seizures prevents long term epilepsy. We aim to determine clinical factors that predict early seizures after acute TBI and the magnitude of their effects. *Methods:* Retrospective cohort study was conducted of adults TBI patients admitted to the Trauma Service at the Hamilton General Hospital, McMaster University (01/2004 - 06/2007). Independent variables: (admission) GCS, ISS, SBP, oxygen saturation; (CT) lobar contusions, SAH, SDH, EDH, depressed skull fractures, basal skull fractures; first week in hospital: lowest sodium and glucose levels. Dependent variable: occurrence of seizures. Both univariate and multivariable analyses were used. *Results:* 90 TBI patients were included, 31 had early seizures. Mean age: 41. Mechanisms of injury: MVC (46%), falls (21%), assault (14%). Univariate analyses (Kruskal-Wallis and Fisher's exact tests) show depressed skull fracture ($p = 0.008$) and ISS ($p = 0.087$) to be significant independent predictors of seizures. Multivariable logistic regression model shows depressed skull fractures to have the most predictive effects for early seizures ($p = 0.015$). *Discussion:* Depressed skull fractures are predictive of early seizures. Higher ISS scores show tendency towards seizure development. A larger cohort of patients with early seizures may identify other predictors.

D-04

Long term progressive encephalomalacia following traumatic brain injury

K Ng (Toronto), R Green (Toronto), B Colella (Toronto), D Lazinski (Toronto), R Agid (Toronto), G Greenberg (Toronto), D Mikulis (Toronto)*

Purpose: Stabilization of acute traumatic brain injury is generally thought to occur by 4 months post-ictus. We elected to investigate the possibility that further evolution may occur after this time frame by examining clinically recovered patients up to 2 years post trauma. *Materials and Methods:* Patients with traumatic brain injury admitted to the neurorehabilitation program at the Toronto Rehabilitation Institute were prospectively recruited into the study from 2004 until 2007 using inclusion/exclusion criteria. Fourteen eligible patients were scanned at 4-6 months post injury and again at 20-35 months. Three experienced neuroradiologists reviewed all pairs of imaging studies for each patient, blinded to the temporal sequences of the scans, and all clinical data. *Results:* All three readers were able to correctly identify the early and late scans in 8 out of 14 patients based on progression of encephalomalacia, with a total of 10 out of 14 patients showing progression by consensus agreement. *Conclusion:* Longitudinal MRI revealed progressive parenchymal volume loss up to 2 years after the original ictus, indicating that further injury is occurring long after the direct mechanical effects of the traumatic event have resolved. Presumably this is related to prolonged apoptotic and inflammatory cascades, with potential treatment implications.

D-05

Sudden onset of swelling and bleeding during meningioma surgery

JS Teitelbaum (Montréal), T Slaoui (Paris), D Fish (Montréal)*

Background: New modalities such as hypothermia and decompressive therapy are presently being studied in the treatment of intra-cranial hypertension. These therapies have yet to become the standard of care. Decompressive craniotomy is reserved for local intractable oedema after severe head trauma or malignant stroke. Hypothermia is considered difficult to institute, and re-warming can lead to a rapid return of oedema. It is unclear how long hypothermia should last, and most studies have 72 hour duration or less of treatment. *Methods:* We present a case of severe intractable intracranial hypertension due to massive swelling and bleeding that occurred during meningioma resection. *Results:* The patient was successfully treated with a prolonged and aggressive hypothermic regimen that has not been described in the literature. We discuss the management for the treatment of severe intracranial pressure with specific emphasis on prolonged hypothermia and discuss the reported incidence of bleeding dyscrasias associated with brain tumours. *Conclusion:* Decompressive craniotomy and prolonged hypothermia are innovative therapies that can be used successfully in patients with refractory intracranial hypertension.

D-06

Trends in pediatric sports-related head injury: A 14-year injury surveillance study at British Columbia Children's Hospital

A Singhal (Vancouver), K Pakzad-Vaezi (Vancouver)**

Background: The current study was undertaken to examine trends of different pediatric sports-related head injuries over a 14-year period in order to better understand causes of injury and avenues for prevention. *Methods:* A prospective traumatic injury surveillance system (the Canadian Hospitals Injury Reporting and Prevention Program) was queried to identify all patients presenting with sport-related injuries, to examine the demographics, trends, and distribution of pediatric sports injuries. *Results:* From 1992 to 2005, 27 466 sport-related injuries (out of a total of 104 414 injuries seen) were identified. The annual number of sport-related injuries increased during this time period (by 28.6%, $p<0.0001$), while all-cause traumatic injuries did not. Males comprised 68% of the visits for sports-related injuries, and both genders displayed the increasing trend. Cycling, basketball, soccer, and ice hockey were the top four injury-causing activities. Sports-related head injuries increased 44.9% during the period of study ($p<0.01$). *Conclusions:* Sport-related pediatric injuries, including head injuries in particular, have increased over the past 14 years, while all other injury causes have remained stable. These data present a number of areas for further research and efforts aimed at understanding and preventing pediatric sports injury.

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D-07

Age as a key determinant of functional recovery after traumatic spinal cord injury: analysis of the third national acute spinal cord injury study (NASCIS-3) database

JC Furlan (Toronto), MB Bracken (New Haven), MG Fehlings (Toronto)*

Background: Given the increasing incidence of spinal cord injury (SCI) in the elderly (age≥65 years), we sought to examine whether age is a key determinant of functional recovery after acute traumatic SCI. *Methods:* All patients who were enrolled in the NASCIS-3 trial were included. Functional Independence Measure (FIM) scores were obtained at 6 weeks, 6 months and 1 year post-SCI. Data analysis was performed using Fisher's exact test, Mann Whitney U test and multiple linear regression. *Results:* There were 499 patients (423M, 76F; ages 14-92 years; mean of 35.7) who were received 24-hour methypredinosolone, 48-hour methypredinosolone or 48-hour tirilazad mesylate. Both younger (n=455) and elderly groups (n=44) were comparable regarding ethnicity, weight, GCS and drug protocol, but significantly different regarding sex, cause, severity and level of SCI. While increase in age was significantly correlated with lower FIM scores at 6 weeks post-SCI (p=0.025), there were no significant correlations between age and FIM scores at 6 months (p=0.289) and at 1 year (p=0.61) in the unadjusted models and after controlling for major potential confounders (gender, ethnic group, GCS, alcohol level, drug protocol, cause of SCI, level and severity of SCI). *Conclusions:* Age at time of injury was not significantly correlated with functional recovery in the chronic stage post-SCI. Our results, therefore, reinforce the need for individualizing treatment protocols for elderly patients with SCI who have the potential to functionally recovery.

D-08

Missed cervical spine injuries-A review of 4 cases

*R Sahjpaul (North Vancouver)**

Background: Failure to diagnose or recognize a clinically significant cervical spine injury can have devastating consequences. Despite the availability of clinical decision-making tools and advanced neuroimaging, errors in cervical spine clearance continue to occur. These errors have been classified into 3 types: Type I: inadequate/improper ordering of imaging; Type II: adequate imaging but misread or not read; and Type III: Adequate tests, read accurately, but tests not sensitive enough to detect injury. *Methods:* Four cases of missed cervical spine injuries presenting over the past 3 years to a university-affiliated teaching hospital were reviewed. *Results:* There were two Type I errors and two Type II errors. The missed injuries occurred at the mid-cervical level in 2/4 and at the lower cervical/cervicothoracic junction in 2/4. Neurologic deficit occurred in all cases. Two of four cases were missed at academic institutions, 1 at a non-academic rural hospital, and 1 at a non-hospital clinic. The recent literature regarding missed cervical spine injuries is reviewed. *Conclusion:* These cases serve to illustrate that despite the availability of clinical decision-making tools to guide cervical spine management and the widespread availability of advanced neuroimaging, cervical spine injuries continue to be missed, with potentially devastating clinical and/or medical-legal consequences.

D-09

Paradoxical cognitive test results in mild versus severe brain injury

D Louw (Edmonton), P Green (Edmonton)*

Background: Closed head injury is one of the few conditions in which there are generally accepted ways of classifying severity of brain disease. However, these classifications are often based on subjective input from patients who may be in a position of moral hazard (compensation or litigation cases). *Methods:* Using GCS, PTA and radiological brain abnormalities, in a consecutive series, we classified 597 head injuries as mild and 199 as moderate to severe. These groups differed in their mean GCS (8.7 versus 14.6) and on other indices of severity. All were given cognitive tests (WMT, MSVT, nonverbal MSVT) which are very easy and which are widely used to measure effort. *Results:* On nine out of ten measures, there was a very clear excess of failures in the mild versus the more severe brain injuries. The effect of effort on results dwarfed the effect of injury. *Conclusion:* These results illustrate a major difficulty in assessing the outcome of brain injuries using either self report or any variable under the voluntary influence of the patient (e.g. cognitive test scores such as the MMSE).

Neurovascular Surgery

E-01

Endarterectomy is safe in high risk patients

*IG Fleetwood (Halifax)**

Introduction: Endarterectomy has an important role in secondary stroke prevention. Trials in high-risk populations have established a role for stenting in certain situations. In this study, outcomes of endarterectomy in high-risk patients are assessed. *Methods:* From a cohort of 193 consecutive patients undergoing endarterectomy, high-risk patients were identified according to NASCET exclusion (52 patients) and SAPHHIRE inclusion (48) criteria. The usual referral for endovascular therapy in our centre relates to accessibility (ie. prior ipsilateral endarterectomy, neck dissection or radiation) rather than medical comorbidity. Analysis for adverse outcomes was made according to the high risk feature using Chi square analysis. *Results:* There was no statistically significant difference in outcome, regardless of which risk factors were tested. Advanced age (>79) didn't increase risk of MI or death. Contralateral occlusion didn't increase stroke risk. Atrial fibrillation and valvular heart disease didn't increase stroke or neck hematoma risk. Exertional angina or abnormal stress test didn't increase risk of MI. High bifurcation didn't increase risk of cranial neuropathy. Patients with any NASCET exclusion or SAPPHIRE inclusion criterion didn't have significant risk of any adverse event. *Conclusion:* Selection bias exists in this retrospective review. However, with appropriate peri-operative management and surgical technique, endarterectomy can be performed safely in high-risk populations.

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E-02

Survey of the rate and causes of long term mortality among 193 patients who had carotid endarterectomy

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Background: The effectiveness of carotid endarterectomy (CEA) has been established by large randomized clinical trials. Peri-operative stroke and death rates are well known. However, there are few data that have formally evaluated the rate and the causes of delayed non-peri-operative mortality in patients who have had CEA. *Method:* An REB approved review of 193 patients who underwent CEA between 2002 and 2008. *Results:* The peri-operative major stroke and death rate was 0.5% and non-disabling stroke rate was 2.07%. Delayed non-perioperative death occurred in an additional 24 patients between 1.5 months - 4.9 years secondary to ischemic heart disease (IHD), sepsis, neoplasia and other causes. Gender was not significant. Symptomatic presentation was associated with delayed mortality ($p<0.05$) as was increasing age (by decile) ($p=0.05$). IHD was associated with higher risk of cardiac death ($p<0.001$) and had a positive likelihood ratio for death by any cause of 2.69 [CI 1.80 - 4.01]. *Conclusion:* With the known benefit of early CEA in symptomatic patients, these results emphasize the importance of comprehensive post-operative care for those with known IHD.

E-03

Wait times for carotid endarterectomy - how can we do better?

EE Dyer (London), S Lownie (London)*

Background: Delay in the surgical treatment of symptomatic carotid artery disease can be neurologically devastating. Thus, it is helpful to analyse practice patterns and surgical wait times to identify ways to improve access for eligible patients. *Methods:* A retrospective database was collected on 85 neurosurgical CEA patients from 2006 to 2007. The number of days' wait was determined, from the first TIA to first medical attention, to the TIA clinic visit, to diagnostic imaging, to the neurosurgical appointment, to preadmission clinic, and finally to the operating room. *Results:* Average wait time from first TIA to CEA was 130 days. Time to first medical attention averaged 18.6 days (range of 1-120 days) and time to TIA clinic averaged 50 days. From that, diagnostic imaging was performed within 2 weeks. A mean of 21 days elapsed between referral to neurosurgery and appointment, with an additional mean 43 day wait to OR. Patients presenting directly to the emergency room had earlier access to the TIA clinic (average 7 days) and thus earlier referral for surgery. *Conclusions:* Early recognition of TIAs by both the patient and medical community, a focus on immediate carotid imaging and prioritization in surgery are methods of reducing wait times.

E-04

Emergency stenting for occlusive carotid artery dissection

GJ Redekop (Vancouver), CS Haw (Vancouver), M Heran (Vancouver)*

Background: The management of carotid artery dissection presenting with symptomatic acute hemodynamic insufficiency is controversial. Medical treatment with antithrombotic therapy is unlikely to improve cerebral perfusion. Emergency endovascular stenting is an attractive treatment approach, but there is little data regarding safety, efficacy, and long term patency. We report our experience with 17 consecutive patients presenting with acute occlusive carotid dissection treated with endovascular stents. *Methods:* The patient population included 11 females and 6 males, with a mean age of 45.5 years (range 24-66 years). Ten dissections occurred spontaneously or after minor trauma, 4 were complications of cerebral angiography, and 3 resulted from moderate to severe trauma. All procedures were performed via a transfemoral approach with systemic anticoagulation. Premedication with antiplatelet therapy was generally not done because of the urgent nature of intervention. Following stent implantation patients were treated with clopidogrel and aspirin in combination for 6 weeks, followed by single agent antiplatelet therapy indefinitely. *Results:* Stents were successfully placed in all patients, with restoration of normal vessel diameter. Cerebral perfusion was restored in 16 patients. One patient who had a carotid dissection with critical stenosis and a middle cerebral artery embolus had successful carotid stenting but the MCA occlusion persisted despite intra-arterial thrombolysis. There were no neurological complications of carotid stenting, and most patients experienced substantial early recovery of their presenting ischemic symptoms. One patient had a femoral artery pseudoaneurysm requiring surgical repair. Clinical and radiographic follow-up ranged from 6 to 72 months (mean 30 months). There were no instances of recurrent dissection or ischemia, and no in-stent stenosis. *Conclusions:* Emergency stenting for occlusive carotid dissection can be accomplished rapidly and safely, with acceptably low morbidity. Our experience suggests that in symptomatic patients presenting with acute cerebral ischemia it is a valuable technique for revascularization.

E-05

Carotid stenting in octogenarians with symptomatic carotid stenosis

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Background: Randomized controlled trials have shown that elderly patients with symptomatic severe carotid stenosis significantly benefit from carotid surgery over medical therapy alone. Although carotid angioplasty and stenting (CAS) offers a less invasive means of revascularization for the very elderly, recent literature has suggested an increased procedural risk in this patient population. We wished to examine our experience of octogenarians with symptomatic carotid disease treated by CAS, with an emphasis on complications and long-term clinical outcome. *Methods:* We conducted a retrospective single-center five-year review (October 2001 - September 2006) of patients aged 80-90 with symptomatic >50% carotid stenosis presenting with transient ischemic attack (TIA) or stroke, who were treated by CAS at our tertiary-care centre. All procedures were performed under local anesthesia by an interventional neuroradiologist and/or endovascular neurosurgeon. Standardized techniques were used including pre- and post-CAS treatment with aspirin and clopidogrel and intra-procedural anticoagulation. An embolic distal protection device was used in 98% of cases. *Results:* Fifty-five patients (80% male) were identified with a mean age of 83 years, who each underwent single vessel CAS. Average stenosis was 82% with near occlusion in 22%

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of cases. Technical success was achieved in 54 cases (98%). No major strokes occurred, and 7 patients (13%) suffered a minor stroke or retinal event within 30 days of the procedure. Two patients (4%) died due to cardiac causes, the same-day and 15 days after CAS. Over a mean follow-up time of 23 months (range 3-57 months), we identified 4 TIAs, 1 minor stroke, no major strokes, and 7 deaths due to non-neurological causes. One patient developed symptomatic re-stenosis requiring uncomplicated repeat carotid angioplasty. *Conclusions:* CAS can be performed in octogenarians with reasonable but not insignificant risk, and may offer protection against recurrent stroke over the long term. Further study is necessary to define the safety and efficacy of CAS in this patient population.

E-06

Direct revascularization of intracranial atherosclerosis with balloon-expandable stents

GJ Redekop (Vancouver), CS Haw (Vancouver), M Heran (Vancouver)*

Background: Symptomatic intracranial atherosclerosis has a high risk of recurrent cerebral ischemia. Antithrombotic therapy has only modest benefit and recent developments in endovascular stent technology allow direct stenting of intracranial arteries as a potential alternative to medical treatment. *Methods:* Forty-five patients with symptomatic high-grade intracranial atherosclerosis underwent attempted revascularization with balloon-expandable coronary stents. There were 9 females and 36 males, with an average age of 64 years. Twelve presented with acute stroke and underwent emergency intra-arterial thrombolysis followed by stent placement. Thirty-three had recurrent TIA or stroke on antithrombotic therapy and had elective stenting. All procedures were performed via a transfemoral approach under general anesthesia. Following stent placement all patients were treated with dual antiplatelet therapy for 6 weeks followed by single agent antiplatelet therapy indefinitely. *Results:* Stents were successfully placed in 43/45 patients (95.5%). Lesions were located in the basilar artery (12), vertebral artery (12), internal carotid artery (11), and middle cerebral artery (10). In two patients a stent could not be navigated to the lesion site and revascularization was limited to balloon angioplasty. Both patients had early recurrent symptoms and required repeat intervention, one with additional angioplasty and one with stent placement. The overall stroke and death rate was 13.3% (6/45 patients). In the 12 patients with acute stroke undergoing intra-arterial thrombolysis followed by stenting, there were 3 strokes and 1 death (4/12=33%). In the symptomatic patients who had elective stenting there were 2 procedure-related strokes (2/33=6%). Patients were followed clinically and radiographically for 5 to 52 months (mean = 30 months). Three surviving patients (including the two with initial angioplasty alone) had recurrent symptoms due to stenosis or thrombosis and required additional intervention (3/44=6.8%). Two additional patients (4.5%) had asymptomatic in-stent re-stenosis of more than 50%. *Conclusions:* Primary stenting for symptomatic intracranial atherosclerotic disease may be a reasonable alternative to medical therapy. In non-emergent situations the technical results are excellent and the morbidity acceptably low. Patients presenting with acute stroke due to thrombotic occlusion at the site of critical stenosis have a significantly higher risk of procedural morbidity. In these potentially life-threatening situations the potential risk of intra-arterial thrombolysis and stenting must be carefully weighed against the natural history and alternative treatment options.

E-07

Assessment of intracranial-extracranial bypass patency with 64-slice multi-detector computerized tomography angiography

L Thines (Toronto), R Agid (Toronto), AR Dehdashti (Toronto), L Da Costa (Toronto), C Wallace (Toronto), KG Ter Brugge (Toronto), M Tymianski (Toronto)*

Background: Extracranial-intracranial (EC/IC) bypass is a useful option in cerebrovascular surgery for indicated cerebral revascularization or complex aneurysms. We explored the role of multi-detector computed tomography angiography (MDCTA), instead of digital subtraction angiography (DSA), for the postoperative assessment of EC/IC bypass patency. *Methods:* We retrospectively analysed a consecutive series of 20 MDCTAs from 16 patients that underwent 23 direct or indirect EC/IC bypass procedures between April 2003 and November 2007. Conventional DSA were available for comparison in 11 cases. MDCTA used a 64-slice MDCT scanner (Aquilion 64, Toshiba). The proximal and distal patencies were analyzed on MDCTA and DSA by a neuroradiologist and a neurosurgeon. The bypass was considered patent when the entire donor vessel was opacified without discontinuity from proximal to distal ends and the recipient vessel was visible. *Results:* MDCTA depicted the patency status in every patient. Bypasses were patent in 20 cases, stenosed in one and occluded in two. DSA always confirmed the results of the MDCTA (sensitivity = 100%, 95% CI = 0.655-1.0; specificity 100%, 95% CI = 0.05-1.0). *Conclusions:* MDCTA is a non-invasive and accurate exam to assess the postoperative EC/IC bypass patency and when conclusive, it could replace conventional DSA in routine follow-up.

E-08

Causes, management and outcome of aneurysmal perforation during coil embolization

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Objective: The purpose of this study is to investigate and describe the incidence, etiologies, and management of intraprocedural aneurysm perforation during coil embolization, and to identify the predictor factors of poor outcome in these patients. *Methods:* A retrospective analysis of 535 patients with 581 intracranial aneurysms treated with endovascular coiling over a 14-year period from 1992-2006 was conducted. Data concerning demographics, anatomical characteristics of the aneurysms, indication for treatment, etiology of perforation, material used for coiling, hemodynamic change during rupture, management of the complications and clinical outcome were examined. The statistical analysis was performed using the SAS statistical package, version 9.1 (SAS Institute Inc; NC, USA). Poor neurological outcome was defined as a Modified Rankin Score of greater than or equal to three. A univariate analysis of predictors of poor outcome was conducted using Fischer's Exact Test for ordinal and categorical variables and one-way analysis of variance for continuous variables. *Results:* A total of 23 intraprocedural perforations were identified (3.9% of total aneurysms). 96% were ruptured at arrival, 78% were females and the

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mean age was 54 years old (range, 20-89yr). Mean follow up time was 11 months (range, 0-48 mo). Aneurysm rupture happened during the insertion of coils in 82%. Over 51% of the aneurysms were located in the anterior circulation. Sixteen patients (70%) had a favorable outcome (MRS≤3). Five patients (22%) died. Predictors of poor outcome following perforation were older age (P=.002), procedure done before year 2003 (P=.03), hemodynamic instability immediately after the perforation (P=.03), hypercholesterolemia (P=.02) and chronic hypertension (P=.02). *Conclusions:* The majority of the intraprocedural ruptures observed in our series occurred in acutely ruptured intracranial aneurysms. The outcome is most often favorable, especially in patients without hypercholesterolemia, chronic hypertension or transoperative hemodynamic instability.

E-09

Recombinant factor VIIa plus surgery for intracerebral hemorrhage

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Background: Hyperacute surgical evacuation of intracerebral hemorrhage is associated with a high rebleeding rate. The peri-operative administration of rFVIIa to patients with intracerebral hemorrhage may decrease the frequency of post-operative hemorrhage, and improve outcome. *Methods:* Patients receiving rFVIIa therapy immediately prior to acute surgery were collected at two centres. The ICH score and ICH Grading Scale were determined, as was long-term outcome using the modified Rankin Scale. Residual/ recurrent clot was evaluated by comparing pre-operative to post-operative CT scans. *Results:* Fifteen patients with intracerebral hemorrhage received 40-90 μg/kg of rFVIIa 5.3±3.5 hours following symptom onset. Surgery was performed 6.0±3.0 hr following symptom onset. Mean pre-operative clot volume was 68±45 mL, decreasing to 6±9 mL post-operatively. There were no thromboembolic adverse events. 13% (2/15) mortality with 11 patients (73%) independent, and two (13%) with moderate to severe disability. These outcomes were significantly better than expected based on the median ICH score (40% mortality) and based on median ICH Grading Scale (18% good outcome). *Conclusions:* The pre or peri-operative administration of rFVIIa resulted in minimal residual or recurrent hematoma volume and may be an important adjunct to surgery in patients with intracerebral hemorrhage.

NEURO-ONCOLOGY

F-01

Expanded endonasal approach: a review of the transsellar approach to skull base pathology in 306 patients

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Background: For the last century, transphenoidal approaches have been used to access pathology in and around the sella. Using the expanded endonasal approach we have been able to access a variety of lesions not only in the sellar but also the parasellar location. *Methods:* We have reviewed the pathology as well as complications associated with the transsellar approach to the skull base. *Results:* From 1998 to 2007, over 700 patients have underwent the expanded endonasal approach to skull base pathology. In 306 patients we have utilized the transsellar module for benign (277/90.5%) malignant (9/2.9%), miscellaneous (7/2.3%) trauma (7/2.3%) inflammatory (1%) and infectious (1%) pathology. The most common lesions have been pituitary adenomas (235), and Rathke's cleft cysts (24). We have had a total complication rate of 5.2% with a neurologic related complication rate of 3.5%. We have had 2 deaths and 2 patients with permanent neurologic deficits (both with permanent VI nerve palsies). *Conclusions:* The expanded endonasal approach can be used safely and effectively to access a variety of pathologies in the the sellar. Furthermore we have been able to safely expand our surgical field into the parasellar region of the skull base.

F-02

Pediatric intracranial epidermoid tumours: the Hospital for Sick Children experience

IH Alahmed (Toronto), S Vachhrajani (Toronto), K Auguste (Toronto), M Shroff (Toronto), P Dirks (Toronto), J Drake (Toronto), J Rutka (Toronto)*

Background: Epidermoid tumors are benign lesions representing 1% of all intracranial tumors. No exclusively pediatric series of intracranial epidermoid tumors has been previously reported. We present our experience in the management of these lesions. *Methods:* The neurosurgical data base at the Hospital for Sick Children was searched for children with surgically managed intracranial epidermoid tumours. Patient charts were reviewed for demographics and details of clinical presentation, surgical therapy, and follow-up. Ethics board approval was obtained. *Results:* There were seven children, interestingly all female patients, identified between 1980-2007. The average age at surgery was 11.2 years (range 8-15) The mean maximal tumour diameter was 2.1 cm. Headache was the most common presenting symptom and one tumour was found incidentally. Most patients were neurologically normal. However, meningism was found in two cases. Hearing loss with cerebellar signs was found in one case. There were three cerebellopontine angle (CPA) lesions, one pontomedullary lesion, and 3 supratentorial tumours. Because of the critical location of these lesions to cerebral arteries and cranial nerves, neurosurgical extirpation was association with some post-operative ischemic and cranial nerve deficits. One patient developed hydrocephalus after aseptic meningitis and was shunted. No operative mortality was seen. Complete resection could be performed in three patients. One of these patients experienced a small recurrence not requiring re-operation, while one subtotally resected patient recurred and underwent a second operation. *Conclusion:* Intracranial epidermoid tumors are rare in the pediatric population. Total resection is desired in order to minimize postoperative aseptic meningitis, hydrocephalus, and tumor recurrence. However, aggressive neurosurgical resection may be associated with cranial nerve or ischemic deficits. Here, neurosurgical judgement at the time of surgery is warranted to ensure maximum resection while minimizing neurological deficits.

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F-03

Long-term functional outcome of childhood ependymoma survivors: stratified for year of diagnosis, location of primary tumor and irradiation

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Background: Ependymoma long-term (LT) survivors have been exposed to therapy which has potential adverse effects on function. The influence of tumor location and treatment on LT morbidity was evaluated. *Methods:* We performed a retrospective review of all children aged < 17 yrs at diagnosis of ependymoma in BC since 1970. LT survivors were defined as surviving > 5 yrs. Functional outcome was based upon the modified Bloom Scale: Grade 1: no disability; 2: mild; 3: partial; and 4: severe disability. *Results:* Overall survival if diagnosed pre 1990 was 32% compared with 62% if diagnosed post 1990 (p=0.024). LT functional outcome was available on 35/43 (11 spinal and 24 intracranial) LT survivors. 43% of LT survivors diagnosed pre 1990 were Bloom's grade 3/4, Vs 6% diagnosed post 1990; 47% received craniospinal irradiation pre 1990 and none post 1990. 29% of intracranial ependymoma survivors were Bloom's grade 3/4; 20% of spinal ependymoma survivors were Bloom's grade 3, none grade 4. 32% who received radiotherapy were Bloom's grade 3/4; none of those who received radiotherapy were Bloom's grade 3/4. *Conclusion:* Survival and functional outcome is improved with diagnosis after 1990. Omission of irradiation and spinal location correlate with improved LT function in survivors.

F-04

Occurrence of basal ganglia germ cell tumors without a mass

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Background: Tumor may not be at the top of the differential diagnosis in children presenting with basal ganglia calcifications without significant mass effect and/or atrophy of the cerebral peduncle. We present a case series wherein such radiographic findings eventually proved to be related to germ cell tumour. These cases highlight potential pitfalls in the interpretation of these radiographic findings. *Case reports:* Four patients, two with metastasis from a previously treated germ cell tumour and two with primary basal ganglia germinomas are reported. All patients had a progressive hemiparesis, associated with basal ganglia calcifications and no mass effect. Two had atrophy of the cerebral peduncle, contralateral to the hemiparesis. In three patients, the initial interpretation of the radiographs was remote injury or stroke and in one low grade glioma. In three patients this led to delayed diagnosis and treatment in one the diagnosis was rapidly made on recognition of this entity. *Conclusions:* These cases point out radiographic characteristics of basal ganglia germ cell tumors, which, if unrecognized, could lead to incorrect interpretation of radiographic findings and compromise the eventual outcome.

F-05

Malignant transformation of intracerebral angiocentric glioma

*S Gul (North Vancouver)**

Background: Angiocentric glioma is a recently described tumour demonstrating infiltrating growth characteristics with prominent perivascular tumor cell arrangements and astrocytic/ependymal differentiation. This tumour tends to present in childhood and early adulthood with seizures. As of yet, there have been no reports in the literature of malignant transformation of this recently described tumour. *Clinical presentation:* A 38 year-old male presented with severe, intractable headaches, subtle cognitive changes and no neurologic deficit. For thirteen years prior, he remained asymptomatic following gross total resection of a right frontal lesion causing epilepsy. The tumour was reported at the time to be ganglioneuroma (1995). Recent MR imaging demonstrated recurrence of the right frontal lesion, which appeared as an enhancing mass containing multiple cysts. *Intervention:* The patient underwent re-resection of the mass and the histopathology was consistent with malignant glioma. Post-operatively, the patient received temozolomide and radiation therapy. Review of the original right frontal tumour appeared to be consistent with angiocentric glioma more so than the original diagnosis of ganglioneuroma. *Conclusion:* This case represents the first described case of malignant transformation of angiocentric glioma.

F-06

Epidermal pathway growth factors in pediatric ependymoma

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Introduction: WHO criteria for intracranial ependymoma is not predictive of outcome. *Hypothesis:* EGFR, HER-2, and YB-1 provide a better risk stratification than WHO criteria. *Methods:* We retrospectively reviewed all children less than 17 yrs at diagnosis of ependymoma in British Columbia since 1982. The charts, imaging and pathology were evaluated. Tissue microarray (TMA) slides were constructed and immunostained with anti-YB-1 (1:250 dilution, Dr. Colleen Nelson from UBC), anti-EGFR (1:100 dilution, StressGen Bioreagents) and anti-HER-2 (1:100 dilution, Lab Vision Corporation). Kaplan-Meier overall survival (OS) was performed using SPSS software (Sutherland, Oncogene 2005). *Results:* We reviewed clinical data, pathology and obtained cores for TMA in 46/59 patients. Median age 5.3 yrs (0.2-14.3). WHO grade 1 (3), grade 2 (29), grade 3 (14). 39/46 arose from the posterior fossa (PF). WHO grade, YB-1 and HER-2 were not predictive of survival. 23/23 patients with a positive EGFR arose from PF, median age 4.9 yrs (0.2-14.3), 19/23 had >95% resection, two had dissemination. 5 yr OS was 35% for positive EGFR Vs 75% for negative EGFR (p<0.05). *Conclusion:* EGFR is prognostic of poor survival in childhood ependymoma. Positive EGFR may be limited to PF location. There was no predictive value with YB-1 or HER-2 alone.

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F-07

SMART (stroke-like migraine attacks after radiation therapy) syndrome after treatment for childhood medulloblastoma

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Background: SMART syndrome is episodic neurological dysfunction associated with migraine-like headaches after radiation therapy. MRI shows focal ribbon-like enhancement of the cortex. *Methods:* A nine year old female received surgery, radiation and chemotherapy for medulloblastoma. Age 32, she developed migraine-like headaches with visual phenomena. An MRI, age 35, showed new enhancing lesions. Needle biopsy of one white matter lesion was non-diagnostic. Age 37, she developed left hemianopsia, neglect and incoordination with headache. MRI showed ribbon-like enhancement of the right occipital cortex. Open biopsy of the lesion was performed. *Results:* The first biopsy showed patchy gliosis and subtle microvacuolation in white matter. The second biopsy showed grey and white matter with patchy intense gliosis, microglial activation and vacuolation. Both specimens showed subtle vascular changes. These features suggested delayed effects of radiotherapy. She subsequently had episodic exacerbations and progressive encephalopathy, dying at age 40 of pneumonia. MRIs showed progressive atrophy with fluctuating lesions. No autopsy was performed. *Conclusions:* We present the first clinicopathologic correlation of SMART syndrome. This patient's attacks were an ominous symptom accompanied by progressive neurological decline. Clinical features were likely due to transient blood brain barrier dysfunction, presumably reflecting delayed radiation effects on endothelial cell function.

F-08

Epilepsy associated with oligodendrogliomas

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Purpose: Oligodendrogliomas (ODs) are the third most common gliomas and account for 2-5% of all brain tumours. A high proportion of patients with ODs present with or eventually develop seizures, that may become refractory to anti-epileptic drugs (AEDs). This study aims to quantify the presence of refractory epilepsy in patients pathologically diagnosed with ODs and identify diagnostic and treatment guidelines as to optimal clinical management. *Methodology:* A retrospective review was conducted using patients pathologically identified as having an OD in the London Health Sciences Centre (LHSC) and London Regional Cancer Program (LRCP) from January 1996 to July 2007. Refractory epilepsy was defined as the failure of 2 appropriately prescribed AEDs. *Results:* One hundred and sixty-four patients were identified that met the inclusion criteria. The population identified was found to hold similar demographic and clinical characteristics to existing populations of oligodendrogliomas in the literature with predominant manifestation in males (89/164; 54.2%) and frontal lobe tumour location (99/164; 60.4%). Refractory epilepsy was found in 58/164 (35.4%). An association (P=0.042) was observed between the occurrences of refractory epilepsy and patients with ODs in the temporal lobe. There was a significant association between tumour contrast enhancement in MRI and final pathological grading (P=0.001). *Conclusions:* Refractory epilepsy is common among the patients with ODs. The occurrence of ODs within the temporal lobe carries the highest risk for the development of refractory epilepsy.

Multiple Sclerosis

G-01

Canadian paediatric surveillance program: clinically isolated demyelinating syndromes of the central nervous system in Canadian children

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Background: The incidence of Clinically Isolated Demyelinating Syndromes ("CIS") in children is unknown. CIS includes optic neuritis, transverse myelitis, hemisensory or hemimotor syndromes, cerebellar or brainstem dysfunction, occurring either alone (monosymptomatic CIS), in combination (polysymptomatic CIS), or with encephalopathy (acute disseminated encephalomyelitis, ADEM). Advancing our understanding of CIS is of utmost importance as these children are at risk for recurrent demyelination (Multiple Sclerosis). *Objectives:* To document the incidence, clinical characteristics, and current medical care of children with CIS and to increase awareness of pediatric demyelination among health care providers. *Methods:* Monthly surveys conducted through the Canadian Paediatric Surveillance Program (CPSP) were used to obtain the incidence and features of pediatric CIS and clinical care practice of over 2,400 Canadian pediatricians. *Results:* Two-hundred and forty-four cases of confirmed CIS were reported between April 1st, 2004 and March 31st, 2007. The average age of the demyelinating presentations was 10.73 (0.66-18.12), and the female to male ratio was 1:18:1. The most common presenting phenotypes were ADEM (25%), optic neuritis (22%) and transverse myelitis (20%). The average age of presentation was lowest in children with ADEM (7.9, range: 0.9-18.0), and highest in children with monosymptomatic presentation (12.0, 1.0-17.9). The incidence rate averaged 74 cases per year. Nine percent reported a family history of MS, and four percent received vaccination(s) within one month of demyelination. Awareness of MS as an outcome of CIS increased from 65% of physicians surveyed at study onset to 87% in year three. One-hundred and thirty five children are enrolled in our prospective clinical, pathobiological and MRI study of Canadian children with demyelination (launched during year two of the surveillance program). *Conclusion:* The annual incidence of pediatric demyelination is approximately 1 in 100,000 Canadian children. Awareness of MS risk in children with CIS has increased markedly amongst Canadian pediatric health care practitioners, which will facilitate the prompt diagnosis of MS in children.

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G-02

Mitochondrial DNA mutations in pediatric clinically isolated syndromes (CIS) and multiple sclerosis

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Background: Frequencies of mtDNA mutations and particular haplotypes in pediatric clinically isolated demyelinating syndromes (PD-CIS), and their potential relationship to disease phenotype including MS development, are unknown. *Methods:* Mitochondrial genotypes were determined for 116 children in the Canadian Pediatric Demyelinating Study. This included 31 single nucleotide polymorphisms (SNPs) consisting of haplogroup-defining SNPs and primary or secondary LHON mutations. The Accelerated Cure Project (ACP) provided DNA samples and clinical data from 346 MS patients. Healthy controls (n=215) were obtained primarily from the Coriell Institute for Medical Research. *Results:* Of the 116 PD-CIS subjects, 7 (6%) harbored a heteroplasmic 15927A mtDNA mutation in the tRNA (Thr) gene versus only 1.5% in the ACP-MS group (p=0.013), and 0.5% in the controls (p=0.003). Three of 7 PD-CIS patients (42%) with the mutation versus 17/109 (16%) PD-CIS patients without the mutation developed MS (2-year average follow-up; p=0.098). Clinical presentations varied, and none had optic neuritis. Haplogroup H predicted a higher risk of confirmed MS among the PD-CIS cases (p=0.005, OR 4.4; 95%CI 1.6-11.7). None of the PD-CIS or ACP-MS patients was positive for LHON mutations. *Conclusions:* These data indicate an unexpectedly high frequency of the 15927A mtDNA mutation in the PD-CIS population, and suggest its presence may predict progression to definite MS.

G-03

On the origins and early descriptions of Multiple Sclerosis

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Background: Most writings on the origins of Multiple Sclerosis (MS) highlight Charcot's famous lectures on Disseminated Sclerosis. Earlier contributions, such as pathological descriptions of the MS plaque from Cruveilher and Carswell, have been established. Yet whether "La Sclerose en Plaques Dissemines" was a new disease or simply the novel recognition of a disease state already prevalent in society remains debated. *Objective and Methods:* To review historical literature leading to the discovery of MS for evidence of potential early cases; and to discuss the challenges of clinical neurology and the nosological categorization of neurological diseases prior to Charcot's time. *Results:* Ecclesiastical writings, dating back to the eleventh century, describe cases of neurological deficits with recovery in young people. Dr. W.R. Charleton documented the types of Palsy seen in Bath during the mid 1700's, identifying paraplegia in the post partum state amongst the "palsied" cases. Lesser known works from the 1700's to mid 1850's by Kirkland, Copland, Rowley and Wilson, briefly document cases of relapsing neurological disease amongst cases of "Palsy" and "Paraplegia". The works of Horner (1829), and Ollivier (1824) advanced the concept of chronic nervous system inflammation, the latter providing the first clear description of what is almost certainly relapsing-remitting MS. *Conclusion:* The existence of MS prior to Charcot's time is unequivocally shown in the great pathological atlases of the 1800's, and in Ollivier's clinical descriptions. Notwithstanding that retrospective identification of modern neurological diseases is inherently uncertain; we have identified additional early cases of neurological deficit in young individuals that may suggest MS exacerbation by context and character.

G-04

Diffusion tensor imaging in pediatric Multiple Sclerosis: studying the pathological corpus callosum

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Objective: To explore corpus callosum white matter changes in pediatric onset multiple sclerosis (MS) using advanced MR imaging. *Background:* Diffusion tensor imaging (DTI) provides a measure of white matter (WM) integrity in adults with MS. Studying DTI in children with MS provides an ideal patient population to explore whether disruption of myelin pathways occurs as a component of early MS pathology. *Methods:* DTI was obtained for 16 children with clinically diagnosed MS (mean age 15.0, range 10-17 years) and 17 healthy children (mean age 11.7, range 6-17 years). Images were acquired using a GE LX 1.5T scanner. A T1 SPGR image was acquired for defining regions of interest. Acquisition of a PD/T2 interleaved sequence facilitated co-registration of images to DTI space (25 directions, 5mm slice thickness, b=1000s/mm2). Fractional anisotropy (FA) and apparent diffusion coefficient (ADC) were calculated in four anatomically defined regions of the corpus callosum: genu, anterior body, posterior body and splenium. Regional FA values in the corpus callosum of MS patients were significantly reduced relative to controls in the anterior body, posterior body, and splenium by 26.2%, 29.1% and 13.86% respectively ($p<0.001$). The most extreme difference in anisotropy was observed in the posterior body with a mean FA of 0.65 for controls versus 0.46 for MS patients ($p<0.001$). Mean ADC values were 75% larger in MS patients relative to controls for all corpus callosal regions ($p<0.001$). *Conclusions:* We present the first DTI study focused on WM pathway integrity in pediatric MS. Dramatic differences in FA and ADC strongly suggest a profound loss of WM integrity in the corpus callosum of affected children. Segmentation of lesional and non-lesional WM is now underway, and will provide further insight to the relative contribution of lesions towards the observed DTI findings, and will indicate whether this disease also impacts normal appearing WM integrity.

G-05

In vivo measurement of remyelination and edema resolution in the core and peripheral zone of acute multiple sclerosis lesions

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Background: Quantitative magnetic resonance imaging (qMRI) techniques allow *in vivo* estimation of the macromolecular content of image voxels, a marker for myelin in CNS white matter, and water content, which may change with inflammation and edema. *Objective:* To characterize the evolution of changes in the macromolecular and water content of the core and peripheral zone of

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acute MS lesions as they evolve over time. *Design:* Five patients with relapsing-remitting MS underwent monthly quantitative MRI exams for six months on a 1.5T Siemens Sonata. Quantitative magnetization transfer imaging (qMTI) and MTR parameter maps were generated. The core and peripheral zone of acute MS lesions as well as normal appearing white matter (NAWM) regions of interest were manually segmented. These labels were propagated to other time points and resampled to match the qMTI maps. Changes in the sizes of the macromolecular proton pool and free water proton pools relative to contralateral NAWM were quantified within the lesion core and peripheral zone. *Results:* At the time of contrast enhancement, the macromolecular content of the lesion core and peripheral zone were reduced to 32 ± 9% (mean ± SD) and 60% ± 13% of the NAWM, respectively, while the water content was increased by 15% ± 9% and 11% ± 5%, respectively. Over the subsequent two months, the macromolecular content of the peripheral zone increased to 81% ± 10% of the NAWM, while the core increased to 46% ± 8% of the NAWM. The water content decreased closer to NAWM values in the peripheral zone than in the core, but remained elevated in both. *Conclusions:* At the time of enhancement, both demyelination and edema were observed not only in the core of acute lesions, but also in the peripheral zone, which is often considered to reflect only edema. The peripheral zone, which returned to normal on conventional MRI, showed better subsequent remyelination and edema resolution than the core, but did not recover to fully normal myelin or water content.

G-06

The Importance of age at onset on the clinical and paraclinical features of childhood Multiple Sclerosis

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Background: The clinical and paraclinical features of pediatric Multiple Sclerosis (MS) appear to differ as a function of age at onset, with adolescent patients more closely resembling adult-onset disease. Detailed analysis of the importance of age on clinical, laboratory and MRI features has yet to be performed in a prospective population of children with MS. *Methods:* Demographic, clinical, laboratory and neuroradiological features are compared between children with MS onset under age 10 and patients with disease onset between age 10 and 18 years. *Results:* Relapsing-remitting MS was diagnosed in 74 children who experienced a first attack of demyelination under the age of 18 (mean 12.0 years, 2.1 - 17.7); 21 under age 10 years. Two children have entered the secondary progressive phase of the disease. F:M ratio increased from 0.91 in the <10 year old group, to 1.94 for the older patients. An ADEM-like presentation occurred in 62% of children with disease onset <10 years, a presentation rarely seen in older children (5.6%). Rescue therapies (IVIg, Cyclophosphamide, PLEX) for acute severe relapse or exceptionally high relapse frequency were prescribed for 57% of children with onset before the age of ten, compared to 23% of the older children. CSF oligoclonal bands were present at onset in only 31% of younger children compared to 78% of children with later age at onset. McDonald MRI criteria for lesion distribution were met by over 75% of the children, irrespective of age. Younger children were more likely to have diffuse lesions (40% vs 2%), while older children tended to have discrete lesions perpendicular to the corpus callosum (60% vs 20%). Black holes were noted in 45% of older children, but in only 14% of younger patients. *Conclusions:* Younger children with MS are more likely to be male, have an ADEM-like first attack, to experience severe disease requiring escalation of therapy, and to have large, diffuse MS lesions. Recognition of these differences is critical for the diagnosis and care of children with MS.

G-07

Mitoxantrone use in acute demyelinating transverse myelitis and optic neuritis

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Background: Mitoxantrone is a chemotherapeutic agent that is a classified as an anthracycline anti-neoplasic agent and immunosuppressant. It is the only medication of its type currently indicated for use in Multiple Sclerosis (MS), a chronic demyelinating disease of the central nervous system (CNS). Because of its effectiveness in treating highly aggressive secondary progressive disease, more and more clinicians are using Mitoxantrone in treating disease that is resistant to standard treatments. Studies have shown that Mitoxantrone is effective in extending the time between relapses as well as improving disease burden on imaging in some specific types of MS. *Methods:* Our study reviewed 18 cases of Mitoxantrone intervention post failure with current standard of care treatments (ie. steroids and/or PLEX) in acute demyelinating disease in patients with involvement of the spinal cord and/or optic nerves. We recorded the patient demographics as well as factors that can influence treatment efficacy while using subjective and objective measures of improvement as our primary and secondary outcomes respectively. *Results:* Our study found that after 1 year, 15 of 18 episodes of demyelination showed marked or moderate improvement, 2 showed a mild improvement, and only 1 case showed no improvement. *Conclusion:* We suggest that that there is a potential role for Mitoxantrone therapy in treating severe acute demyelinating attacks of the central nervous system, and that a trial should be instituted early on if the patient has failed typical first line therapies.

G-08

Autonomic dysfunction in multiple sclerosis patients with mild disability and spinal cord lesions: reality or myth?

KS Waspe (Langley), A Krassioukov (Vancouver), G Vorobeychik (Burnaby)*

Background: Multiple sclerosis (MS) is a chronic disease of the central nervous system with presumed autoimmune aetiology that initially presents with variety of visual, sensory and motor abnormalities. However, there is also clinical evidence of a variety of dysfunctions of the autonomic nervous system in this population. The objective was to assess autonomic dysfunction in MS patients with mild disability with and without spinal chord lesions confirmed on MRI.

Method: A prospective blinded match-controlled study, in subjects with clinically definite MS (McDonald Criteria) and mild disability (EDSS 4 or less) with (N=5, Group 1) and without (N=5, Group 2) spinal cord involvement were recruited. Neurological examination was performed by a single neurologist (GV) and autonomic assessment by single registered nurse (JN). Autonomic assessment included: baseline blood pressure (BP) and heart rate (HR), orthostatic challenge test and Holter monitoring over 24 hours. *Results:* The resting cardiovascular (BP and HR) parameters did not

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differ between the two groups. However, following sit-up test arterial blood pressure in individuals in group 1 (with spinal chord lesions on MRI) decreased significantly (-11 mmHg) and did not return to baseline during the next 15 minutes. There were no significant alterations in cardiovascular parameters in individuals from group 2. Furthermore, patients with spinal cord involvement had higher rate of abnormalities on Holter monitoring than patient with only brain lesions. *Conclusions:* The results of this study point to the necessity of early recognition and a better understanding of abnormal autonomic control in MS patients with mild disability.

G-09

Self-Reported fatigue and presence and severity of sleep disorders among patients with multiple sclerosis

*SD Brass (Boston)**

Objective: To report on the association between Fatigue Severity Scale scores, Epworth Sleepiness Scale scores and polysomnographic findings among a group of patients with multiple sclerosis.
Background: Fatigue is reported to be the most common and the most disabling symptom associated with multiple sclerosis (MS). The cause of fatigue in MS is unknown, although there are theories that link fatigue with immune factors, muscular dysfunction, depression, and medication side effects. *Methods:* A planned retrospective chart review of data on all MS patients who complained of fatigue to one MS clinician over a 2 year period and agreed to undergo polysomnography. Data collected included weight, age, gender, expanded disability status scale score, Fatigue Severity Scale scores, Epworth Sleepiness Scale scores, Apnea/Hypopnea Index, Respiratory Disturbance Index, and Periodic Limb Movement Index. *Results:* Data is forthcoming but preliminary results suggest a large proportion of MS patients with fatigue have confirmed sleep disordered breathing and/or restless leg syndrome. Statistical associations will be determined to assess the relationship between the intensity of the fatigue score/ sleepiness score and the magnitude of the diagnosed sleep disorder. *Conclusions:* The outcome of this analysis will demonstrate whether the self reported indicators of fatigue and sleepiness correlate with the presence and severity of sleep disorders in patients with MS.

STROKE

H-01

Admission hyperglycemia predicts a worse outcome in a large community-based cohort of acute ischemic stroke patients treated with intravenous thrombolysis

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Background: Admission hyperglycemia has been associated with worse outcomes in ischemic stroke. We hypothesized that admission hyperglycemia (glucose >8.0 mmol/L) would be independently associated with increased mortality, symptomatic intracerebral hemorrhage (SICH) and poor functional status at 90-days in a large cohort of stroke patients treated with intravenous (IV)-tPA. *Methods:* Using data from the Canadian Alteplase for Stroke Effectiveness Study (CASES), the association between admission hyperglycemia and mortality, SICH, and poor functional status at 90-days (modified Rankin Scale [mRS] >1) was examined. Similar analyses were conducted examining glucose as a continuous measure. *Results:* Of 1098 patients, 296 (27%) had admission hyperglycemia, including 18% of those without diabetes and 70% of those with diabetes. Admission hyperglycemia was associated with increased risk of death (RR 1.64, 95%CI 1.31 to 2.06), SICH (RR 1.87, 95%CI 1.07 to 3.25) and decreased probability of a favourable outcome at 90 days (RR 0.69, 95%CI 0.56 to 0.85). An incremental risk of death, SICH and unfavourable 90-day outcomes was observed with increasing admission glucose. This held true for patients with and without diabetes. *Conclusions:* In this cohort of IV-tPA treated stroke patients, admission hyperglycemia was independently associated with increased risk of death, SICH and poor functional status.

H-02

Effect of pre-stroke use of antihypertensives, antiplatelets, and statins on ischemic stroke severity and early outcomes

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Background: Some studies have suggested that treatment with antihypertensives (AHT), antiplatelets (APL), or statins (STAT) decreases ischemic stroke severity, whereas others have not. We examined the effect of pre-stroke use of these medications on initial severity and early outcome of ischemic stroke. *Methods:* We reviewed the charts of 364 acute ischemic stroke patients. Severe stroke was defined as a Canadian Neurological Scale score ≤7. Poor early outcome was determined by a modified Rankin score >3 at 10 days post-stroke. Unconditional multivariable logistic regression analysis was used with adjustment for age, diabetes, coronary disease, hypertension, atrial fibrillation, hyperlipidemia, and initial blood pressure. Stroke severity was an additional covariate for early outcome. *Results:* In three separate analyses, we compared the pre-stroke use of AHT, APL, or STAT with untreated patients. None of these medications showed a significant protective effect. However, APL therapy resulted in a trend with better early outcome [OR=0.66(95%CI, 0.36-3.00)], as did STAT treatment [OR=0.63(95%CI, 0.29-1.36)]. *Conclusions:* Although none of the medications showed a significant protective effect, the point estimates suggested that better outcomes may be associated with pre-stroke use of antiplatelets or statins.

H-03

Effect of Ximelagatran and Warfarin on stroke subtypes in atrial fibrillation

JS Teitelbaum (Montréal), R von Kummer (Dresden), Gregory (Stanford)*

Background: The most common stroke subtype among atrial fibrillation (AF) patients not receiving anticoagulants is cardioembolic. In the SPORTIF III and V trials, the oral direct thrombin inhibitor ximelagatran was as effective as warfarin in reducing the risk of stroke in patients with nonvalvular AF. We assessed any differential effect of warfarin versus ximelagatran on the risk and outcome of cardioembolic and noncardioembolic stroke.

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Methods: 7329 patients with AF and ≥1 risk factors for stroke were randomized to warfarin or fixed-dose ximelagatran. Strokes were classified into specific subtypes. Therapeutic effect, adverse events, and stroke outcomes were assessed. *Results:* The annual stroke rate was low for cardioembolic (ximelagatran, 0.39%; warfarin, 0.47%) and noncardioembolic stroke (ximelagatran, 0.57%; warfarin, 0.37%). In ischemic strokes, 33.9% (ximelagatran) and 34.3% (warfarin) were of presumed cardioembolic origin. When fatal stroke, disabling stroke, myocardial infarction, and death from any cause were combined as poor outcome, patients with cardioembolic strokes had a non-significant increase in poor outcome (40%). *Conclusions:* Warfarin and ximelagatran were similar for prevention of cardioembolic and noncardioembolic strokes. Overall outcome tended to be worse following cardioembolic stroke. Ximelagatran has been withdrawn from the market due to hepatic side effects, but similar compounds are presently being studied.

H-04

Intravenous thrombolysis for acute ischaemic stroke in patients aged 50 years or less: the CASES experience

AY Poppe (Calgary), AM Buchan (Oxford), MD Hill (Calgary)*

Background: We sought to describe baseline differences in patients ≤ 50 years-old taken from a large prospective cohort of acute stroke patients treated with intravenous tPA (IV tPA) and to determine whether outcomes differed for this population. *Methods:* Data (n = 1120) prospectively collected from the Canadian Alteplase for Stroke Effectiveness Study (CASES) were reviewed and patients aged ≤ 50 years-old (n = 99) treated with IV tPA for acute ischaemic stroke were compared with those aged > 50 years (n = 1021). *Results:* Among patients aged ≤ 50 years, 40.4% were women and mean age was 41.4±6.1 years. They had significantly more current cigarette use but fewer other vascular risk factors than patients over 50 ($p<0.05$) and their baseline median NIHSS score was lower (13 versus 15, P=0.001). Although this group was more likely to have a favourable 90-day outcome (modified Rankin Scale score 0-1), multivariate logistic regression confirmed that age ≤ 50 years, while independently associated with a decreased risk of death (OR 0.30 95% CI 0.11 to 0.79), was not itself predictive of a favourable 90-day outcome or decreased risk of symptomatic intracerebral haemorrhage (sICH). *Conclusions:* Patients ≤ 50 years-old had fewer medical co-morbidities and a modestly lower baseline median NIHSS score than their older counterparts. Age ≤ 50 years was independently associated with a decreased risk of death but not with favourable outcome or risk of sICH.

H-05

Intra-arterial thrombolysis for acute stroke of anterior and posterior circulations: a retrospective study

Y Nadeau (Québec), G Milot (Québec), J Gariepy (Québec)*

Background: A minority of patients with ischemic stroke are treated with intra-veinous thrombolysis, mainly because of the narrow time window. With intra-arterial thrombolysis (IAT), that window could be extended. We present our experience with IAT. We compare the angiographic results with clinical evolution and we try to identify characteristics that could predict good results following IAT. *Methods:* We report 28 patients with stroke in the anterior circulation and 20 patients with stroke in the posterior circulation. We reviewed charts and angiographies and we evaluated functional outcome. *Results:* IAT resulted in good outcome in 65.4% and 30.0% of patients with anterior and posterior circulation strokes respectively. Complications were mostly benign. No symptomatic intracranial haemorrhage (ICH) was recorded in patients with anterior circulation strokes, but 39.3% had asymptomatic ICH. For posterior circulation strokes, 25% suffered a symptomatic ICH and an asymptomatic ICH was detected in 10%. We could not establish that recanalization was statistically correlated to clinical outcome. For posterior circulation strokes, no patient over 64 year-old had a good outcome compared with 55% in the younger group (p=0.006). We did not find any other significant association between baseline characteristics and outcome. *Conclusions:* Our study showed the IAT was safe. Besides age of patients with posterior circulation stroke, we could not identify other characteristics that could help target patients that would benefit the most from IAT.

H-06

Distribution pattern of MRI signal abnormalities in notch 3 positive CADASIL patients from a single centre Canadian clinic

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Background: Cerebral Autosomal Dominal Arteriopathy with Subcortical Infarcts and Leukoencephalopathy (CADASIL) is a well known condition causing recurrent subcortical strokes. Neuroimaging plays an important role in its diagnosis and follow up. We studied MRI features and distribution characteristics of the signal abnormalities in genetically proven CADASIL patients seen in our institutional clinic. Similar methods were applied to patients seen in clinic but who tested negative. *Methods:* Eight patients (mean age 54), genetically proven to have the notch3 mutation were seen in the CADASIL clinic and referred for imaging at presentation. The MRI scans were graded for lesion load using Scheltens score. The control population consisted of eleven patients (mean age 54.18) seen in clinic but negative by genetic testing. *Results:* The total lesion load at presentation was higher for the notch3 positive patients (mean 31) compared to controls (mean 20.6). The lesion load in individual areas such as periventricular score, white matter score, basal ganglia score and infratentorial score was also higher in CADASIL patients. When comparing regional distribution of lesions, temporal lobe involvement was seen to a greater extent in the notch3 positive patients (median score 4) compared to controls (median score 1). *Conclusions:* Patients with genetically proven CADASIL have a characteristic distribution pattern of white matter abnormalities with a higher lesion load at presentation compared to controls. Temporal lobe involvement was also seen to be more prominent in notch3 positive patients.

H-07

Neuroimaging pattern of stroke in young patients with cardiac atrial septal abnormalities

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Background: The role of patent foramen ovale (PFO)/atrial septal defect (ASD) in stroke etiology is unclear. We compared the distribution of acute infarcts on Neuroimaging in young patients with or without PFO/ASD. A 'cardioembolic' pattern should be

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more common in PFO/ASD patients if the presence of PFO/ASD is etiological rather than incidental. *Methods:* From a prospective registry of young ischemic stroke patients, we selected those who had undergone transesophageal or transthoracic echocardiography or transcranial ultrasound with bubble study. We excluded patients with other proximal source of embolism. We divided patients into those with PFO/ASD (n = 43) and those without (n = 32). Detailed CT and/or MRI data of the number and distribution of stroke lesions was recorded. Two literature-based definitions of cardioembolic pattern were created: 1) CE1 = the presence of any acute cortical infarcts OR 2 or more acute infarcts OR acute infarcts in greater than 1 vascular territory OR acute posterior circulation infarcts; 2) CE2 = the same criteria as CE1 with the exclusion of the posterior circulation infarcts. *Results:* All patients had either CT or MRI. Chi square tests were used to compare frequencies of CE1 and CE2 between the study groups. A CE1 pattern of acute infarcts occurred in 25/32 (78%) of persons without PFO/ASD and in 32/43 (74%) of persons with PFO/ASD (Fisher's exact test p=0.7891). A CE2 infarct pattern occurred in 19/32 (59%) of persons without PFO/ASD and in 24/43 (56%) of persons with PFO/ASD (Fisher's exact test p = 0.8162). *Conclusion:* Presence of PFO/ASD is not associated with cardioembolic infarct patterns derived from the literature. Our results imply that either PFO/ASD is not an etiological factor in young stroke, or that the classic 'cardioembolic' pattern on brain imaging is not valid to describe all proximal sources of embolism.

H-08

Predictors of carotid artery dissection associated with traumatic injuries

D Jichici (Hamilton), BW Lo (Hamilton), A Serb (Hamilton), R Petrovic (Hamilton)*

Background: Diagnosis of traumatic carotid dissection is often challenging, as symptoms may not develop for hours to days, leading to delay in diagnosis and treatment. *Methods:* The Hamilton Health Sciences Corporation Trauma Registry containing 7403 patients from 1/1/1992 to 12/31/2007 was reviewed . Two independent reviewers collected data. Univariate analysis was performed. Modified Rankin Score (MRS) was the dependent variable. *Results:* 28 patients suffered traumatic carotid dissections. Mean age-37 (17-77). Mechanisms of injury: MVC (Closed head injury, neck injury, facial fractures, blunt chest trauma)-18, stab wounds-4, falls-3, gunshot wounds-2, other-1. Delay in diagnosis-11/28. Presentation:brain ischemia-12, decreased LOC-11, carotidynia-4, hematoma/exsanguination-3, Horner's syndrome-2. Method of diagnosis: CT angiogram-12, formal angiogram-11, clinical-5. Multi-system injuries-22/28. ICU admission with ventilatory support- 25/28. Treatment: none-11, antiplatelet/anticoagulant-12, ligation/repair-3, endovascular-2. Immediate death from injury-4. Univariate analysis showed: GCS($p<0.001$), ISS($p=0.02$), neck injury($p=0.09$), age($p=0.20$), blunt chest trauma($p=0.63$), CHI($p=0.58$), facial fracture($p=0.40$). Mortality:1/12 (8%) of those on antiplatelets died versus 5/12 (42%) of non-treatment group. Morbidity: MRS was 2 or better in 9/11 (82%) of treatment group versus 3/5 (60%) in non-treatment group. *Conclusions:* Carotid dissection is an infrequent event following trauma. Predictors of carotid dissection were low GCS, high ISS, and presence of neck injury. Even with delayed presentation, treatment with antiplatelet agents reduced mortality and improved functional outcome. Patients with suspected dissection should be investigated and treated.

H-09

Carotid dissections with multiple intracranial and extracranial aneurysms

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Background: Cerebral vasculitis syndromes are rare. They include isolated angiitis of the CNS, benign isolated arteritis, polyarteritis nodosa and fibromuscular dysplasia. *Methods:* We report a case of medium vessel vasculitis with bilateral ICA dissections, intracranial and extracranial aneurysms. *Results:* A 49-year-old previously healthy man, with no immunosuppression, presented to McMaster University with two-week flu-like prodrome. He experienced an acute episode of abdominal colic with hypovolemic shock. CT angiogram showed active extravasation of contrast from his right ileocolic SMA branches. He underwent mesenteric embolization. He also had IVH and SAH, bilateral ICA dissections distal to the carotid bulb, and right vertebral (V4) wide necked, multilobed aneurysm. These lesions were deemed unsuitable for endovascular treatment. Subsequently, this patient developed femoral arterial and venous thrombi, and pulmonary emboli. IVC filter was placed. He had increased ESR and CRP but negative vasculitic markers. His angiographic findings are not typical of those of PAN and does not have any retinal vasculitis. He is currently mobile with walker post VP shunt insertion for communicating hydrocephalus. He is currently on prednisone, cyclophosphamide and aspirin. *Conclusions:* To our knowledge, this is the first reported case of a patient with medium vessel vasculitis and both intracranial and extracranial aneurysms with superimposed carotid dissections.

General Neurology II

I-01

Acute bacterial meningitis in adults: temporal association between initiation of Parenteral Antibiotic Therapy and Cerebrospinal Fluid Sterilisation

BF Menezes (Liverpool), G Francis (Wirral), T Solomon (Liverpool)*

Introduction: We attempted to evaluate cerebrospinal fluid(CSF) sterilisation after commencement of parenteral antibiotics in meningitis in adults, particularly in those with high likelihood of acute bacterial meningitis(ABM), and to ascertain causes of delay in lumbar puncture(LP). *Methods:* Hospital discharges over 3 years with diagnosis of meningitis were identified. Records of those fitting the following case definitions were retrospectively reviewed- Adult meningitis: Clinically meningitic patients aged ≥15years with CSF pleocytosis (>4leucocytes/ml), Likely bacterial meningitis: Adult meningitis cases fitting criteria of Chavanet et al for meningitis of likely bacterial aetiology, Culture positive ABM: Adult meningitis cases with positive CSF cultures. *Results:* 92 cases of adult meningitis were identified, 16 being culture positive ABM. All culture positive cases were detected when LP was performed <8 hours of the first parenteral antibiotic dose and ≥8 hours later, no

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culture positive cases were identified. 24 cases of likely bacterial meningitis were detected. 8 of these cases had sterile CSF. However, 6 of these were noted to have had LP ≥8 hours after initiating parenteral antibiotic therapy (statistically significant). The commonest reason for delay in LP was performance of cranial computerised tomography(CT). However, in 68% of these, it was not clinically indicated. CT was normal in nearly all who underwent inappropriate scanning. *Conclusions:* When meningitis is suspected, LP should be performed within 8 hours of initiating parenteral antibiotics to prevent missed diagnosis due to early CSF sterilisation. Inappropriately requested CT delays LP and is invariably normal.

I-02

Infective endocarditis in Vancouver's Downtown: neurologic complications in intravenous drug users and HIV positive patients

*NG Hatfield (Vancouver)**

Background: Intravenous drug use (IVDU) is a risk factor for infective endocarditis (IE). Drug related, age adjusted mortality rates in Vancouver's Downtown Eastside neighbourhood are over 12 times the rest of the province. The influence of IVDU and HIV on neurologic involvement and mortality in IE is not known. *Methods:* A retrospective chart review of all patients admitted to St. Paul's Hospital with neurologic complications of IE between 1995 and 2005 was completed. IVDUs and non-IVDUs with IE were compared in terms of frequency and type of neurologic complication, treatment and outcome. *Results:* Of 669 patients with IE, 373 (55%) were IVDUs, 25% were HIV positive. Neurologic complications were reported in 11%, with a similar incidence in IVDU and non-IVDUs. IVDUs were more frequently infected with *Staphylococcus* aureus, and had less surgical intervention (20% vs 52%). Patients with neurologic complications had greater mortality (45% vs 27%). Neither IVDU nor HIV status was associated with increased mortality. *Conclusions:* This is the largest Canadian case series of neurologic complications of IE. IVDU is an emerging risk factor for IE. Neurologic complications are common in both IVDUs and non-IVDUs. HIV+ and/or IVDU status did not adversely affect outcome in IE with neurologic involvement.

I-03

Functional MRI in comatose survivors of cardiac arrest demonstrates decreased BOLD signal in patients with unfavourable outcome

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Background: Individual outcomes are difficult to determine in comatose survivors of cardiac arrest. Recent functional studies demonstrate associations between regional cerebral metabolism and levels of consciousness. The goal of this study was to compare cerebral responses to tactile stimulation applied in comatose survivors of cardiac arrest demonstrating favourable versus unfavourable outcome. *Methods:* We measured cerebral responses to tactile stimulation applied over either the left or the right hand in 19 comatose survivors of cardiac arrest and in 10 healthy controls using functional magnetic resonance imaging (fMRI) and somatosensory evoked potential (SSEP) testing. SPM software was used to quantify changes in the blood oxygenation level dependent (BOLD) signal in the S1 region of the two hemispheres. Clinical outcome was assessed using the Glasgow Outcome Scale (GOS) at 3 months post cardiac arrest. *Results:* Patients with unfavourable outcome (GOS<3) demonstrated a decrease in BOLD in the contralateral S1 region ($p<0.05$) as compared to healthy controls. An a priori comparison revealed decreased BOLD in the contralateral S1 of patients with bilaterally absent SSEP N20 waveforms when compared to healthy controls. *Conclusion:* Functional MRI in comatose survivors of cardiac arrest demonstrates decreased BOLD in patients with unfavourable outcome. Given the emotional burden on families and the difficulties in clinical decision making, we hope that further examination of cerebral function in comatose survivors of cardiac arrest will contribute to a better understanding of cerebral recovery and consequently improve patient care.

I-04

Chiari type I malformation in a patient with Brachio-Oto-Renal syndrome

KS Waspe (Langley), G Vorobeychik (Burnaby)*

Background: To our knowledge this is the first case report of Chiari type I malformation associated with Brachio-Oto-Renal (BOR) syndrome, a rare autosomal dominant disorder. *Methods:* Case report and literature review. *Results:* 37 years old female with known BOR syndrome presented with non-specific sensory facial abnormalities. During investigations Chiari syndrome was identified on MRI. Data on other family members with BOR syndrome will be presented at the meeting.

The literature review revealed the no prior cases describing both conditions in a single patient. *Conclusions:* It is a rare combination of BOR syndrome with Chiari I malformation. BOR syndrome with autosomal dominance inheritance pattern is a rare entity (incidence 1:40,000) as well as is Chiari malformation (1: 20,000), making the combination of both an exceptional occurrence (1:800 000).

I-05

Medical problems in children with orofacial clefts

M Chitre (Cambridge), S Bhakthavalsala (Cambridge), PN Hall (Cambridge), S Burton (Cambridge), T Ahmad (Cambridge), W Kelsall (Cambridge)*

Background: Our aim was to study the medical problems in a cohort of children born with oro-facial clefts in the UK and establish the level of paediatrician input into their care. *Methods:* Retrospective review of medical records of children with cleft lip and/or palate born in the Cleft.NET.East network, UK between January 2003 and December 2004 and a questionnaire survey of paediatric departments in district general hospitals (DGHs) across the network. *Results:* 147 children had orofacial clefts. Antenatal diagnosis was made in 46(31%) pregnancies. The detection rate depended on the type of defect. No cleft palates (CP) were detected prenatally. Nine (12%) babies were diagnosed with CP after discharge. Median gestation was 40 (range 29 - 42) weeks; median weight 3145(1200 - 4680) grams. The initial hospital stay was 4 (1 - 90) days. 32(22%)

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children had an identified syndrome, 10(7%) had chromosomal anomalies, 13(9%) had cardiac anomalies. 79(54%) children had impaired hearing and 4(3%) visual impairment. 34(23%) children had feeding difficulties. In 25(17%) children there were concerns about developmental delay; 4(3%) had abnormal MRI scans. 6(4%) children died. Only 67(45%) children had a named paediatrician. *Conclusions:* The antenatal diagnosis rate varies with the type of cleft. Children with CP, have many additional medical problems compared to other cleft types. Paediatricians do not routinely participate in the multi-disciplinary team looking after children with oro-facial clefts.

I-06

Global developmental delay and its relationship to later cognitive skills

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Background: Global Developmental Delay (GDD) is currently operationally defined as evidence of significant delays in two or more developmental domains. Our study aimed to correlate objective measures of delays in two important domains of functioning (language and fine motor) in children with GDD at initial diagnosis with results of formal cognitive testing, performed later prior to school entry. *Methods:* A retrospective chart review of all children diagnosed with GDD within the Developmental Progress ambulatory clinic of the Montreal Children's Hospital was undertaken. Scores on fine motor, expressive language and receptive language testing were obtained from the initial assessment. Cognitive performance was recorded from reports of later systematic psychological evaluation. *Results:* A total of 93 patients were retained for analysis. No correlation was found between a combination of fine motor and language scores and later cognitive performance ($p = 0.06$). Significant correlation was however present for fine motor and expressive language scores, when isolated and compared with later cognitive performance (p values of 0.04 and 0.05 respectively). *Conclusion:* Our study suggests that a diagnosis of GDD, based on current criteria, does not necessarily predict later cognitive delay. Fine motor and expressive language performance may help predict future cognitive function.

I-07

NeuroIRIS in HIV infection: clinical and epidemiological aspects

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Background: Immune reconstitution inflammatory syndrome in the nervous system (NeuroIRIS) is an uncommon complication of HIV therapy (HAART). *Methods:* A retrospective analysis was performed of all NeuroIRIS patients at two Alberta (HIV) Clinics. A nested epidemiological study was performed at the Southern Clinic. *Results:* NeuroIRIS was diagnosed in six males with severe immunosuppression (mean CD4+ T cells: 100 + 25 cells/mcl). Three presented to the Southern Alberta Clinic. This represents all NeuroIRIS cases in 461 patients begun on HAART over 8 years (incidence 0.007%). Mean age of onset was 38 years. Three patients were HAART naive. NeuroIRIS onset ranged from 2 to 25 weeks and was not specific to the HAART regimen. In four patients, no pre-existing neurological infection was evident, while Toxoplasmosis encephalitis and progressive multifocal leukoencephalopathy was identified in two. All patients demonstrated a robust increase in CD4+ T cell count in response to HAART, concomitant with neurological deterioration. Cerebrospinal fluid examination revealed a mild lymphocytic pleocytosis and increased protein (n=3) or a normal result (n=2). One patient underwent a brain biopsy, revealing necrosis, macrophages, CD4+and CD8+ T cell infiltrates. Two patients received corticosteroids. Survival was 83%; 33% exhibited fixed neurological disabilities. *Conclusions:* Initiation of HAART in immunosuppressed patients requires close monitoring to diagnose and treat NeuroIRIS expediently.

I-08

Prevalence of hypertension increases during follow-up of ischemic stroke

*M Dakermandji (Montréal),S Lanthier (Montréal)**

Background: Hypertension is the most important modifiable risk factor for ischemic stroke (IS), being present in two-thirds of cases at IS onset. Hypertension accounts for an attributable risk of 50%. The proportion of normotensives who develop hypertension following IS is unknown. Our goal is to determine the prevalence of hypertension at different time intervals following IS. *Methods:* Consecutive individuals admitted for acute IS at our stroke unit are enrolled in a database, which is approved by our local ethics board and includes data prospectively collected on medication and systematic blood pressure measurements during hospitalization and at clinical follow-up visits. We reviewed data of individuals hospitalized between Jan. 2003 and Jun. 2007. Hypertension diagnostic criteria were : (a) treatment with antihypertensive agents, (b) blood pressure >140/90 mmHg on 2 or more occasions, or (c) mean blood pressure >135/85 on self-measurements or ambulatory monitoring. We excluded 47 individuals with follow-up duration <20 days because blood pressure is often transiently increased during acute IS. *Results:* We analyzed 629 individuals (333 men, 296 women) with a mean of 3.2 follow-up visits over a mean of 29.8 months. At admission, 233/629 (37%) individuals were on antihypertensive drugs. Prevalence of hypertension increased from 415/629 (66%) at ≤4 months following IS, to 342/475 (72%) at >4-15 months (p=0.036), 260/353 (74%) at >15-27 months (p=0.015), 168/226 (74%) at >27-39 months (p=0.024), and 81/104 (78%) at >39-51 months (p=0.017). *Conclusion:* One-third of those who are normotensive at ≤4 months following IS develop hypertension in the next 4 years. Careful monitoring of blood pressure is mandatory in the follow-up of IS.

I-09

Contralesional repetitive transcranial magnetic stimulation for chronic hemiparesis in pediatric stroke

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Background: Arterial ischemic stroke (AIS) causes disabling hemiparesis in children. Contralesional, inhibitory repetitive transcranial magnetic stimulation (rTMS) may reduce interhemispheric inhibition and improve hand motor function in subcortical adult stroke but is unstudied in the plastic brains of

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children. *Methods:* Eligible SickKids Children's Stroke Program patients included: (1) subcortical AIS, (2) transcallosal pathway sparing, (3) >2yrs since stroke, (4) age >7 years, (5) hand motor impairment, and (6) no seizures, dyskinesia, or neuromedications. Children were matched for age and weakness and randomized to rTMS or sham. Inhibitory, low frequency rTMS was applied over contralesional motor cortex (20 minutes/1200 stimuli) daily for 8 days. Standardized hand-function outcome measures (GS: grip strength, MAUEF: Melbourne assessment of upper extremity function) were administered by a blinded occupational therapist (days 1/5/10/17). *Results:* Ten children were enrolled (mean 12.4 years-old, 34 months since stroke) with mild (4), moderate (2), or severe (4) weakness. GS was improved at day 10 in rTMS versus sham patients (2.28±1.01 versus -2.92±1.2kg, p=0.009) with rmANOVA demonstrating significant time/treatment interaction across days (p=0.03). Day 10 MAUEF score was also improved (7.25±3.8 rTMS versus 0.79±1.3 sham, p=0.002). GS benefits persisted one week after treatment (2.63±0.56 rTMS versus -1.00±0.70kg sham, p=0.01). Unaffected hand function remained stable. Daily rTMS was well tolerated. *Conclusion:* Randomized, therapeutic trials of rTMS in children are safe and feasible. Contralesional inhibitory rTMS may improve hand function in hemiparetic children. Further studies are required to define the role of rTMS in pediatric neurorehabilitation.

I-10

The essential neurological examination

F Moore (Montréal), C Chalk (Montréal)*

Background: Graduating medical students often lack confidence in performing the neurological examination (NE). We believe this is because the NE generally taught to medical students is long and complex, in contrast to the concise NE considered satisfactory by practicing neurologists in most situations. To help students learn to use the NE better, we are carrying out a formal gap analysis, comparing the existing situation (what graduating students believe to be an 'adequate' NE) with the desired situation (what experts consider an 'adequate' NE). *Methods:* Using the Delphi method, twenty practicing McGill University neurologists will indicate their opinion of the importance of each of 44 NE elements, using a 4-point scale. This process will continue iteratively until the group mean ratings and standard deviations for each element stabilize. These results will be corroborated by 20 neurologists from other North American centres. Graduating McGill medical students will complete the same survey. *Results:* The expert consensus and student mean scores and standard deviations for each survey item will be compared statistically, providing a detailed picture of the gaps between student and expert understanding of the key elements of the NE. Data collection is underway, and we anticipate completing data analysis by April 2008. *Conclusions:* Our findings will guide new approaches to teach the NE.

SPINE

J-01

Value of MRI parameters in the prediction of neurological improvement in patients with acute cervical traumatic spinal cord injury (SCI): a multi-center prospective study of 60 consecutive patients

JC Furlan (Toronto), B Aarabi (Baltimore), MG Fehlings (Toronto)*

Background: This multi-center study examines whether quantitative and qualitative MRI parameters after SCI are predictors of outcome at long-term followup. *Methods:* Clinical data and MRI studies from consecutive patients with cervical SCI were collected prospectively. Neurological improvement was defined as one-grade conversion in the ASIA grade. An independent observer assessed six qualitative and three quantitative MRI parameters. Study population was divided into patients who had the same ASIA grade on admission and at follow-up (Group 1) and patients who had at least one-ASIA-grade conversion between admission and latest follow-up (Group 2). *Results:* There were 46 males and 14 females with mean age of 47 years (19-79 years). Mean follow-up was 6.7 months (1-24 months). Both groups were comparable regarding age (p=0.64), gender (p=0.13) and follow-up time (p=0.46). Patients in Group 1 had more severe SCI than patients in Group 2 (p=0.007). Univariate analyses indicate that there was a trend for an association of neurological improvement with absence of hemorrhage (p=0.09) and smaller length of lesion (p=0.08). Edema, disc herniation, canal stenosis, swelling, soft tissue injury, maximum spinal cord compression and maximum canal compromise did not significantly correlate with neurological improvement. *Conclusions:* MRI parameters appear to be useful in prognosticating the potential for neurological improvement after traumatic SCI. Smaller length of lesion and the absence of hemorrhage, observed at admission, might be associated with at least one ASIA-grade conversion.

J-02

Outcomes of surgical treatment for cervical spondylotic myelopathy: A prospective multi-center study involving 316 patients

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Background: Although cervical spondylotic myelopathy (CSM) is a common cause of neurological disability, the literature supporting the use of surgery for this condition is limited. Hence, we conducted a large, multi-center, prospective cohort study to assess the outcomes of surgery in CSM. *Methods:* A total of 316 cases of CSM have been enrolled. Of these, 117 have reached 6 months F/U and 58 have reached 1 year F/U. Neurological recovery was assessed by the modified JOA (mJOA), Nurick scale and Neck Disability Index (NDI). Gait was quantified by a 30 meter walk and timed up and go tests. *Results:* The average age was 53 years; 53% were male; 64 % of patients underwent anterior surgery ; 36% of the patients underwent posterior surgery. At six months all outcome parameters improved significantly from the baseline values. Average

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improvements were: mJOA 2.2 points; NDI 14.7 points; 30-meter walk test 5.1 seconds; SF36 PCS 4.6 points; SF36 MCS 7.0 points, Nurick 1 grade. In the subjects with 1 year F/U, the improvement in outcome parameters have been maintained. *Conclusions:* The initial results of this study indicate that the operative treatment of CSM significantly improves all relevant clinical, functional and quality of life outcomes.

J-03

A nationwide evaluation of how premorbid myelopathy and surgical approach impacts on perioperative complications after cervical spine fusion

MF Shamji (Ottawa), C Brown (Durham), C Cook (Durham), RE Isaacs (Durham)*

Introduction: Cervical spine fusion is performed in patients with widely variable comorbidities. Disease pathoanatomy dictates surgical approach, but preoperative neurological status does not mandate specific technique. One expects anterior decompression over fewer segments in healthier patients to have fewer complications, but how preoperative myelopathy impacts perioperative morbidity and hospitalization costs remains unclear. This study evaluated associations of these outcomes with surgical approach and neurological status. *Methods:* Data for 96773 patients undergoing cervical fusion was collected from the Nationwide Inpatient Sample database (1988-2003). Subjects were grouped by approach and neurological status. Multivariate regression evaluated group effects on mortality, morbidity, and resource utilization. *Results:* This study confirms that clinical myelopathy impacts negatively on perioperative morbidity. Anteriorly-approached, non-myelopathic patients experienced 0.05% mortality, with transfusion required in 0.34% and venous thromboembolism occurring in 0.04%. These rates increased 13-fold in posteriorly-approached, myelopathic patients. Beyond surgical approach, myelopathy independently predicts perioperative mortality, morbidity, and resource utilization. These outcomes at least doubled, with some increasing more than 10-fold. *Conclusions:* This nationwide study clarifies frequency and associations of inpatient complications during cervical spine fusion. Whereas immediate morbidity from anterior approaches on non-myelopathic patients is limited, clinical myelopathy significantly augments complication rates during cervical fusion regardless of surgical approach.

J-04

Spinal cord stimulation versus conventional medical management for failed back surgery syndrome: Randomised controlled multicentred trial- long term results (PROCESS Study)

*K Kumar (Regina)**

Background: Patients with Failed Back Surgery Syndrome (FBSS) experience chronic pain, disability, and reduced health-related quality of life (HRQoL). *Methods:* A prospective multi-centre study, randomised 100 FBSS patients, with predominant leg pain to receive SCS (n=52) plus CMM or CMM alone (n=48). After 6 months, patients were allowed to cross-over. Primary outcome was 50% leg pain relief. Secondary outcomes were functional capacity (Oswestry Disability Index), health-related quality of life (SF-36), patient satisfaction, and adverse effects. Seventy-three percent patients randomized to CMM crossed-over, versus 10% randomized to SCS. Analysis was done at 24 months. *Results:* Forty-two randomized to SCS, at 24 months reported statistically significant improvement in leg pain ($p<0.0001$), HRQoL ($p<=0.01$ for 7/8 domains of the SF 36), and function ($p=0.0002$) compared with baseline. Thirteen patients (31%) experienced device-related complications requiring surgery. At 24 months, ≥50% leg pain relief was achieved by SCS 37% versus 2% randomized to CMM ($p=0.003$) according to the treated as intended analysis. Similarly, in an "as treated" analysis 7% of patients receiving CMM at 24 months achieved 50% or more leg pain relief, compared to 47% for patients on SCS ($p=0.02$). *Conclusion:* Pain relief with SCS is sustained at 24 months, with improvements in all domains.

J-05

Cervical spine instability following cervical laminectomies for Chiari II malformation: a retrospective cohort study

FC Lam (Edmonton), BJ Irwin (Vancouver), KJ Poskitt (Vancouver), P Steinbok (Vancouver)*

Objective: The treatment of symptomatic Chiari II malformations typically involves multilevel cervical laminectomies in very young children. These patients are at significant risk of cervical instability. The purpose of this study was to determine the incidence and significance of cervical instability after multilevel cervical laminectomies in a cohort of patients decompressed for Chiari II malformation. *Methods:* Post-operative dynamic lateral cervical spine radiographs were obtained on pediatric patients who had multilevel cervical laminectomies for symptomatic Chiari II malformations. Post-operative cervical spine instability was determined radiographically using published criteria. Clinical instability and need for cervical fusion were also assessed. *Results:* Nine patients met inclusion criteria for the study. Five of the nine patients (56%) showed evidence of radiographic instability of their cervical spines following surgery for their Chiari II malformations. No patient showed evidence of clinical instability or required cervical fusion. *Conclusion:* Radiographic evidence of cervical spine instability following multilevel cervical laminectomies for Chiari II is common, but may be of minimal clinical significance. The reason for the lack of clinical instability in what might be considered high risk patients is not understood.

J-06

The safety and utility of MRI-guided traction to determine reducibility in patients with advanced pathology at the craniovertebral junction

TE Darsaut (Edmonton),MM Sartawi (Edmonton), P Dhaliwal (Edmonton), RJ Fox (Edmonton)*

Background: For patients with ventrally compressive pathology at the craniovertebral junction (CVJ), reducible lesions can be managed by operative reduction followed by occipitocervical stabilization and fusion, while non-reducible lesions often require a prior anterior decompressive procedure. Conventional traction trials require the treating surgeon to infer from plain films how traction forces are likely affecting neural and ligamentous structures. To avoid over-distraction injury, low increments of weight are added in a gradual fashion, a process that typically requires several days. Here

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we outline the use of an MRI-compatible traction board to safely and rapidly determine reducibility in patients with ventrally compressive CVJ pathology. *Methods:* Four patients with advanced CVJ pathology underwent a trial of MRI-guided traction using an MRI-compatible spine board. Serial sagittal images were acquired at baseline and following each sequential addition of force. *Results:* All patients tolerated traction without neurological worsening. The neural elements were seen to be adequately decompressed in all cases during a single MRI imaging session. Patients subsequently underwent craniocervical stabilization and fusion, avoiding an anterior approach. Post-operative imaging at 6 months showed maintenance of reduction without neural compression. *Conclusion:* The MRI compatible spine board facilitated the rapid and safe determination of reducibility of ventrally compressive lesions in four patients with advanced CVJ pathology. Direct visualization of the effects of traction on the soft tissues of the CVJ may permit the determination of reducibility to be made more accurately.

J-07

Resection of intradural-extramedullary lesions using Minimal Access Spinal Techniques (MAST)

S Berry (Halifax), R Murphy (Halifax), SD Christie (Halifax)

Objective: Intradural-extramedullary lesions represent an important sub-category of spinal cord pathology and most commonly present with myelopathy or radiculopathy. Classically, these lesions have been treated with open laminectomy and intradural resection, however recently; minimally invasive techniques have been described as an alternative. *Methods:* Five consecutive patients (three men, two women) presented over a 12 month period (11/06-11/07) with pain (four out of five) and/or neurological deficit (three out of five) and evidence of intradural pathology on MRI. All lesions were resected using a minimally invasive, unilateral approach. Extent of resection was assessed intraoperatively and radiographically confirmed postoperatively. *Results:* All patients underwent uncomplicated, gross total resection of their intradural-extramedullary lesions. The average patient age was 53.8 years (range, 39-66 yr) with two lumbar and three thoracic lesions. Mean blood loss was 215 ml (range, 50-500 ml) and length of stay was 149 hours (range, 72-240 hrs). Histological diagnosis confirmed five neoplasms; three schwannomas, one meningioma and one angiolipoma. *Conclusion:* Minimally invasive resection of intradural-extramedullary lesions has been shown to be a safe and effective alternative to traditional open surgery. Reduction in blood loss, length of hospital stay and morbidity associated with tissue disruption and spinal instability are all potential benefits of a less invasive approach.

J-08

Impact of a rapid access spine clinic in reducing surgical wait times

S Gul (North Vancouver), R Sahjpaul (North Vancouver)*

Background: Access to spinal surgery has been a significant challenge in many Canadian health jurisdictions. Waitlists for spinal surgery have grown with the increased demands for spinal surgery placed by the growing aging population. The Lions Gate Hospital Rapid Spine Access Clinic (RASC) is a recent initiative designed to reduce wait times for consultation and surgery for patients with degenerative spinal problems. At the RASC, patients receive a consultation from a neurosurgeon or orthopedic surgeon and surgical patients receive a pre-operative assessment from the clinic nurse. The primary objective of this study was to assess the clinic's impact in reducing surgical wait time. *Methods:* The RASC database was reviewed. We studied the referral patterns to the RASC and the mix of cases being treated. We also reviewed the wait times for surgery. Patients were asked to complete satisfaction questionnaires for the RASC. *Results:* In the first year, 543 patients were seen at the RASC with a surgical yield of 17%. Patients referred to the clinic included patients from several surrounding health jurisdictions. The average surgical wait time was 48 days. Overall patient satisfaction with the RASC was high. *Conclusions:* The Lions Gate Hospital RASC provides earlier access to consultation and surgical intervention. Satisfaction amongst patients treated at the Lions Gate Hospital RASC is high.

J-09

Appropriateness of lumbar spine referrals to a neurosurgical service

N Deis (Edmonton), M Findlay (Edmonton)*

Background: Many lumbar spine referrals are for low back pain rather than nerve-root symptoms or deficits. We examined a consecutive series of referrals and classified them according to their apparent appropriateness for surgical assessment. *Methods:* All lumbar spine referrals to ten neurosurgeons were collected over two months. Only patients who had already undergone either CT or MRI imaging were considered; those with neoplasia or acute trauma were excluded. Appropriateness criteria were established in advance though consensus from the entire group of neurosurgeons. Referrals classed as appropriate for surgical assessment were those where leg pain was the chief complaint +/- evidence of neurological deficit and with imaging positive for root compression. Referrals considered "uncertain" for surgical assessment did not specify principal pain location (back vs. leg), contained no mention of deficit and only possible compression (such as "foraminal stenosis") was seen on imaging. Inappropriate referrals contained no mention of leg symptoms or deficit and there was no evidence of compression on imaging. *Results:* Of the 162 referrals reviewed 36 (22%) were "appropriate", 47 (29%) were "uncertain", and 79 (49%) were "inappropriate" for surgical assessment. *Conclusion:* In that patients who would most benefit from surgical assessments are those with possible surgical pathology, it appears that physicians seeking to help patients suffering degenerative back conditions need to be informed which patients are best sent to surgeons as opposed to other types of back care providers.

J-10

Minimally invasive management of lumbar spinal stenosis: bilateral lumbar laminectomy using a unilateral approach

DH Zhang (Hamilton), K Reddy (Hamilton)*

Background: Lumbar spinal stenosis is a common cause of pain and disability. Open lumbar laminectomies can be associated with significant postoperative pain and prolonged recovery. Recently, minimally invasive techniques have been developed to treat this problem. The authors wish to report their experience with minimally invasive lumbar decompression, in the management of lumbar spinal

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stenosis. *Methods:* A chart review was performed on 44 patients who underwent bilateral lumbar laminectomies and foraminotomies using a unilateral minimally invasive approach with the METRx Tubular Retractor System (Medtronic Sofamor Danek). The senior author performed all the surgeries, at a single center, between 2002 and 2007. *Results:* Forty patients (91%) underwent a single level laminectomy, while 4 patients (9%) underwent two level laminectomies. All 7 complications (16%) were unintended durotomies. The average hospital stay was 1.4 days. Thirty-five (80%) of the patients experienced significant improvements in pain and function. Two patients (5%) required open re-operation. *Conclusions:* Miminally invasive lumbar laminectomy and foraminotomy for the treatment of lumbar spinal stenosis is a safe and efficacious technique in appropriately selected patients. Long-term prospective evaluation of this treatment, using objective pain and disability scales is necessary to better understand its role in the management of lumbar spinal stenosis.

General Neurosurgery II

K-01

Neuroendoscopy: experience with 300 adult and pediatric patients

MG Hamilton (Calgary), F Girgis (Calgary), T Myles (Calgary), W Hader (Calgary)*

Background: The indications for neuroendoscopy are constantly increasing. However, neuroendoscopy is often thought of as a Pediatric Hydrocephalus procedure. In this study, we examine and contrast the role of neuroendoscopy in both a Pediatric and Adult population. *Methods:* A retrospective review was conducted for patients in the Calgary Health Region undergoing neuroendoscopic surgery between 1994 and 2007. The Pediatric group is defined as age < 18 years and the Adult population as > 18 years. We have reported on the number and types of procedures and postoperative complications. We compared these variables between the Adult and Pediatric populations. *Results:* 300 patients were identified who underwent 339 operations for a total of 357 procedures. There were 162 Pediatric and 138 Adult patients. The most common procedure was endoscopic third ventriculostomy (ETV) accounting for 53% of procedures, followed by cyst fenestration (19%), colloid cyst removal (9%), tumor biopsy (8%), and septostomy (5%). The ETV population includes 35 patients with successful removal of a previously inserted ventriculoperitoneal shunt. The ratio of Pediatric to Adult procedures was 2:3.3 for ETV, 11:6 for cyst fenestration, 0.3:8.7 for colloid cyst removal, 1.4:6.6 for tumor biopsy, and 1:1 for septostomy. One postoperative death occurred in a pediatric patient and one in an adult patient. Postoperative infection was the most common serious complication (3 Pediatric and 6 Adult), followed by subdural or epidural hematoma (1 Pediatric, 2 Adult), transient hemiparesis (2 Adult), endocrine dysfunction (2 Pediatric), and lacunar infarction (1 Pediatric). *Conclusion:* Neuroendoscopy was performed almost as frequently in Adult as in Pediatric patients. A higher percentage of Pediatric patients underwent cyst fenestration, while a higher percentage of Adults underwent ETV, colloid cyst removal, and tumour biopsy. The most common complication associated with neuroendoscopy was infection. Neuroendoscopy should be considered as a potential therapeutic modality in the management of appropriate Adult patients.

K-02

Endoscopic approach to intracranial cysts

*K Reddy (Hamilton), R Hollenberg (Hamilton), K Kamian (Hamilton)**

Background: Endoscopic approach to intraventricular lesions is a well recognized surgical procedure. Surgical resection of arachnoid cyst and opening of the cyst wall into the basal cistern is also a well established procedure, but this approach needs craniotomy and this will increase the surgical risk, so endoscopic approach on the other hand provide excellent view of the pathological process and has the comparable result. *Study Design:* A Retrospective chart review (1996-2007) was performed by authors. *Demographics:* 19 patients ranging in age from 24 days-76 years were identified as undergoing surgery with endoscopic approach. In this series there were 12 female and 7 male, and 8 pediatric and 11 adult cases. The mean follow-up was 32 months (range 6 months to 9 years). *Diagnosis:* Our post operative diagnosis were: 1 patient with Enlarged Cavum Septum Pellucidum+Cavum Vergae, 2 patients with Intraventricular Arachnoid cyst, 4 patients with Convexity Arachnoid cysts, 3 patients with Quadrigeminal plate Arachnoid cysts, 4 patients with Suprasellar Arachnoid cysts, 1 patient each with Sylvian fissure Arachnoid cysts, Interpeduncular Arachnoid cysts, Parafalcine Arachnoid cyst, Midbrain Arachnoid cyst and Loculated Hydrocephalus. *Results:* The outcome were defined as: Very good: Adequate Cyst Decompression/ Complete Symptom Relief (6 patients) Good: Partial Cyst Decompression/Partial Symptom Relief were achieved (5 patients) Fair: Radiological Cyst Decompression, Further surgery (shunt) required (4 patients) Poor: No radiological or Symptomatic Improvement (2 patients) Unacceptable: Serious complications Ensue (0 patients) *Conclusion:* Endoscopic Fenestration of the intracranial cyst in experienced hands is a safe and effective treatment. however, it requires significant training and experience. It could be consider as a possible alternative to some of the classical procedures but case selection is of paramount importance.

K-03

Residents' portfolio in neurosurgery: promotion of reflexion in a surgical program

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Background: Although neurosurgical residents are often confronted to ethical dilemmas during their training, time is not always taken to discuss or guide reflexions. Nevertheless, ethic and attitude competences are essential for a good clinical practice as recognized by the Royal College of Canada. *Method:* Implementation of a portfolio assessment of ethics in Neurosurgery. Voluntary participants noted circumstances that evoked a feeling of discomfort or a positive emotional perception. Every 3-4 months, a written reflexion of an event was shared with a tutor chosen by the resident. After discussion, the resident was asked to complete the reflexion considering the elements provided by the tutor. Occasionally, residents were asked to present their learning experience to local and international meetings. Eighteen months after implementation, participants met to estimate the value of their experience of portfolio learning. *Results:* All participants felt positively regarding the portfolio as a training tool. For residents, the liberty of choosing

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their tutor(s) was essential: trust prevented limiting reflexion subjects. It was felt that 3 to 4 subjects of discussion per year were adequate. Residents felt this experience significantly enriches their clinical practice. For tutors, portfolios provide a better understanding of particular residents' needs. *Conclusion:* Portfolio learning is a useful tool for residents in neuroscience. It provides the opportunity to openly discuss ethics and attitudes. Longer term assessments are required to establish whether portfolio learning positively influences residents.

K-04

Surgical Maneuvers: ten things neurosurgeons can do today to improve the outcomes of their patients

S Brien (Ottawa), D Louw (Edmonton)*

Background: Although nearly ten years ago the Institute of Medicine report identified the need to address patient harm, progress has been slow. According to the World Health Organization, problems associated with surgical safety in developed countries account for one half of serious avoidable adverse events. *Methods:* Evidence-based patient safety practices reported by individual researchers,groups and international safety agencies were scrutinized by the authors (neurosurgeons). EMBASE and OVID data bases were mined with overlapping research questions, and hand searched/content expert interviews conducted. *Results:* The generic safety protocols identified were interpreted within the context of contemporary neurosurgical practice. We were able to distill these broad principles into ten sensible steps for immediate application into any OR. They emphasize the concept that communication is competence, and also lay out specific tactics to operationalize their deployment. *Conclusions:* The complexity and criticality of neurosurgery implies the importance of an elevated safety 'consciousness'. The neurosurgical OR is therefore an ideal test bed for the implementation and study of the ten step program.

K-05

An image-guided MR compatible surgical robot

*GR Sutherland (Calgary)**

Objective: The past decade has witnessed the application of robotics to surgery and ongoing advancements in intra-operative imaging. Current robotic systems cannot function within the intra-operative MR imaging environment. To fulfill this niche, a MR-compatible image-guided robotic system, capable of both stereotaxy and microsurgery, has been designed and manufactured. *Technical Development:* This robotic system conveys the sight, touch and sound of surgery to the operator seated at a remote workstation. Motion scaling, tremor filtering and precision robotics allow the surgeon to become technically proficient while working at a spatial resolution of less than 50 microns, instead of a few millimeters. When coupled with automation, this system has the potential to shift surgery from the organ to the cellular level. By integrating the robot with images obtained during a surgical procedure, the effects of surgery on both the lesion, and brain are immediately revealed. *Conclusion:* This technology will advance and transform surgery, with the potential to improve patient outcome.

K-06

Remote presence robots in neurosurgery

M Kis (Halifax), I Mendez (Halifax)*

Background: The ability to "lay eyes" on a patient is an essential component of clinical decision making. In neurosurgery, making timely and accurate decisions can mean the difference between life and death. Robotic remote presence is a revolutionary new technology that provides a new medium of communication for neurosurgeons providing the ability to interact with patients in real-time from anywhere in the world. *Methods:* The robot is fully mobile, equipped with advanced audiovisual sensors and controlled, using a laptop computer, through the internet via a wireless network. The department of neurosurgery in Halifax has been using remote presence on the inpatient ward for the past six months and in the emergency department in Sydney NS for three months. *Results:* The robot's sensor information has consistently been of high quality. The interpersonal interactions have mimicked true face-to-face encounters. As additional robots are acquired and located in peripheral centres throughout Nova Scotia, the utility of remote presence for outside consultations will be further enhanced. *Conclusion:* Robotic remote presence allows the projection of neurosurgical care in real time, without distance constraints. The ability to see patients allows more timely and informed decision making, which can often translate into lives saved.

K-07

A haptic training workstation for robotic surgery

CA Serrano-Almeida (Calgary), J Larsson (Calgary), YP Starreveld (Calgary), GR Sutherland (Calgary)*

Background: The successful integration of new technology into surgery may require new surgical skills. Robot assisted neurosurgery will require preclinical learning for safe and effective clinical application. *Methods:* The neuroArm haptic workstation was developed as a computer based surgical simulator for the MR compatible image guided robot, neuroArm. *Results:* The simulator has bimanual haptic hand controllers for the manipulation of two virtual robotic arms. The realism of simulation is enhanced by 6 + 1 DOF position and 3DOF force feedback. Virtual scenarios in which the user is able to acquire basic robotic skills while performing part-tasks are included. The visual output can be enhanced by stereoscopic images improving visual depth of field and hand-eye coordination. *Conclusion:* The neuroArm haptic workstation is a virtual reality learning technology that aids surgeons in the transition to the neuroArm robot.

K-08

Complications of gamma knife radiosurgery at Two Canadian centres

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Background: Gamma Knife radiosurgery (GKRS) is used to treat benign and malignant brain tumours, arteriovenous malformations, trigeminal neuralgia, and others. Patients experience reduced neurological morbidity, but risks of radiation injury and technical

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limitations persist. We report treatment complications in Toronto and Sherbrooke. *Methods:* In Toronto, a prospectively maintained database was searched for adverse events and incomplete treatment administrations. In Sherbrooke, data were acquired by chart review. Patients were accrued up to August 1, 2007. *Results:* 973 patients were treated as of August 1, 2007. Nineteen patients (2%) suffered anxiety or syncopal episodes. Two patients suffered acute coronary events during treatment. Treatments were incomplete in 12 patients (1.2%). Severe pain was a delayed complication. 8 patients suffered significant headaches, and 9 patients developed severe facial pain. Motor deficits were seen in 11 patients, including edema-induced ataxia in 4 and one case of facial weakness after treatment of a vestibular schwannoma. Four patients required shunting for hydrocephalus, and 16 patients suffered delayed seizures. *Conclusions:* GKRS is a minimally invasive treatment modality for many intracranial diseases. Treatment is not risk free, and some patients do develop complications. Expanding availability and indications will necessitate discussion of these risks with patients considering treatment.

K-09

Concodrance between radiological and surgical impression of extent of resection and point of attachment for posterior fossa ependymoma in children

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Background: In pediatric ependymoma, extent of surgical resection at diagnosis is a strong prognostic indicator as most recurrences are local. Additionally, the site of attachment of posterior fossa ependymoma is correlated with outcome. The concordance between radiological and surgical interpretation of these two features were therefore investigated. *Methods:* We conducted a population based, retrospective review of pediatric patients diagnosed with ependymoma of the posterior fossa between 1970 and 2005 in British Columbia. We evaluated the degree of concordance between radiological and surgical evaluation of extent of resection and tumour attachment at diagnosis in 53 patients. Degree of resection was determined to be total/near total (>95%), incomplete (10-94%), or biopsy only (<10%); attachment point was determined to be lateral recess, midfloor or roof of fourth ventricle. *Results:* There was a relatively high degree of concordance, 89%, between radiological and surgical evaluation of extent of resection. There was a far lower degree of concordance, 57% relating radiologic and surgical assessment of tumour attachment. *Conclusions:* There is a high degree of concordance between radiological and neurosurgical evaluation of degree of resection which is not the case for determination of attachment point. It is often difficult to determine the primary attachment of posterior fossa ependymomas. These data should be taken into account when prognosticating the outcome of pediatric ependymoma.

K-10

Changing manifestations and management of Von Hippel Lindau disease

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Background: Von Hippel Lindau disease (VHL) is an autosomal dominant disorder with predisposition to benign or malignant neoplasms particularly of the retina, cerebellum, spinal cord, kidney, adrenal and pancreas. Management includes genetic testing then clinical screening to identify and treat neoplasms at an early stage. *Method:* Since 1982, individuals with suspected VHL were included in a comprehensive screening program. The mutation was identified in each family and genetic testing offered to those at risk. Frequency and age at onset of manifestations have been monitored since 1982. *Results:* Six families with VHL have been identified in Newfoundland each with a different mutation. The largest family has 50 affected family members. In three families, the proband had a new mutation. As patients are living longer because of early diagnosis and treatment, the frequency of cerebellar (CH) and spinal cord hemangioblastomas (SpCH) and renal cell carcinoma has increased. *Discussion:* The presentation of VHL has changed over time as some manifestations are successfully treated, and others, including CH and SpCH and pancreatic islet cell tumours, are contributing to morbidity and mortality. Up to 30% of families with VHL present with a new mutation, and cerebellar hemangioblastoma has been the first manifestation in three NL families with new mutations.

Child Neurology

L-01

Antenatal and intrapartum risk factors for neonatal seizures in term infants: a population-based study, California 1998-2002

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Background: The objective of this study was to assess antenatal and intrapartum risk factors for neonatal seizures. *Methods:* Using multivariable logistic regression analysis, we evaluated the association between maternal characteristics and neonatal seizures in a cohort of 2.3 million California children born ≥36 weeks gestation from 1998-2002 using the California Office of Statewide Planning and Development database containing birth certificates linked to infant and maternal hospital discharge abstracts. *Results:* The incidence of neonatal seizures was 0.95/1000 live births. In an adjusted analysis, infants of women who were primiparous, had diabetes mellitus, intrapartum fever, chorioamnionitis, or delivery >42 weeks had an increased risk of neonatal seizures. Together, these risk factors had a population-attributable risk of 14%. Infants of Hispanic and Asian mothers had a lower risk when compared to infants of white mothers. *Conclusions:* In this large population based study, preventable antenatal and intrapartum risk factors for neonatal seizures included diabetes, fever or infection and post-term delivery. Identifying and avoiding risks for neonatal seizures may lead to lower infant neurological morbidity and mortality.

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L-02

Intraventricular hemorrhage in premature infants at CHEO

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Background: Intraventricular hemorrhage (IVH) is the most common neonatal intracranial hemorrhage and the incidence is directly related to the degree of prematurity. *Methods:* The charts of 360 neonates with IVH born between 1990 and 2005 were retrospectively reviewed. Of these, 297 were identified as premature infants. The IVH grading was based on head ultrasound reports. *Results:* There was a male preponderance in all IVH grades with grade 1 representing almost half the cases (48%) and the remaining three grades almost equally represented (19%, 14%, 19%). Mortality rate was 19%; 70% of these were patients with grade 4 IVH. Hydrocephalus occurred in 21% of the premature infants, and of these 39% required shunting. Long-term outcome information was extracted in 272 patients that had adequate information in the chart with a mean follow-up of 6.5 years. Good outcome was almost equally distributed in grades 1-3 (85%, 72%, 75%) and bad outcome was predominately in the grade 4 cases (86%). *Conclusions:* Hydrocephalus is only one sequela of many others in premature infants and may not be as important in contributing towards the long-term outcome handicaps. This is especially evident since grade 2 and grade 3 IVH patients were found to have similar outcomes.

L-03

Post-Ischemic hypothermia neuroprotection - mechanisms in the newborn

JY Yager (Edmonton), E Armstrong (Edmonton)*

Background: Post-ischemic hypothermia is the most promising therapeutic intervention for newborn infants who have experienced perinatal asphyxia. Though clinical trials have been positive, neuroprotection is incomplete, and it is questionable as to whether there is benefit for those infants with the most severe insults. Combining hypothermia with additional neuroprotective agents has been suggested may improve therapy. However, a better understanding of the mechanisms by which hypothermia functions will help to better target chemotherapeutic agents. We determined the evolution of cerebral energy metabolites and inflammatory cytokines during the post-ischemic period of hypothermia and recovery to 5 days, to further understand the mechanism of hypothermic neuroprotection, and regions for targeted supplementation. *Methods:* Seven-day rat pups were exposed to hypoxia-ischemia (HI) for 90 minutes, followed by 24 hours of hypothermia. Animals were sacrificed at 15, 30, 60, and 240 minutes, and 1, 2, 3, and 5 days of recovery for measurement of cerebral energy metabolites (PCr, ATP) and inflammatory cytokines (IL-1, IL-6, IL-10, TNF-a). *Results:* Post-ischemic hypothermia had no significant effect on the recovery of cerebral energy metabolites. However, pro-inflammatory cytokines IL-1, IL-6, and TNF-a were significantly suppressed during recovery from HI ($p<0.05$). Interestingly, the anti-inflammatory cytokine IL-10 was increased in the hypothermic group compared to control animals ($p<0.05$). *Conclusions:* 1. Improved energy recovery following HI is not a mechanistic feature of post-ischemic hypothermia neuroprotection. 2. Post-ischemic hypothermia has a profound influence on the pro and anti-inflammatory response, likely contributing to its beneficial effect on brain damage in the newborn. 3. Targeting mechanisms distal to the pro-inflammatory response may provide additional benefit to hypothermia in protecting the newborn brain.

L-04

A systematic review of tissue biomarkers of brain injury in term neonatal encephalopathy

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Objective: We undertook a systematic review of biomarkers in human term neonatal encephalopathy to determine if biomarkers that currently exist are clinically useful as predictors of outcome. *Methods:* A search of multiple databases identified 110 publications which met our inclusion criteria including: 1) Newborn >36 weeks, 2) Neonatal encephalopathy as defined by ACOG, and 3) the use of a serum, urine or CSF biomarker. *Results:* Of the 110 publications which met our inclusion criteria, 22 reported outcome beyond 12 months of age. Single reports revealed urine lactate ($p<0.001$), first urine S100 ($p<0.0001$), cord blood IL-6 ($p=0.02$), serum non-protein bound iron ($p<0.001$), serum CD14 cell NFκB activation ($p=0.014$), serum IL-8 ($p=0.03$) and serum ionized calcium ($p=0.001$) were potential predictors of death and/or abnormal outcome. A meta-analysis revealed serum IL-1β ($p=0.04$, $n=3$), serum IL-6 ($p= 0.04$, $n=2$), CSF neuron specific enolase ($p=0.03$, $n=3$), and CSF IL-1β ($p=0.003$, $n=2$) to be putative predictors of abnormal outcome in survivors. *Conclusion:* This analysis reveals that several serum, urine and CSF biomarkers of term neonatal encephalopathy exist with the potential to provide important information regarding long term outcome. Validation of these markers either alone or in combination is urgently required as we move towards the development of viable therapeutic interventions.

L-05

Delays in the diagnosis of Paediatric Arterial Ischaemic Stroke

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Background: Arterial ischaemic stroke (AIS) is a major cause of morbidity and mortality in children, with long term neurological deficits occurring in 50-85% of children. However, paediatric AIS is often unrecognized compared to the adult population. *Methods:* Neonates (aged 28 days or less) and children at the Royal Children's Hospital, Melbourne, with a first presentation of radiologically confirmed AIS, were retrospectively identified between June 1993 & January 2006. The time to diagnosis of AIS (i.e. from symptom onset to radiological confirmation) was calculated, and factors influencing stroke diagnosis were reviewed. *Results:* 107 patients with a diagnosis of AIS were identified (19 neonates & 88 children). The median time to stroke diagnosis in neonates was 87.9 hours, significantly longer than the median time to stroke diagnosis of 24.8 hours in the children ($p = 0.0002$). 91 of the 107 patients (86%) had a focal neurological deficit when first seen by a doctor. 64 patients of the 107 (64%) were inpatients at the time of stroke. 67% of strokes was likely cardio-embolic in mechanism. Seven of 107 patients were diagnosed with AIS within the 3 hour t-PA window; all seven were inpatients at the time of stroke, and 5 patients had structural heart disease. *Conclusions:* There are considerable delays

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in the diagnosis of paediatric AIS. This is despite a high number of inpatients developing AIS with identifiable cardiac disease and a high presentation of focal neurological deficits.

L-06

Management of pediatric interhemispheric arachnoid cysts: clinical, radiological, and quality of life outcome

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Background: Arachnoid cysts in the interhemispheric location are rare lesions often associated with major brain malformations. The optimal treatment for these cysts is unknown and longterm outcome unclear. The objective of this study is to determine the clinical, radiological, and quality of life (QOL) outcomes for this population. *Methods:* The Hydrocephalus Database at the Alberta Children's Hospital was searched for patients with interhemispheric arachnoid cysts. Patient data obtained included age at diagnosis, age and type of intial treatment, and number of further surgical interventions required. Cyst size was calculated before and after treatment stability had been achieved. QOL was assessed using the Hydrocephalus Outcome Questionnaire (HOQ). *Results:* A total of 16 patients were included in the study with a mean follow up of 11.2 years. Twelve (75%) patients were diagnosed in utero. All had either complete (44%) or partial (56%) agenesis of the corpus callosum and 10 patients had additional structural malformations. Initial treatments included endoscopic fenestration (38%), shunt insertion (50%) or a combination of both (12%). Fifteen patients (94%) were initially treated before one year of age. Patients who had endoscopic fenestration only as the initial treatment had fewer neurosurgical operations over the course of FU (1.7) compared to the shunted group (6). Neuroimaging revealed that initial shunt insertion resulted in the largest reduction in cyst size. Analysis of the HOQ results revealed that those shunted initially have poorer overall health scores (0.67) compared to those who are fenestrated initially (0.77). *Conclusions:* Interhemispheric arachnoid cysts and associated malformations including corpus callosum dysgenesis, are commonly diagnosed in utero and treated early in infancy. Initial endoscopic treatment of these patients may result in fewer future surgical interventions and overall improved quality of life compared to those undergoing shunting procedures.

L-07

Safety and efficacy of morphine infusions in pediatric neurosurgical patients

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Introduction: Children undergoing cranial operations experience significant pain. Continuous morphine infusion (CMI) is often avoided outside the ICU after pediatric cranial neurosurgery given concern for complications. We review efficacy and safety of CMIs after cranial operations in children in a ward setting. *Methods:* Single institution retrospective case series of 84 children (41 cranial reconstructions : 43 intradural craniotomies). We review CMI use and outcomes including pain scores (1-10) and complications (respiratory depression, nausea and excessive sedation) related to CMI. *Results:* Patients undergoing cranial reconstruction are transferred directly to the ward post operatively. Craniotomy patients typically spend one post-operative day in the ICU. All patients received CMI during ICU stay. On the ward, 35/84 (30 CR : 5 Craniotomies) had CMI, while 49/84 (11 CR : 38 Craniotomies) received no CMI. 1/30 CR and 0/5 craniotomies experienced complications on CMI on ward, while 1/11 CR and 1/38 craniotomies experienced complications without CMI. All patients had good pain scores (<3). There was no statistical difference between those with and without CMI in pain control or complications. *Conclusions:* CMI appears to be safe and effective. CMI should be considered a pain management option after pediatric cranial operations.

L-08

Patent foramen ovale in children and adolescents with migraine with aura

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Background: Results from observational studies have indicated an association between migraine and patent foramen ovale (PFO) in adults. *Methods:* The aim of this case -control study was to evaluate the frequency of PFO in children and adolescents with migraine with aura (MA) and compare it with the frequency of PFO in healthy controls. PFO was detected by transthoracic echocardiography with bubble study. We investigated the PFO association with migraine, considering factors like age, gender, type of aura, frequency of attacks, and familial occurrence. *Results:* 20 MA patients and 25 controls were recruited from 2003 to 2006. The F/M ratio for MA patients was 1.2 compared to 1.1 for controls. The average age of MA patients was 14.67 yrs (7.68 - 17.92) compared to 14.40 yrs (10.70 -17.06) for controls. A PFO was found in 7/20 (35.0%) patients with MA compared to 4/25 (15.4%) control subjects. *Conclusions:* Our findings suggest the possible association of migraine with aura and PFO in children and adolescents. Further statistical analysis is pending regarding an association between PFO and age, gender, type of aura, frequency of attacks, and familial occurrence. Future studies are needed to evaluate the role of PFO closure in the treatment of migraine.

L-09

Hippocampal volumes in normal children: an age dependent analysis

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Background: Hippocampal sclerosis (HS) accounts for 17-40% of operative pathology in children with refractory temporal lobe epilepsy. Although normal HCV reference values are established for adults, there is little data for children. Our goal was to establish reference values of HCV for children aged 2-16 years. *Methods:* 3D MP-RAGE T1-weighted images (T1WI) and regular fast spin-echo T2-weighted images (T2WI) were acquired from children who had no known cerebral abnormalities, abnormal neuroimaging or seizure history. Measurements were performed using 3D Slicer software. HCV was measured (T1WI) using the method of Watson et al. and was normalized with intracranial volume measured (T2WI) using

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the analysis of covariance approach described by Jack et al. Intra-rater reliability was performed (r=0.86, p<0.001). *Results:* 37 children participated (mean age 8.75 years). No statistically significant difference was found between age and HCV uncorrected or corrected (P=0.24 and 0.85 respectively). The values of hippocampal volume determined in our cohort of normal children were 3961 ± 341mm^3 and 3963 ± 374mm^3 for right and left side respectively. There was no difference for gender or side (P>0.05). *Conclusion:* The lack of statistically significant correlation between age and HCV has allowed us to establish a single normal range for children aged 2-16 years.

L-10

The epidemiology of post-concussion syndrome in children

KM Barlow (Calgary), D Dewey (Calgary)*

Post-concussion Syndrome is a common problem but its validity is hotly debated and many argue that symptoms can be accounted for by pre-morbid/psychosocial factors.
The objective of this study was to investigate the incidence and symptom characteristics experienced by children with mild traumatic brain injury (mTBI). *Methods:* Study Population: Any child 0-18 years attending the ED at ACH with a mTBI (cases) or orthopedic injury (controls). Outcome measures: Baseline "pre-injury" and "post-injury" Post-concussion Symptom Inventory (PCSI); Family Assessment Device; Brief Symptom Inventory. *Results:* 670 cases and 210 controls. Pre-injury controls had higher post-concussion symptoms than the mild TBI group F(1,290)=5.44, p=.020) and repeated measures ANOVA revealed significant group by time interaction (F(4, 283)=5.03, p=.001). At 7-10 days (p=.001) and 2 months (p=.001) post-injury, the mild TBI group scores significantly higher than controls. At 6 months the difference is a trend (p=.092), few cases had symptoms at 20 months. Kaplan Meier survival analysis: a significant difference between the survival curve for mTBI and controls (log rank X2(1)=17.57, p<.001). Predictors include loss of consciousness and age (p<0.05). *Conclusions:* Children experience a significant number of symptoms following mTBI which decrease over time but appear to persist longer than in children with orthopedic injuries.

Movement Disorders/ Neuromuscular/Dementia

M-01

Benefit of music therapy in patients with Parkinson disease: a randomized controlled trial

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Background: Dopaminergic medications are insufficient in maintaining symptomatic relief in Parkinson disease (PD) with disease progression. Alternative strategies such as exercise and music therapy have been suggested to improve motor function and quality of life in advanced patients. *Methods:* 28 patients were randomized to Music or Control arms (n=14 each). Music patients listened to musical pieces walking for thirty minutes three times a week; Control patients maintained their normal daily activity. Patients were evaluated by a blinded rater at baseline and 3-months on Gait and Balance Scale (GABS), UPDRS III, PDQ-39, and Activities-Specific Balance Confidence Scale (ABC). Primary outcome was mean change between baseline and 3-months. Differences between Music and Control arms were tested for statistical significance using ANCOVA with adjustment for baseline score, age, and disease stage. *Results:* At 3-months, Music patients showed significant improvement compared to Controls on GABS (mean change -1.9 vs. 0.1, p=0.002). No significant differences were seen on UPDRS (although trend to improvement was seen); PDQ-39; and ABC. *Conclusions:* Regular walking while listening to music improved motor function in PD patients as measured by GABS. These findings are important in establishing proof-of-concept of the role of music in enhancing motor function of PD patients.

M-02

Clinical and electrophysiological parameters distinguishing acute onset chronic inflammatory demyelinating polyneuropathy (A-CIDP) from acute inflammatory demyelinating polyneuropathy (AIDP)

A Dionne (London), MW Nicolle (London), AF Hahn (London)*

Background: Up to 20% of CIDP patients may present acutely, making distinction from AIDP difficult in the first 8 weeks. We looked for early parameters that would predict whether a patient presenting acutely will turn out to have CIDP instead of AIDP. *Method:* A retrospective chart review was performed of 15 unselected AIDP and 15 A-CIDP patients. *Results:* A-CIDP patients were significantly (p<0.05) more likely to have sensory ataxia (53.3% vs 6.7%), less likely to have autonomic nervous system involvement (13.3% vs 60%) and less likely to have a preceding respiratory illness (13.3% vs 66.7%). There was a trend toward less facial weakness (20% vs 53.3%), less need for mechanical ventilation (6.7% vs 40%) and more severe impairment of vibration sensation, but these were not statistically significant. With regards to electrophysiological features, neither a sural sparing pattern, a sensory ratio above one (Muscle and Nerve 2007), nor the presence of A-waves were significantly different between the two groups. *Conclusion:* Patients presenting acutely with a demyelinating polyneuropathy who have prominent sensory ataxia and no involvement of the autonomic nervous system should be clinically monitored carefully as they could more likely turn out to have CIDP at follow up.

M-03

Electrophysiologic changes in randomized, double-blind, placebo-controlled chronic inflammatory demyelinating polyneuropathy (CIDP) trial evaluating immune globulin intravenous, 10% caprylate/chromatography purified (IGIV-C)

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Background: Nerve conduction studies (NCS) are an objective tool to diagnose CIDP and measure response in clinical trials. *Methods:* CIDP patients received a 2-g/kg baseline loading dose of IGIV-C (Gamunex(r); n=59) or placebo (n=58) and then a 1-g/kg maintenance infusion every 3 weeks for up to 24 weeks (first

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period). Motor and sensory nerves were assessed at baseline and endpoint/week 24. The amplitude measured from the most proximal site of the most severely affected nerve and the amplitudes for each nerve/stimulation site were analyzed by analysis of covariance. All nerve conduction tracings were read by a centralized laboratory. *Results:* A trend toward improvement in amplitude of the most severely affected motor nerve at the most proximal stimulation site was observed with IGIV-C (0.69±1.86 mV) versus placebo (0.47±2.29 mV; P=0.542), and a larger improvement was observed (1.08±2.15 mV versus 0.46±2.03 mV, respectively; P=0.089) when Erb's point was excluded from consideration of the most proximal site. Improvements from baseline favoring IGIV-C versus placebo were observed for 129/142 electrophysiologic parameters, with 22 reaching statistical significance. *Conclusions:* Although the study was not powered to detect significant differences in NCS, IGIV-C treatment for up to 24 weeks improved the majority of parameters, with some reaching significance versus placebo. Improvements in electrophysiologic parameters further support intravenous immunoglobulin as first-line CIDP therapy.

M-04

Is there a higher risk of restless legs syndrome in peripheral neuropathy?

C Chalk (Montréal), E Hattan (Montréal), R Postuma (Montréal)*

Background: Restless legs syndrome (RLS) is widely believed to be more common in patients with peripheral neuropathy than in the general population, implying that peripheral mechanisms are important in the generation of RLS. We sought to ascertain whether the prevalence of RLS is in fact increased among patients with peripheral neuropathy. *Methods:* 245 patients with peripheral neuropathy and 245 age and sex-matched controls were screened for RLS using a standardized RLS phone questionnaire. All screen-positive subjects underwent a confirmatory diagnostic evaluation by a movement disorders specialist blinded to the neuropathy status of the subject. RLS prevalence was calculated and compared using Fisher's exact test. *Results:* 65 (26.5%) neuropathy patients and 25 (10.2%) controls screened positive for RLS (p<0.0001). However, the diagnosis was confirmed in only 46% of neuropathy patients versus 80% of controls (p=0.005). Cramps and paresthesia without true diurnal variation or exacerbation with rest were the commonest causes of false-positive screens. After the confirmatory evaluation, the overall prevalence of RLS did not differ between neuropathy patients and controls (12.2% vs. 8.2%, p=0.14). However, the prevalence of RLS in patients with inherited neuropathies (15/67, 22.3%) was significantly higher than in controls (p=0.004) and acquired neuropathy patients (15/178 (8.4%) (p=0.007). *Conclusions:* The prevalence of RLS is increased among patients with inherited, but not acquired, neuropathy.

M-05

Clinical variability of seropositive and seronegative neuromyotonia

*SK Baker (Hamilton)**

Case reports: A 46-year-old man developed leg stiffness and constant twitching in his calves, at the age of 25, approximately 5 years after recovering from acute inflammatory demyelinating polyneuropathy. Carbamazepine moderated his symptoms and he remained on this drug for over 2 decades. His mental status and neurologic examinations were normal with the exception of constant fasciculation-like activity noted over his calves. Nerve conduction studies were normal. Needle electromyography (EMG) revealed continuous muscle fiber activity manifesting as singlet discharges at a frequency of 20 Hz. A high titer of anti-voltage gated potassium channel antibodies was found confirming a diagnosis of post-GBS Isaacs' syndrome. Two courses of IVIg failed to mitigate the clinical or electrophysiologic peripheral nerve hyperexcitability (PNH). A 31-year-old triathlete developed episodes of painless leg stiffening at the age of 28. These episodes would typically evolve with crescendo-type fasciculation-like activity in her legs followed by disabling stiffness lasting minutes to hours terminating with a gradual release and decrescendo fasciculations. She was initially diagnosed with exercise-induced cramps partly due to her history of hyperhydrosis. Over-hydration and electrolyte supplementation offered temporary benefit but her symptoms returned. Needle EMG demonstrated doublet and triplet discharges with contraction-induced after-discharges. She was negative for VGKC antibodies. Sequencing of KCNA1 is in progress. *Discussion:* Extreme clinical variability exists in the spectrum of PNH. Given a history of stiffness or unremitting muscle activity a high index of suspicion should govern the search for neuromyotonia.

M-06

A cross-sectional study of 25-hydroxyvitamin d levels in children with neuromuscular disease

JK Mah (Calgary), CA Stoian (Calgary), N Liu (Calgary), E Goia (Calgary)*

Objective: To determine the prevalence of hypovitaminosis D among children with neuromuscular disease. *Methods:* Retrospective chart review plus comparison of 25-hydroxyvitamin D (25OHD) between paediatric neuromuscular patients and 136 healthy children in Calgary. *Results:* 55 children (46 boys, 9 girls) with neuromuscular diseases were reviewed. Their mean age was 11 (SD 4.9) years. 25OHD was not available in 13 children. The remaining 42 (76%) children had a mean 25OHD of 48.3 (SD 17.5) nmol/L, which was significantly different than healthy controls (p=0.0002). Sixteen (29%) children had hypovitaminosis D (defined by 25OHD below 40 nmol/L), including 12 boys with Duchenne/Becker muscular dystrophy (DMD/BMD), 1 child with myotonic dystrophy, 1 child with spinal muscular atrophy, and 2 children with congenital myopathies. Boys with DMD/BMD on corticosteroids were more likely to have hypovitaminosis D (p<0.05). Children who received 400 to 1000 IU vitamin D daily did not have significantly higher mean 25OHD levels when compared to those without supplements. *Conclusions:* Vitamin D deficiency was common among children attending the paediatric neuromuscular clinic, and the optimal amount of vitamin D supplementation requires further studies. Recognition of children at risk for hypovitaminosis D and on-going dietary counselling are necessary to ensure optimal bone health.

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M-07

Design of a multidisciplinary rural and remote memory clinic using telehealth technology

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In order to better serve needs of persons with dementia and other memory concerns in rural Saskatchewan, we developed a Memory Clinic. Upon receipt of a referral from a family doctor, a telehealth visit using videoconferencing technology allows patients and families in their own communities to meet with the clinic nurse and neuropsychologist for orientation to clinic procedures and for preliminary data collection. Blood taken at that visit screens for treatable causes of dementia. A few weeks later, patient and family travel to Saskatoon for an in-person clinic appointment. In the morning they see a neurologist, neuropsychologist, and geriatrician for history-taking and physical examination. Neuropsychological testing, CT evaluation, and physiotherapy assessment are then carried out. At day's end, clinic staff meets to discuss results, diagnosis, and management of the two new patients seen that day. The neurologist and neuropsychologist then meet with each patient and family to provide feedback, discuss plans, and answer questions. Patients are then seen in follow-up by the neurologist at 6 and 12 weeks, 6 and 12 months, and then annually or as dictated by clinical need. To assess patient and family satisfaction with telehealth follow-up, patients have been randomly allocated to a 6 week appointment either in-person in Saskatoon or via telehealth with subsequent appointments alternating between in-person and telehealth.

M-08

Vascular risk factors and survival in Alzheimer patients

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Background: Vascular risk factors (diabetes, hypertension, dyslipidemia, and atherosclerosis) are associated with increased risk of developing dementia, but their influence on survival in Alzheimer disease (AD) is less clear. Here we examined the relationship between these vascular factors and survival in an AD clinic cohort. *Design/methods:* Survival after diagnosis of AD was evaluated at a single center within the ACCORD study (inception 1997-1999). Vital status was complete for all 146 AD patients. Survival was calculated by subtracting the time of death from the time of diagnosis. Log-rank test and Cox regression were used to compare factors affecting survival. *Results:* Seventy-three (50%) patients died after up to 10 years of follow up. The median survival for all patients with AD was 8.2 years. Patients with diabetes had shorter survival (4.7 yrs) compared to those without (9.5 yrs, p=0.006). No significant association was found with other vascular risk factors. Male sex and lower MMSE were also associated with shorter survival. No significant effects were observed with other demographic factors, including age at diagnosis, years of education, or APOEe4 carrier status. *Conclusion:* Although vascular risk factors appear to affect risk of development of dementia, only diabetes significantly shortens survival in our AD cohort.

M-09

Bilingualism fails to delay the onset of Alzheimer Disease

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Background: A recent paper suggested that early bilingualism produced a statistically significant 4.1 year delay in onset of memory loss symptoms in older individuals with Alzheimer Disease, reflecting an increase in the cognitive reserve of these individuals. The study focused on multilingual elderly patients of whom 90% were immigrants. Our Memory clinic, in Montreal Canada, has the advantage of having a large set of individuals who are either multilingual immigrants to Canada, or who were raised in both official languages of Canada - French and English. We thus attempted to replicate the above findings in a larger cohort in a different setting, looking at age at diagnosis of dementia, age at symptom onset, and age of diagnosis for those who were non-immigrants bilingual in English and French. *Method:* Chart review of 632 patients referred (between 1997 and 2006). Language history was obtained from patient and caregiver interviews, and multilingualism was defined according to defined criteria. *Results:* There was no difference in the age of diagnosis of dementia between monolinguals and multilinguals (76.6 vs 77.5, $p>0.05$). Amongst multilinguals, the number of languages spoken was not found to be associated with age at diagnosis, $r=0.05$, $p>0.05$. This lack of difference held even when only native born French/English vs. bilinguals were considered. *Conclusion:* We were unable to replicate the claim that bilingualism confers a protective effect on memory loss or dementia diagnosis.

EPILEPSY

N-01

Seizure outcome following selective amygdalohippocampectomy for mesial temporal lobe epilepsy

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Background: Selective amygdalohippocampectomy is widely accepted surgical option for patients with refractory mesial temporal lobe epilepsy. Limited data, however, is available on the results of the use of SAH within Canadian centres. Here we present the seizure outcomes for patients treated with SAH in the Calgary Comprehensive Epilepsy Program. *Methods:* A retrospective review of patients who have undergone SAH for MTLE at Foothills Medical Centre, with minimum one year follow up, was completed. All patients underwent a comprehensive epilepsy surgical work up including MR imaging and neuropsychological evaluation. Patient data collected included age of onset of epilepsy, age at surgery, seizure types and frequency, pharmacotherapy, results of preoperative investigations, pathology at surgery and post-operative seizure outcome. Seizure outcomes were assessed using the Engel classification. *Results:* Eighty-one patients were identified. The mean age at onset of epilepsy was 14.5 yrs and mean duration of epilepsy prior to surgery was 22 yrs. The most common cause of TLE was mesial temporal sclerosis (77% of patients). Patients were followed post-operatively for an average of 25 months at which time

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72% of patients were free of seizure free since surgery. Three patients with failure subsequently had subtle lesions identified outside of the selective resection. Permanent complications occurred in 3 patients. *Conclusions:* Selective amygdalohippocampectomy is a safe procedure which provides very effective seizure control in patients with intractable MTLE. Care must be taken for selection of these patients to avoid a misdiagnosis of MTLE which may result in surgical failure.

N-02

Anxiety and depressive symptoms in children with epilepsy

L Hamiwka (Calgary), E Sherman (Calgary), E Wirrell (Rochester), C Yu (Calgary)*

Purpose: To determine the prevalence of anxiety and depressive symptoms in children with epilepsy. *Methods:* Children with epilepsy, 8-16 years, were included if they had been diagnosed with epilepsy, on anti-convulsant therapy or had > 2 seizures (1 in the preceding year). Families completed the Children's Depression Inventory (CDI) and the Revised Children's Manifest Anxiety Scale (RCMAS). Epilepsy factors (age of seizure onset, type, and frequency, number of current and previous medications) were recorded. *Results:* Fifty-five (F=27, M=28) completed the questionnaires. Children with epilepsy showed significantly lower total CDI scores than published normative data ($p < 0.01$). They demonstrated interpersonal problems ($p < 0.01$), felt negatively about their school performance ($p < 0.01$), and had low self-esteem ($p < 0.01$). Although RCMAS total scores were not significantly different from published data, greater physiological anxiety ($p = 0.01$) and social concerns ($p < 0.01$) were reported. Clinically significant depression scores, 8(16%) and anxiety scores 15 (30%) were documented and did not correlate with epilepsy factors. *Conclusion:* Children with epilepsy experience more depressive symptoms and show greater anxiety than the expected base rate. A significant proportion experience clinically significant scores requiring further assessment. Our data suggests that children with epilepsy should be clinically screened.

N-03

Economic impact of psychogenic non-epileptic attacks on health care system and therapeutic value of video-EEG telemetry

OV Finlayson (Waterloo), SM Mirsattari (London), PA Derry (London), JG Burneo (London), DC Diosy (London), RS McLachlan (London), BG Young (London), WT Blume (London)*

Background: Diagnosis of PNES has proven therapeutic value. We hypothesize that early diagnosis of PNES is associated with improvement or recovery and avoidance of excessive utilization of health care resources and unnecessary AEDs administration. *Methods:* Retrospective study of 86 PNES patients admitted to the EMU at London Health Sciences Centre over 4 years. All the patients underwent video-EEG telemetry. *Results:* 66 patients (76.7%) were females and 20 (23.3%) were males (mean age 36.45+/-13.34 years). Average delay in diagnosis of PNES was 6.72+/-6.32 years. Prior to the diagnosis the patients extensively utilized health care resources, such as head MRI, multiple visits to ED and neurologists, PNES-related hospital and ICU admissions. Establishing the diagnosis of PNES led to 81.4% reduction in the use of AEDs in patients with PNES alone. Follow-up data were available on 54 patients. From those, 75.9% improved after the diagnosis of PNES, 29.6% recovered. There was 72.6% reduction in the number of ED visits. However, there was no difference in outcome between patients with early (under 2 years) and late diagnosis. *Conclusions:* Lack of PNES diagnosis was associated with excessive health care resources utilization and unnecessary AEDs administration. Diagnosis of PNES resulted in high rates of improvement and recovery.

N-04

An evaluation of anterior temporal lobectomy on linguistic ability using functional magnetic resonance imaging

SW Wong (Los Angeles), SM Mirsattari (London), F Bihari (London), D Bandur (London), DH Lee (London)*

Background: Anterior temporal lobectomy (ATL) has been used to treat Temporal Lobe Epilepsy (TLE) patients with resistance to medical therapy. Nevertheless, aphasia has been reported in 5 to 40% of the TLE patients that undergo ATL. It is still unclear how ATL may affect the linguistic ability of TLE patients. The present study aims to compare the cortical response of TLE patients to a naming task before and after ATL with functional magnetic resonance imaging (fMRI). *Methods:* Eight left TLE patients participated in this study. They repeated the same naming task during two fMRI sessions, before and after left ATL. Blood-oxygen-level dependent (BOLD) signal was acquired from a 1.5 Tesla GE Signa Excite MRI scanner. The post-surgery session was scheduled two to six months after the surgery. *Results:* Before the left ATL, BOLD signal changes were observed at the left inferior frontal gyrus (LIFG), mid frontal gyrus (LMFG) and supplementary motor area (SMA). Similar areas were activated after left ATL. However, stronger LIFG activation was observed before the surgery. *Conclusions:* These findings suggested that ATL may affect the cortical network within the LIFG and contribute to the impairment of linguistic ability of TLE patients following ATL.

N-05

Prevalence of benign epileptiform variants observed in an EEG laboratory from Canada

SK Balagopal (London), J Chong (London), SM Mirsattari (London)*

Background: There are numerous distinctive electroencephalographic (EEG) patterns which are morphologically epileptiform but are non-epileptic. These benign patterns need to be distinguished carefully from the epileptiform transients. No study has investigated the prevalence and pattern of the benign epileptiform variants (BEVs) from a single EEG laboratory in Canada. *Methods:* 35,242 individuals who underwent EEG recordings between January 1, 1977 to December 31, 2007 formed the cohort. Subjects who did not have a sleep recording were excluded. We used the definitions of the Committee on Terminology of the International Federation of Societies for EEG and Clinical Neurophysiology (IFSECN) to delineate epileptiform patterns (Chatrian et al 1974), and the descriptions of Klass and Westmoreland (1985) to categorize the BEVs. *Results:* BEVs were identified in 992 out of 9322 subjects

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(10.6%) who had adequate awake, drowsy and sleep EEG tracings. The frequency distribution of individual BEVs were as follows: benign sporadic sleep spikes 6.4%, wicket waves 0.1%, 14 and 6 Hz positive spikes 1.7%, 6Hz spike-waves 2%, rhythmic temporal theta bursts of drowsiness 0.3% and subclinical rhythmic electrographic discharge of adults in 0.2%. *Conclusion:* The prevalence of BEVs among Canadian subjects is not too different from those reported from other developed countries. Their mere presence in a record does not justify the diagnosis of epilepsy or the institution of anticonvulsant therapy. Suitable candidates should not be denied epilepsy surgery due to the misinterpretation of these benign variants

N-06

Independent component analysis of subdurally recorded occipital seizures

A Patel (London), WT Blume (London), SM Mirsattari (London)*

Purpose: To study the components of occipital seizures using independent component analysis (ICA) of subdurally recorded electroencephalogram (EEG) data. *Methods:* Twenty-seven subdurally recorded occipital seizures from eight patients were studied. ICA was performed, and the resulting independent components (ICs) were compared with respect to their power, frequency, degree of spread within the epileptogenic zone, and propagation patterns. The ictal ICs were further subdivided into propagating and non-propagating types. *Results:* ICA was in agreement with the visual analysis of these seizures and it confirmed that all of the seizures indeed originated in the occipital lobe. Each seizure was composed of multiple ICs, some of which propagated while others remained within the epileptogenic zone. There was no statistical difference between the propagating and non-propagating ICs with respect to power or frequency. However, propagating ICs involved a significantly greater number of recording electrodes at their onset when compared to the non-propagating ICs. *Discussion:* The propagation likelihood of ICs in occipital seizures is independent of their power or frequency, but it is dependent on the volume of brain giving rise to that signal; ICs that are generated by a greater volume of brain within the epileptogenic zone are more likely to propagate. This study shows that ICA has the potential to be used to redefine the epileptogenic zone and guide the extent of corticectomy for the treatment of patients with medically intractable occipital epilepsy.

N-07

Localization of expressive language in teenagers using fMRI and MEG

EJ Donner (Toronto), F Wang (Toronto), M Malone (Toronto), D Kadis (Toronto), EW Pang (Toronto)*

Functional MRI (fMRI) is the gold standard for non-invasive expressive and receptive language localization. Magnetoencephalography (MEG) is a newer neuroimaging technology with high spatial and temporal resolution. While there are established MEG protocols for receptive language, there is limited data regarding expressive language localization. The objective of this study was to develop MEG expressive language tasks suitable for use in children and compare MEG results to fMRI. Ten healthy, right-handed, English-speaking teenagers were tested with fMRI and MEG using three covert tasks: picture naming, picture verb generation, and word verb generation. fMRI acquisition and analysis followed our standard clinical protocols. MEG data were analysed with differential synthetic aperture magnetometry (SAM). fMRI group averaged data demonstrated significant activations in the left inferior frontal gyrus for all tasks. Group averaged MEG results demonstrated significant beta band (13-30 Hz) desynchrony at 300-600 msec post-stimulus in left inferior frontal gyrus. Desynchrony in this frequency band has been found to correlate with fMRI localizations with other cognitive tasks. In summary, these novel MEG expressive language tasks showed high localization concordance with traditional fMRI tasks. Furthermore, the use of picture-based stimuli makes this a promising candidate for localizing expressive language in the clinical paediatric setting.

N-08

Alpha-B-crystallin as a tissue marker of epileptic foci in paediatric brain resections

HB Sarnat (Calgary), L Flores-Sarnat (Calgary)*

Introduction: A neuropathological tissue marker to demarcate the extent of epileptogenic foci would be useful for prognosis and patient management. We have studied a small heat shock chaperone protein alpha-B-crystallin as an immunocytochemical marker in paediatric brain resections. *Materials and Methods:* 34 surgical resections of cerebral cortex, hippocampus or amygdala (or combinations) were examined from June 2005-Dec.2006 in children from 3 months to 18 years of age, of both genders. Epileptic foci were identified by EEG and ECoG; MRI was performed preoperatively to identify structural lesions. Four cases showed no histopathological alterations; 17 had focal cortical dysplasias (2 Taylor-type), 7 mesial temporal sclerosis with neuronal loss, 3 tuberous sclerosis (ts) and 3 DNET. Autopsy tissue was available from 2 epileptic children who died. A series of 20 normal human fetal brains of 14-41wk gestation were studied for ontogeny. ICC antibodies were applied for alpha-B-crystallin and several neuronal and glial markers. *Results:* In all epileptic foci, alpha-B-crystallin was upregulated in oligodendrocytes and astrocytes, including satellite cells, in both white and grey matter, and in a few cases neurons overexpressed the protein also. Balloon cells and atypical cells of ts were intensely reactive. In all cases, reactivity was strongest at the epileptic focus and followed a gradient of weaker reactivity and fewer glial cells involved at 2-3cm away from the focus, disappearing at greater distances. No correlation was found with microglial activation (CD-68), gliosis or the presence or absence of structural lesions. Normal fetuses did not express alpha-B-crystallin at any age. *Conclusions:* alpha-B-crystallin is a reliable tissue marker denoting the extent of epileptic foci, irrespective of structural lesions. This reactive, and probably neuronal-protective, chaperone protein responds to metabolic stresses, including epileptic activity.

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N-09

Seizure-like activity in the hypoglycemic rat: lack of correlation with the electroencephalogram of free-moving animals.

M del Campo (Toronto), P Abdemalik (Toronto), C Wu (Toronto), L Zhang (Toronto), P Carlen (Toronto)*

Background: The neuropathology of hypoglycemia and its mechanisms seem to be understood. The physiopathogenesis of hypoglycemia-related seizures has escaped elucidation. Various animal models reportedly show "seizures" when rendered hypoglycemic however, correlation with the electroencephalogram (EEG) is inconsistent. In order to characterize the role of the hippocampus and frontal neocortex in the generation of hypoglycemic seizures, this study was undertaken. *Methods:* Adult rats were implanted stereotaxically with electrodes in the left hippocampus and right frontal cortex. After one week, they were fasted 18-24 hours, then injected intraperitoneally with insulin, 35 IU/Kg. Simultaneous EEG/video monitoring was conducted. *Results:* Interpretable EEG recordings were obtained in 8/12 animals. Two showed poor association of seizure-like behaviour (neck extension, vocalizations, tonic extension of the tail, digging or running limb movements) with ictal EEG patterns. Four animals exhibited such behaviours during periods of high amplitude polymorphic slow wave activity, burst-suppression patterns or non-rhythmic spiking. Two others were encephalopathic until death. *Conclusions:* Not all animals develop seizure-like behaviour when hypoglycemic. If these are seizures, they may originate from subcortical structures. The "convulsive" behaviours observed may simply be flight/fight reflexes released during profound encephalopathy. Spike activity in the EEG may be a manifestation of this state. This is likely the wrong model in which to attempt determining the mechanisms of epileptogenesis in hypoglycemia.

N-10

Hemispherectomy in children: role of pathology and surgical technique in predicting patient outcome

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Background: Hemispherectomy is an established neurosurgical procedure for catastrophic epilepsy in childhood. We conducted a retrospective review to examine the influence of underlying pathology and surgical technique [hemidecortication (HD) versus peri-insular hemispherotomy (PIH)] on patient outcome. *Methods:* The medical records of 40 children undergoing hemispherectomy were reviewed for patient demographics, clinical criteria, and surgical outcomes. *Results:* HD and PIH were performed in 21 and 19 children, respectively. Mean age of seizure onset was 17 months. Mean number of seizure-types was 3. All patients were extensively investigated with neurological examination, EEG, prolonged video EEG monitoring, and neuroimaging. Mean age for HD was 54 months; for PIH, 56 months. Mean length of surgery for HD and PIH were 5.4 hrs and 7.5 hrs, respectively. For HD, 7 patients required a second surgery and 2 required a third. For PIH, 3 required a second procedure. Post-operative shunting was required in 5 patients with HD, but only 1 patient with PIH. All patients had increased contralateral hemiparesis following surgery. The main pathologies were: Rasmussen's encephalitis, 8 patients; hemimegalencephaly, 11; Sturge-Weber, 6; and cortical dysplasia in 9. Mean follow-up time was 61 months. Engel Class I or II outcomes following surgery were better in PIH (77%) compared to HD (53%). Following second surgeries, 5 patients with HD and 2 with PIH improved to Engel Class I or II. *Conclusion:* Hemispherectomy is an effective surgical procedure for intractable, catastrophic epilepsy in childhood. This study suggests that underlying pathology and choice of neurosurgical procedure may influence patient outcome.

NEUROVASCULAR

O-01

Ceramic aneurysm clips for improved MR visualization

JJ Kelly (Calgary), GR Sutherland (Calgary)*

Objective: To develop a cerebral aneurysm clip that allows intra- and post-operative evaluation of the aneurysm complex. The clip will incorporate ceramics, thereby decreasing susceptibility artifact at the aneurysm neck. *Methods:* A number of aneurysm clips were designed and manufactured using ceramic jaws and a titanium spring. A corresponding clip applicator with a unique clip-applicator interface was developed in order to enhance clip placement during surgery. The clips were imaged with MRI at 3.0 Tesla in a kiwi fruit phantom model and compared to contemporary MR compatible aneurysm clips. The clips were subsequently evaluated in a human cadaveric model using MRI at 1.5 Tesla. *Results:* Cerebral aneurysm clips were developed initially using silicon nitride ceramic and subsequently with yitria stabilized zirconia ceramic. The ceramic clip jaws reduced susceptibility artifact compared to contemporary MR compatible clips. Closing pressure was maintained with 50 repeated clip opening and closing cycles. The novel clip applicator improved visibility during clip application and greatly reduced the potential for torque during clip removal. *Conclusions:* The use of ceramics significantly reduced MRI susceptibility artifact and image distortion.

O-02

Complications of endovascular treatment of intracranial aneurysms

LB da Costa (Toronto), MQ Ribeiro (Porto), PR Howard (Toronto), L Thines (Toronto), A Dehdashti (Toronto), KG ter Brugge (Toronto), RA Willinsky (Toronto)*

Background: Coiling has become an established option for intracranial aneurysms. Knowledge of complication rates is crucial. We reviewed our coiling complication rates in the last 15 years to evaluate changes with improvement of techniques and technology. *Methods:* Retrospective review of prospectively collected data with identification of complications related to coiling procedures. Complications were classified into thromboembolic, intra-procedural rupture, vessel injury/occlusion, coil migration and post-coiling hemorrhage. Comparison between initial 10 years (277 procedures) and final 5 years (316 procedures) was performed. *Results:* 593 procedures were performed in 535 patients with mean f/u of 1.54 years (1 month-13.9 years). 390 (66.4%) presented with SAH. Neck remnant was seen in 166 (27.9%) aneurysms, residual body 130 (21.9%) and 297 (50.1%) were completely occluded. 83 complications occurred: 24 intra-procedural ruptures, 48 thromboembolic. In the initial 10 yrs, 26 (9.4%) complications in

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277 procedures occurred with 4% morbimortality and 56 (17.7%) in the final 5 years (316 procedures), 1.9% morbimortality. *Conclusion:* Overall complication rate increased in the last 5 years if compared with the initial 10. However, mortality and permanent morbidity decreased significantly. It is likely that more complex, technically demanding cases are being treated, and management of procedural complications improved, resulting in better outcomes.

O-03

Large aneurysms causing focal neurological deficit: treatment and evolution

D Tampieri (Montréal), M Cortes (Montréal), D Sirhan (Montréal), D Sinclair (Montréal)*

The aim of this presentation is to report our experience with the treatment of giant and large unruptured symptomatic intracranial aneurysms using endovascular technique. This review includes aneurysms in subarachnoid location excluding intracavernous aneurysms. *Material and Methods:* A group of 9 patients presenting with progressive neurological deficit in 5 cases, Parkinson in one case and III cranial nerve palsy in three cases came to our observation. The symptoms were caused by giant or large unruptured intracranial aneurysms in different location. All the aneurysms were intracranial in the subarachnoid space (Table 1). In 7 cases coiling with adjunctive techniques was performed while in 2 patients the lesion was treated with parent artery occlusion. The patients were evaluated at follow up with MRI-MRA at 6 months, 1 and 2 year intervals and angiogram at 12 months. *Results:* The initial clinical condition resolved in all patients. At the latest clinical follow up 1 to 2 years after the endovascular procedures the patients did not have symptoms recurrence. The MRI demonstrated a complete reduction of the edema caused by the unruptured aneurysms in 4 cases, the resolution of the edema was accompanied by resolution of the clinical symptoms. In 2 cases (FC and EN) the aneurysms partly re-canalized without recurrent symptoms and they were re-treaded. No complications occurred during or immediately following the endovascular procedures. *Conclusion:* Endovascular treatment of giant and large symptomatic aneurysms is a safe and valuable method for the resolution of the clinical symptoms. In spite of the re-canalization observed the patients persist asymptomatic, probably due to the beneficial removal of the pounding effect of the pulsatile blood on the aneurismal wall. Parent artery occlusion is an efficient treatment modality without risks of re-canalization.

O-04

Familial intracranial aneurysms in Newfoundland and Labrador: preliminary report

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Introduction: Subarachnoid hemorrhage due to ruptured aneurysm has devastating consequences. It is estimated that 20% or more of these aneurysms are familial. The purpose of this study is to delineate the clinical, epidemiological features of familial and sporadic intracranial aneurysm (ICA) and identify gene(s) that predispose to them. *Methods:* Once ICA patients were identified, a 3-generation pedigree was constructed and the participant was classified familial or sporadic. DNA was collected and molecular study as well as 3D-CT scan or MRA were requested. We focused on recruiting familial cases, particularly those with more than 2 affected relatives. *Results:* The cohort includes 46 probands with ICA, including 31 familial cases. In total 306 individuals have been enrolled. CT or MRA has been completed on 188. Of the 55 affected participants, clipping has been performed on 20, coiling on 9. Subarachnoid hemorrhage resulting in death occurred in 2. 24 patients have been followed for unruptured aneurysms. There are 4 major families (each with 4-9 affected individuals) and these will be the focus of future molecular genetic studies Details of some of these families will be discussed. *Conclusion:* Identification of patients with familial ICA is important for early treatment, family screening and eventual prevention of subarachnoid hemorrhage.

O-05

Endovascular Clip System (eCLIPs(r)) - histological results

LB da Costa (Toronto), J Spears (Toronto), I Penn (Vancouver), DR Ricci (Vancouver), I McDougall (Vancouver), A Marko (Vancouver), G Bourne (Vancouver), B Qiang (Toronto), TR Marotta (Toronto)*

Background: eCLIPs(r), a new system for treatment of intracranial aneurysms was previously described. We report first histological analysis and comparison with coronary stents. *Methods:* 40 New Zealand White Rabbits were divided in 3 groups. eCLIPs® was implanted in one cervical carotid artery and a bare coronary stent in the contra-lateral vessel. Animals were sacrificed at different dates (10 at 30, 10 at 90 and 20 at 180 days) and both carotids removed for histological analysis. Luminal area, acute thrombosis and neo-intima formation were evaluated. *Results:* Neointimal proliferation was similar between eCLIPs® anchor and coronary stents at 30(P=0.332), 90(P=0.526) and 180 days (P=0.414). Neointimal proliferation of leaf part of eCLIPs® is higher than the anchor in all groups. No significant differences were found at both leaf (P=0.154) and anchor (P=0.077) among eCLIPs® implants at 30, 90 and 180 days. No implant related parent vessel thrombosis occurred. *Conclusions:* eCLIPs® concept is based on occluding aneurysms not penetrating the sac. Histological analysis demonstrates minimum reaction at the anchor portion and neointimal formation at the leaf, expected in order to promote aneurysm neck healing, similar to microsurgical clipping. eCLIPs® may prove useful for endovascular treatment of cerebral aneurysms, reducing risk, cost and irradiation.

O-06

The reliability of negative CTA for spontaneous subarachnoid hemorrhage

R Agid (Toronto), S Lee (Toronto), RA Willinsky (Toronto), RI Farb (Toronto), KG Terbrugge (Toronto)*

Purpose: To check if a negative CTA is reliable enough to exclude pathology in patients presenting with a spontaneous SAH. *Methods:* Retrospective analysis of all negative CTAs performed from 2005 to 2007 for patients presenting with spontaneous SAH compared to the gold standard intra-arterial diagnostic cerebral angiography (DSA). Patients with history of trauma were excluded. CTAs were performed using a 64-slice multi detector CT scanner. In addition to the axial source images, image processing included coronal, sagittal and oblique maximal intensity projection (MIP) and 3D volume rendered reconstructions. *Results:* 74 patients with SAH and

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negative CTA were identified, 69 of which had a DSA. The distribution of blood on unenhanced CT for the 69 patients was: Perimesencephalic (PMH) in 29, diffuse aneurysmal pattern in 18, no blood on CT (xanthochromic LP) in 16 and peripheral distribution in 6. All patients presenting with PMH distribution or with no blood on CT had negative DSA (0% false negativeof CTA). Three out of the 6 patients presenting with peripheral distribution of blood had a DSA positive for vasculitis (50% false negative of CTA). In the case of diffuse aneurysmal distribution of blood, all first DSAs were negative with no false negative CTA. However, 13 of these patients received repeat delayed DSA, which revealed 2 small aneurysms. One 3 mm distal pica aneurysm retrospectively seen on both CTA and DSA (diagnostic error) and a 1.4 mm basilar tip aneurysm not retrospectively seen on CTA or on the first DSA. 2 patients suffered a complication of DSA (2.9%): 1 clinical stroke (1.4%) and 1 asymptomatic vertebral dissection. *Conclusions:* Our preliminary results suggest that CTA is a reliable tool in the case of PMH pattern of SAH or no blood on CT. In the case of diffuse or peripheral SAH - DSA is indicated.

O-07

Pial Synangiosis for Moyamoya Disease with hemorrhagic presentation in children: long-term follow-up

RT Grondin (Boston), ER Smith (Boston), R Scott (Boston)*

Introduction: In pediatric moyamoya patients who present with brain hemorrhage, there are very few reports of long-term results after surgical treatment with indirect surgical revascularization procedures such as pial synangiosis. In this report, we describe the results of a long-term follow-up of patients with moyamoya syndrome presenting with hemorrhage who underwent a standardized surgical procedure - pial synangiosis. *Methods:* We retrospectively reviewed the clinical and radiographic records of patients with moyamoya disease presenting with hemorrhage who were under 21 years of age when operated upon and who underwent surgery performed by a single neurosurgeon from 1988 to 2005. *Results:* Eight children (6 females, 2 males) were treated with pial synangiosis at mean age of 10.7 years (range 7-14). Seven patients underwent surgery on both hemispheres under the same anaesthetic, and one patient was treated only on the left hemisphere. One patient had a perioperative contralateral caudate infarct, from which she had a good recovery. Clinical follow-up is available for 7 of 8 patients (mean 10 years, range 2.5-19.6). Of these patients, no patient has had subsequent hemorrhagic or ischemic events, and all were well at last follow-up. Six patients had radiographic evidence of significant collateral development at 1 year with angiographic studies. Of these, 3 patients underwent catheter angiography demonstrating Matsushima grade A or B collaterals. *Conclusions:* Pial synangiosis is a safe, effective method of cerebral revascularization in children with moyamoya disease. Moyamoya patients presenting with hemorrhage appear to benefit, with long-term protection from repeat hemorrhage and ischemic events. Our data supports utilization of pial synangiosis for moyamoya disease presenting with cerebral hemorrhage.

O-08

Prevention of vasospasm with intraventricular thrombolysis after endovascular aneurysm occlusion

*JH Wong (Calgary)**

Background: Cerebral vasospasm remains a common source of morbidity after aneurysmal subarachnoid hemorrhage (SAH). Endovascular therapy allows aneurysm occlusion in a minimally-invasive manner without direct arterial manipulation thus possibly reducing mechanical vessel irritation. We hypothesized that clearance of subarachnoid clot via chemical thrombolysis with intraventricular tissue plasminogen activator (TPA) after endovascular aneurysm occlusion, could ameliorate or prevent delayed vasospasm in high-risk patients. *Methods:* In 2002, we initiated a prospective protocol of treating selected patients with high-grade SAH (Hunt-Hess grades 3-5) and large volume subarachnoid and intraventricular hemorrhage (Fisher grades 3-4), with intraventricular dose(s) of TPA, and performed serial radiological and clinical assessments. *Results:* Twenty-one patients (62% female, mean age 54 years) were identified. All had acutely ruptured aneurysms with diffuse thick SAH with intraventricular blood requiring emergent ventriculostomy for hydrocephalus. Six patients were classified as Hunt-Hess grade 5, 12 were grade 4, and 3 were grade 3. All aneurysms were treated acutely by coiling except two by glue embolization. All patients underwent (repeated) dosing of TPA, typically in daily 4 mg aliquots, via the ventriculostomy catheter. Serial imaging showed evidence of significant new bleeding after treatment in two patients (10%) who later died and the remainder had significant reduction in amount of intracranial blood. Followup computed tomographic and/or digital subtraction angiography was performed during the time frame of potential vasospasm in 15 patients, and three had severe vasospasm (20%), one moderate (7%), five mild (33%), and six none (40%). No patient developed new large vessel territory infarction. Two patients were lost to follow-up after discharge, and long-term clinical follow-up showed three patients were severely disabled (14%), five moderately (24%), and eight were not or only slightly affected (38%). *Conclusions:* Our results suggest that early endovascular aneurysm repair combined with intraventricular thrombolysis can reduce the incidence and severity of post-hemorrhagic vasospasm. Further studies are needed to elucidate the potential risks and benefits of this therapeutic strategy.

O-09

Recruitment of patients for the TEAM study (Trial on Endovascular Aneurysm Management): an achievable goal

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Background: TEAM is a randomized study comparing endovascular treatment to observation of unruptured aneurysms. Recruitment might be one of its main challenges. Recruitment rate was determined at our institution in order to estimate the clinical feasibility of the study. *Materials and Methods:* Retrospective study of the consultations for unruptured aneurysms from the beginning of TEAM recruitment (June 2006) to October 2007 at our institution. *Results:* One hundred and eighty-eight (188) patients were seen for unruptured aneurysms. One hundred and thirteen (113) patients

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fulfilled the inclusion criteria of the TEAM study. The attending physician did not offer participation to 51 of these patients (45%) for various reasons (27 were treated and 24 were observed). Participation in the study was proposed to 62 patients (55%) and 11 (18%) accepted. Thirty-five patients refused to participate (21 chose to be treated and 14 chose surveillance). Sixteen patients never informed us of their decision. One of these patients died from rupture of her aneurysm 2 months after study was proposed. *Conclusion:* At our institution, 18% of patients to whom the TEAM study was proposed accepted participation. A significant number of patients deferred their decision and did not contact us again.

O-10

Multimodality care of occipital AVMs: Neurological outcomes in a series of 135 patients

A Dehdashti (Toronto), L Thines (Toronto), L Da costa (Toronto), M Schwartz (Toronto), K TerBrugge (Toronto), R Willinski (Toronto), M Tymianski (Toronto), C Wallace (Toronto)*

Objective: The proximity of occipital AVMs to the visual cortex and optic radiations makes their management challenging. We studied the neurological outcomes of patients with occipital AVMs and evaluated the role of multimodality management. *Methods:* A prospective analysis was conducted for 135 patients with occipital AVMs.The decision was based on patients'characteristics, mode of presentation and morphology of the AVM. The management modalities were correlated with their neurological outcomes. *Results:* One hundred-twenty-five patients presented with one or more symptoms. Visual deficit was more common in the group of ruptured AVMs ($p < 0.002$). Mean follow-up period was 4.78 years. Forty-one patients were elected for observation. No new neurological deficit was observed in this subgroup. Among the 14 patients in this subgroup with visual deficit at presentation, two showed improvement and two worsening during follow-up. Two patients presented with hemorrhage, one underwent treatment and the other died. The annual bleed rate was 0.05%/patient. Ninety-four patients were treated with one or a combination of treatment modalities. The AVM was eliminated in 42 of 45 patients who underwent surgery versus 24 of 34 treated with radiosurgery and 4 of 13 who had embolization alone. The final cure rate was 82%. Visual deficit at presentation improved in 5 of 32 patients (16%)and worsened in 2 (9%). There were 8 new visual field deficits (9%) and 2 other neurological deficits (2%). There were two deaths (2%) related to the AVM treatment. Hemorrhage and medial occipital location were associated with more visual field deficit at presentation. Medial occipital location and calcarine artery supply to the AVM were considered as significant surgical risk factor for visual field deficit. Neurological morbidity was higher in the treatment group($p < 0.005$), but the difference in mortality did not reach statistical significance. *Interpretation:* There is a relatively low risk of new neurological deficit after treatment of occipital AVMs. Appropriate patient selection for observation can achieve a better outcome than the natural history of AVMs. The multimodality care of occipital AVMs can aim for a good neurological outcome.

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Poster Presentations

Child Neurology

P-001

To CP or Not CP-the spectrum of abnormal neurologic outcomes subsequent to term intra-partum asphyxia

*N Al-Macki (Montréal), S Miller (Vancouver), N Hall (Montréal), M Shevell (Montréal)**

Background: The purpose of this study was to delineate the spectrum of abnormal neurologic outcomes in term infants with intra-partum asphyxia and identify those clinical factors associated with the occurrence of later cerebral palsy. *Methods:* All children with term intra-partum asphyxia encountered in a single pediatric neurologic practice with at least two years follow up and an abnormal neurologic outcome were identified. The etiology of intra-partum asphyxia was strictly ascertained as per present consensus criteria. Abnormal outcomes were grouped into those with or without cerebral palsy. *Results:* A total of 40 children (28 males, 12 females) met the study's inclusion and exclusion criteria. Of these 23 developed cerebral palsy and 17 an abnormal neurologic outcome that did not include cerebral palsy. A more severe grade of neonatal encephalopathy, a high number of neonatal seizures, neonatal use of phenytoin, diffuse abnormalities on imaging and an abnormal neurological exam on discharge subsequent to birth all were significantly ($p<0.05$) associated with an outcome that included cerebral palsy. *Conclusion:* Abnormal neurologic outcomes other than cerebral palsy subsequent to term intra-partum asphyxia may occur. It appears that a more severe grade of initial asphyxial injury is more likely to result in cerebral palsy.

P-002

Neonatal *E. coli* meningitis: Fiery MRI picture need not predict bad neurodevelopmental outcome

R RamachandranNair (Hamilton), G LeBlanc (Hamilton), R Mesterman (Hamilton)*

Introduction: Brain abscesses occur rarely in neonates but remain a serious and life-threatening disease despite advances in diagnosis and management. Most often, they represent a complication of bacterial meningitis or septicemia due to Gram-negative organisms. *Methods:* We report the MRI findings and neurodevelopmental outcome of a neonate with meningitis and brain abscess who had significant abnormalities on MRI. *Result:* An 18-day-old term neonate was admitted in septic shock after a couple of days of poor feeding and lethargy. CSF showed a high neutrophil count, low sugar and Gram-negative bacilli. E Coli grew in the CSF culture. CT brain showed an area of hypodensity in the posterior aspect of the right temporal lobe and extending into the right occipital lobe and the right vertex posteriorly. MRI showed multiple areas of confluent as well as patchy cerebritis in the right hemisphere with a 2.3 cm abscess in the right occipital area and hydrocephalus. The neonate was treated with antibiotics and VP shunt. Drainage of the abscess was not performed. At 1 year, the child is developmentally normal without any neurological deficit. *Conclusion:* Timely antibiotic therapy can minimize brain damage even in the presence of florid MRI changes in neonatal meningitis and brain abscess. Prediction of neurodevelopmental outcome based on MRI findings in neonatal CNS infection is difficult and this should be kept in mind while counseling the parents.

P-003

Coenzyme Q10 deficiency presenting with hypotonia and infantile spasms

RJ Huntsman (Saskatoon), EG Lemire (Saskatoon), CP Dunham (Vancouver)*

Background: Coenzyme Q10 deficiency is a rare mitochondrial disorder. Less than 40 cases have been reported worldwide. A severe infantile form has been reported in 7 children with hypotonia, seizures and ataxia. Coenzyme Q10 deficiency has not been reported in association with infantile spasms. *Methods:* The patients' medical charts were reviewed including results of metabolic workup, neuroimaging and detailed family history. An extensive medline search was performed regarding Coenzyme Q10 deficiency, as well as Infantile spasms and mitochondrial disease. *Results:* The child presented at 5 days of age with severe hypotonia. At 5 months she developed infantile spasms. Magnetic resonance spectroscopy demonstrated abnormal lactate peaks. Muscle biopsy revealed nonspecific myopathic changes. A single paracrystalline inclusion was identified on nerve biopsy. Respiratory chain enzyme analysis showed a complete absence of Coenzyme Q10. *Conclusions:* This is the first case of Coenzyme Q10 deficiency to be reported in Canada. Mitochondrial diseases are an uncommon cause of infantile spasms and this is the first patient with infantile spasms due to Coenzyme Q10 deficiency. Of special significance is the large number of children in this close knit community who have been diagnosed with an unknown mitochondrial disease or have features suggestive of mitochondrial disease.

P-004

Chiari I malformation and comitant esotropia: an uncommon etiology for a common childhood pathology

M Labib (London), A Ranger (London)*

Background: Chiari I malformation presenting with acute acquired comitant esotropia (AACE) is exceedingly rare. *Methods:* A case of a 14 years old male who presented to his ophthalmologist with a 1 year history of worsening esotropia is reported. His physical examination revealed bilateral ptosis, cominant esotropia, and gaze evoked nystagmus. An MRI was consistent with Chiari I malformation which was managed surgically. A literature review of similar cases was also conducted. *Results:* A decompressive suboccipital craniectomy, C1-C2 laminectomies, and a duraplasty were performed. Post-operatively, the patient had a markedly significant improvement in his ptosis, nystagmus, and balance. The esotopia was persistent, however. A literature review revealed only fourteen cases of comitant esotropia associated with Chiari I

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malformation. Six of these patients were managed initially by strabismus surgery where the recurrence rate of esotropia was 83 %. In contrast, of six patients treated with posterior fossa decompression, only one patient had mild persistent esotropia. *Conclusion:* Chiari I malformations should be considered as a potential cause for esotropia in patients presenting with AACE. Posterior fossa decompression is the primary management intervention in these patients. Strabismus surgery may have a role in correcting esotropia in cases where surgical decompression may not be sufficient.

P-005

Utility of bilateral decompressive craniectomy for refractory intracranial hypertension in a child with severe ITP-related intracerebral hemorrhage: Case report

AM Ranger (London), M Salvadori (London), G Morrison (London), L Jardine (London), L Perlman (London)*

Background: Decompressive craniectomy (DC) is well-described as a rescue intervention in patients with medically refractory intracranial hypertension. Guidelines for DC in children relate to patients with traumatic brain injuries and there are no data to support the procedure for children with stroke or spontaneous ICH. We present the use of DC for ITP-related ICH, which is a rare and dreaded complication of ITP in children. *Methods:* A 13 month old girl developed a spontaneous ICH with persistent severe elevation of intracranial pressure (ICP) despite aggressive medical measures. While hospitalized for ITP with a platelet count of 3, the child became progressively irritable, drowsy and hemiparetic on the right side. CT imaging revealed a 6 cm acute ICH involving the left rolandic region with extensive surrounding edema and midline shift. ICP was managed initially with an external ventricular drain, with pressures recorded as high as 40 mmHg. *Results:* We removed large bone flaps and did not evacuate the ICH because of profoundly low platelet counts with risks of intra- and postoperative bleeding. A splenectomy was not performed. By six months postoperatively, she recovered the use of her right side. Daily transfusions were required for four months and she was eventually diagnosed with aplastic anemia. She has survived to the point of bone marrow transplantation. *Conclusion:* In the setting of ITP, performance of DC necessitates consideration of platelet and clotting factor management and possible performance of splenectomy to preserve platelet counts. Multi-disciplinary management of the patient with hematology, general surgery and critical care in addition to neurosurgical management is necessary. We conclude that DC is a lifesaving procedure and is applicable to non-traumatic settings.

DEMENTIA

P-006

Utility of telehealth for following cognition in memory clinic patients from rural areas

WM McEachern (Regina), A Kirk (Saskatoon), D Morgan (Saskatoon), M Crossley (Saskatoon), C Henry (Saskatoon)*

Background: Advances in telehealth have improved access to health care for those in rural areas. Thus, examinations conducted via telehealth must be comparable to in-person testing. A rural and remote memory clinic in Saskatoon provided an opportunity to compare scores on Mini-Mental State Examinations (MMSE) administered in-person and via telehealth. *Methods:* After an initial one day assessment in Saskatoon, patients were seen in follow-up at 6 and 12 weeks, either in-person in Saskatoon or by telehealth assessment in their home community. Patients who initially received in-person assessments were seen by telehealth for their next follow-up visit and vice-versa. The same neurologist administered all MMSEs. The first seventy-one patients with both 6 and 12 week follow-up assessments were included. The scores of in-person and telehealth MMSE administrations were compared using the methods of Bland and Altman as well as a paired t-test. *Results:* MMSE scores did not differ significantly between telehealth (22.34 ± 6.35) and in-person (22.70 ± 6.51) assessments. *Conclusion:* Telehealth provides an acceptable means of assessing mental status of patients in remote areas.

P-007

Distribution of [^{18}F]-FEOBV in rat: a promising tracer for imaging cholinergic innervation densities

E Landry St-Pierre (Montréal), P Rosa (Montréal), G Massarweh (Montréal), A Alliaga (Montréal), S Mzengeza (Montréal), M Bédard (Montréal), J Soucy (Montréal)*

Background: Acetylcholine (ACh) neurotransmission is altered in neurodegenerative diseases such as Alzheimer's disease. [^{18}F]-Fluoroethoxy-benzovesamicol (FEOBV) is a positron emitting ligand of the ACh vesicular transporter which reversibly binds to its target. It holds promise as a potential ACh system pre-synaptic marker which could be useful for early detection of Alzheimer's disease. *Methods:* Seven male Sprague-Dawley rats were anaesthetized with isofluorane 2% and placed in a CTI Concorde R4 microPET scanner. Physiological parameters (respiration rate, EKG and temperature) were recorded throughout the sessions. Animals received an average i.v. dose of 10.88 MBq of high specific activity FEOBV. Emission scans were obtained for 60 min. Images were co-registered to a rat anatomical template. *Results:* Physiological parameters remained constant during the experiment. Rats manifested no overt acute/subacute (days) signs of toxicity following the experiment. Distribution of the tracer was found to be as expected from the literature on Ach systems anatomy. There was a fast washout of radioactivity from the cerebellum. The highest binding potentials were detected in the caudate, amygdala, hippocampus and basal forebrain. *Conclusions:* [^{18}F]-FEOBV is a promising ligand for imaging the innervation density of the cholinergic system, a potentially important parameter in neurodegenerative diseases assessment.

P-008

Plasma chromatographic profile of [^{18}F]-FEOBV in rat: results and implications for clinical applications

E Landry St-Pierre (Montréal), P Rosa (Montréal), G Massarweh (Montréal), S Mzengeza (Montréal), M Bédard (Montréal), J Soucy (Montréal)*

Background: Acetylcholine (ACh) neurotransmission seems to be altered in neurodegenerative diseases such as Alzheimer's disease. [^{18}F]-Fluoroethoxy-benzovesamicol ([^{18}F]-FEOBV) is a positron emitting ligand of the ACh vesicular transporters which reversibly

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binds to its target. It holds promise as a potential ACh system pre-synaptic marker which could be useful for early detection of Alzheimer's disease. *Methods:* Ten male Sprague-Dawley rats received an average i.v. dose of 6.8 MBq of high specific activity [^{18}F]-FEOBV. They were sacrificed at 5, 10, 15, 30 and 60 minutes. Brains were kept for further analysis and blood was analyzed for metabolites using reversed-phase HPLC. *Results:* Blood analysis showed two hydrophilic metabolites (still to be identified). The parent compound had a mean retention time of 120 seconds. Importantly, no lipophilic metabolites were found. Although no physiologic monitoring was done, rats showed no overt signs of physiological distress until sacrifice (up to 60 minutes). *Conclusions:* In this (and other) experiment, FEOBV induced no overt toxicity, an encouraging result in terms of its potential utilisation in humans. The absence of lipophilic metabolites suggests that analysis with a Simplified Reference Tissue Model (a non-invasive, easily implemented approach in a clinical setting) is possible.

P-009

Figurative language is better preserved than literal language in dementia

*L Fornazzari (Toronto)**

Background: Creativity in any of its forms should be understood as a cognitive function with its own neural network. Literal language corresponds to an evolved human acquisition and has its well-established neural network. Only recently, figurative language and metaphors have been incorporated to the discussion of evolutionary biology and the neuro-sciences. *Objectives:* To discuss two writers who in the course of their dementia show marked discrepancies amongst their well-preserved fluent and elegant figurative languages and poor literal ones. Patient 1. 84-year-old right-handed woman, MA in Child education and writer from the age of 16. She was exiled from Chile on September 11th, 1973 and she continued very active in public events directing a writing group for seniors until 2005. In 2002, her family noticed forgetfulness, poor memory for recent events, repeating questions, and dysnomia. Her activities of daily living progressively deteriorated as well as her visuospatial skills. An MRI showed moderate atrophy. Mini-Mental Status Examination 16/30, Frontal Assessment Battery, 14/18, Fluency test, categories 9, F 8, and A 7. Trail making test A & B impaired. Rey Complex figure, revealed global impairment. Preserved were her level of public information and the use of elegant circum locution. Her written material, as we see in the samples, is very well preserved. Diagnosis: AD. Patient 2. 72 years old left handed woman, MA in Theology and writer. In 2004 her family noticed difficulties with names, faces , new places, gradual visuospatial and ADL difficulties. Her creative writing is preserved. She is hypertensive and she had a stroke on the (L) MCA, few years ago. In a year she has decreased her MMSE from 25 to 24, and her MOCA from 22 to 19. She has difficulties with attention, executive functions, immediate and delayed recall and visuospatial functions. FAS for categories was 10 and for F 8. Brain MRI shows an (L) old infarct, Spect Scan, decreased intensity on (L) MCA, (L) orbito frontal and (R) temporal lobe. *Diagnosis:* Vascular Cognitive Impairment. Mixed Dementia? *Discussion:* Artists have the ability to process symbols and to integrate them into a symbolic system as pictorial, linguistic, musical, etc. There has been previously reported preservation of painting and musical expression in patients with dementia. In the literary field the writer Iris Murdock wrote her final novel when the changes provoked in her brain by a confirmed Alzheimer's disease were already well established. In our patients their circumlocutory languages remain elegantly metaphoric as their creative writings, and were better protected of the effect of dementia than their literal language. The dissociation of the figurative language from the literal one is an open and fruitful field of investigation. Figurative language could be a possible way to communicate with ADRD patients when other ways of communication are not possible.

P-010

Correlates of Knowledge of Alzheimer's disesase in Latin American seniors in the GTA

L Fornazzari (Toronto), C Fischer (Toronto), I Abramov (Toronto), T Hansen (Toronto), L Ringer (Toronto)*

Background: Memory loss with age varies across individuals and also across ethno cultural groups. There have been few studies of knowledge levels of Alzheimer's disease in minority populations such as the Latin American population. *Objectives:* To evaluate knowledge of Alzheimer's Disease (AD), subjective and objective memory impairment and depressive symptoms in a group of community dwelling seniors of Latin American (LAS) origin, from the Great Toronto Area. *Methods:* Participants were 125 LAS, 55 years of age and older living in GTA and belonging to the "Associacion de Seniors de Habla Hispana de Toronto" (ASHTOR) who attended an educational session on Alzheimer's disease. Using standardized informed consent procedures they were asked to provide some basic demographic information and then were administered a series of questionnaires both before and after the educational event. The questionnaires were designed to measure knowledge levels, depressive symptoms, memory complaints and objective memory function. *Results:* The group consisted of primarily Latin American women (72%) with a mean age of 70.6 years, a mean level of education of 10.1 years and a mean 21.9 years of living in Canada. Overall, the group was noted to have an average knowledge level (KAD 9.6), relatively high cognitive complaints (MAC-Q 21.7), low depressive symptoms (GDS 1.06), and scored cognitively within normal limits (SPMSQ 8.7). Knowledge levels were identical among men and women and correlated very weakly with level of education (r=0.18 for less than 4 years, and r=0.23, for 4 or more years), age, (r= -0.11) and years living in Canada ,(r= -0.03). There was no correlation between knowledge levels and complaints (r= 0.13). Complaints tended to correlate better with low levels of education (r=-0.5) than higher levels of education (r=0.3). *Discussion:* In spite of the genetic demographic heterogeneity of the group, the sample analyzed is homogenous in education, years spent living in Canada, mood and is cognitively intact. Their knowledge of Alzheimer's disease is low and is not associated with years of education, gender, and only weakly with age, years in Canada, and subjective memory impairment. Memory complaints are negatively correlated with poor education. *Conclusion:* Latin American seniors could benefit from future health promotion initiatives aimed at increasing knowledge of Alzheimer's.

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P-011

The first account of fatal familial insomnia with Alzheimer's type pathology

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Background: FFI is an autosomal dominant disease linked to a prion protein gene (*PRNP*) mutation. It presents with sleep disturbance and is characterized by neuronal loss and gliosis in the thalamic nuclei. Amyloid β/A4 plaques have been described in sporadic Creutzfeldt-Jakob Disease (sCJD) but not FFI. *Methods:* A 49-year-old Chinese woman presented with insomnia, behavioural changes and cognitive decline. Her brother had died of genetically confirmed FFI. There is no family history of Alzheimer's disease. She died 6 months after symptom onset. Post-mortem brain studies and genetic analyses of *PRNP*, *APOE* and *PSEN1* genes were performed. *Results: PRNP* examination revealed an aspartic acid to asparagine mutation at codon 178 and methionine homozygosity at codon 129. *PSEN1* analysis was unremarkable and *APOE* genotype was e3/e3. Neuropathological investigation revealed prion protein staining in neuronal areas, neuronal loss and gliosis in the medial thalamic area, and mild microspongiosis. Alzheimer-type plaques were noted in the neocortex and hippocampus in a frequency beyond that expected for age. Tau staining showed neurofibrillary tangles. *Conclusion:* This is the first reported case of FFI with β/A4 plaques. The relationship between plaques and FFI pathology is unknown. Possibilities include a relationship in the pathogenic process of FFI or a co-occurrence of two diseases.

Epilepsy (EEG, Basic Science, Imaging, Neurology and Epilepsy Surgery)

P-012

A metanalysis of the efficacy of Callosotomy as a treatment for seizures

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Background: Callosotomy has been used over the years to treat atonic seizures ("drop attacks") but some efficacy has been seen in other type of seizures. The objective of this study is to provide evidence-based estimates of the seizure outcome after callosotomy for different type of seizures. *Methods:* An expert in library resources and electronic databases searched electronic sources such as Medline, Index Medicus, and the Cochrane database. We also performed a manual search using pertinent reviews and original articles, book chapters and expert consultation. Two reviewers independently applied the following inclusion criteria: studies published since 1980, at least 10 patients and reporting seizure outcome. We considered outcomes in children and adults. We used seizure freedom as defined by authors. Two investigators independently extracted data, resolving disagreements through discussion. *Results:* Of 795 available articles, 100 potentially eligible were reviewed in full text. Fifty three studies fulfilled eligibility criteria. Overall the median proportion of patients with developmental delay before callosotomy was 94% (95% CI 93-95). The proportion of patients with partial callosotomy was 83% (95% CI 83-84) and complete callosotomy was 10% (95% CI 9-11). Globally the proportion of seizure free patients after callosotomy was 11% (95% CI 9-13). The corresponding proportion of seizure free status for drop attacks was 38% (95% CI 35-41), grand mal seizures was 20% (95% CI 16-24), tonic seizures 17% (95% CI 11-22), absence seizures 24% (95% CI 17-30) and myoclonic jerks 15% (95% CI 9-21). *Conclusions:* 11% of patients became seizure free of all types of seizures and 38% from drop attacks after callosotomy. This metanalysis reports a lower rate of seizure free status in general and for the different type of seizures than previous reports. As was expected, the benefit of callosotomy was higher in patients with drop attacks, although the rate of seizure free is lower compared with the general belief that more than 80% of patients could be seizure free after this procedure.

P-013

The reliability of interictal and ictal EEG in surgically treated refractory temporal lobe epilepsy

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Introduction: Lateralized interictal and ictal EEG recordings and lesions on MRI predict good outcome in temporal lobectomy. Seizure onset and interictal sharp waves cannot always be lateralized with certainty. We assess reliability of interictal versus ictal EEG findings in refractory temporal lobe epilepsy (TLE) in adults and children. *Method:* We retrospectively reviewed 43 patients (28 adult: 15 children), with refractory TLE who underwent temporal lobectomy at a single institution. A four-point grading was developed for EEG findings based on lateralization. 1 - No, 2 - poor, 3 - moderate and 4 - clear lateralization. Patients were grouped to compare clear interictal with poor ictal findings and vice versa. MRIs were reviewed. Surgical outcome was graded by the Engel classification. *Results:* Good outcomes occurred in >80% of patients of all ages with identifiable lesions on MRI and/or clear lateralization on EEG. An MRI finding with clear lateralization resulted in 100% good outcome. A lateralized interictal discharge with poor ictal lateralization was more predictive of success. Good outcome was identified in >90% with interictal lateralization and >80% in ictal lateralization. *Conclusions:* Interictal EEG findings predict TLE surgery outcome. A lesion on MRI with clear lateralization of EEG is predictive of good outcome in this series.

P-014

Movie of ictal high-frequency oscillations and intracranial video EEG: Marching high-frequency power correlating with symptoms in Jacksonian seizures

T Akiyama (Toronto), A Ochi (Toronto), D Chan (Toronto), SK Weiss (Toronto), OC Snead III (Toronto), JT Rutka (Toronto), J Drake (Toronto), H Otsubo (Toronto)*

Background: High-frequency oscillations (HFOs, ≥ gamma frequency) occur at the epileptogenic zone during focal onset seizures. Spatial propagation of HFOs is observed on intracranial video EEGs (IVEEGs) during ictal evolution. We evaluated dynamic

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changes of ictal HFO powers correlating with EEG and ictal semiology in Jacksonian seizures. *Methods:* We recorded IVEEGs in two patients with focal sensory-motor seizures with secondary generalization (sampling rate, 1 kHz). We used Multiple Band Frequency Analysis to calculate power spectra of ictal IVEEGs with windows of 20 ms and 2 Hz, and averaged power within the predominant frequency range of ictal HFOs. We pioneered time-locked movie with topographic HFO power, EEGs and digital videos. *Results:* Ictal HFOs over the postcentral gyrus preceded focal hand sensory symptoms. After the HFOs propagated anteriorly to the precentral gyrus and began reverberating, tonic posturing of the arm occurred. Generalized clonic convulsions coincided with increase in HFO power; however, the HFOs remained in the Rolandic region. *Conclusions:* Jacksonian seizures presented ictal HFOs marching from sensory to motor cortex but staying in the Rolandic region while secondary generalization, time-locked movie of HFO powers and IVEEG reveals evolution of ictal HFO powers from the ictal onset zone to the symptomatogenic zone.

P-015

Identifying children with absence epilepsy requiring two medications for seizure control

*B Nadler (Montréal), M Shevell (Montréal)**

Background: The objective of this study was to identify clinical or electroencephalographic features at initial presentation in a cohort of children with absence epilepsy that may be associated with the need for a second medication. *Methods:* Computerized pediatric neurology data (1991-2007 inclusive) was scanned for all patients with absence seizures. Those children with typical absence seizures, 3 Hz spike and wave on EEG and no apparent symptomatic etiology who were over the age of two years at seizure onset with at least one year of follow-up were included for further analysis. All such children were then divided into two groups; a) a single medication for seizure control and b) two medications for seizure control. *Results:* Fifty-two children met the study's inclusion and exclusion criteria. Of these 52 children, 43 required a single medication for seizure control while 9 required two or more medications for seizure control. A significant difference ($p<0.05$) was apparent between groups with respect to gender (16/43 males vs 8/9 males) and mean age of diagnosis (8.19 years +/- 3.00 vs 6.06 years +/- 2.22). *Conclusion:* Male gender and an earlier age of diagnosis is associated with the need for two medications in children with absence epilepsy.

P-016

EEG patterns of adult patients with cortical dysplasia

JY Jiang (London), LC Ang (London), WT Blume (London)*

Background: Although epileptogenic cortical dysplasias (CD) usually appear as discrete MRI lesions, resective surgery reduces seizures significantly in only 67% (Bingaman and Catalepe, 2001). To investigate this discrepancy, pre-operative EEGs of 50 consecutive patients who underwent resective surgery for CD-related intractable focal epilepsy were reviewed. *Method:* The entry criterion was demonstration of one or more types of CD disclosed by histological review of resective specimens. Sufficiently congruent data for seizure localization from semiology, EEG and MRI were required for surgical candidature. Archived EEG reports were scrutinized for localization of epileptiform (ictal and interictal) and non-epileptiform abnormalities. *Results:* Several EEG abnormalities reflected widespread cortical dysfunction: 1) independent bi-hemispheric abnormalities (spikes, delta, theta) in 25 (50%), 2) EEGs of 22/25 (88%) had focal spikes in each hemisphere , and 3) 14/50 (28%) had spike-waves (SWs) or other bisynchronous epileptiform patterns. Abnormalities were more widespread in extra-temporal (ET) than temporal (T) patients: 1) greater average number of lobes with focal spikes (mean= 3.14 (ET) vs.2.14 (T); $p=0.02$), and 2) higher incidence of SWs (5/23=22% for ET vs. 0/15 for T). *Conclusions:* Multifocal and bilateral EEG abnormalities, common among patients undergoing resective surgery for CD-based intractable epilepsy, may underlie less than expected surgical effectiveness.

P-017

Using administrative databases for research in epilepsy: Validation of ICD-9 and ICD-10 epilepsy codes

A Reid (Calgary), N Jetté (Calgary), H Quan (Calgary), M Hill (Calgary), S Wiebe (Calgary)*

Background: The prevalence of epilepsy is expected to rise with the aging population, making it important to develop surveillance programs to determine future healthcare needs. The purpose of this study was to assess the validity of ICD-9/10 epilepsy coding from administrative databases. *Methods:* We identified all emergency room and inpatient visits at a Canadian tertiary care center during fiscal year 2000 (ICD-9-CM) or 2004 (ICD-10) using discharge abstracts with an ICD code corresponding to epilepsy, transient ischemic attack, syncope, classical migraine, or convulsion. Randomly selected cases were independently reviewed by an epileptologist and neurology resident to determine the presence of epilepsy. *Results:* Epilepsy coding was equally good regardless of hospital setting or ICD classification. The sensitivity and specificity for epilepsy in ICD-9-CM data were 84% and 97% respectively (n=486), and for ICD-10 data were 76% and 94% respectively (n=454). When convulsions were excluded the sensitivity was 98% in ICD-9-CM and 99% in ICD-10. Coding agreement between the epileptologist and resident was excellent. *Conclusions:* Emergency room and inpatient administrative data have good validity in recording epilepsy, however some epilepsy cases may be missed due to miscoding as convulsions. Validation of outpatient databases will also be required for any future surveillance programs.

P-018

Memory perception in a presurgical cohort of adults with intractable temporal lobe epilepsy

SK Balagopal (London), RS McLachlan (London), S Brown (London), BH Abello (London), PA Derry (London)*

Background: Memory impairment, a common complaint of those with temporal lobe epilepsy, has been mainly studied after epilepsy surgery. We are conducting a prospective evaluation of subjective memory in patients with medically refractory temporal lobe seizures undergoing surgical management. *Methods:* Inclusion criteria: (1). At least 16 yrs of age (2) IQ >70 (3) Diagnosis of temporal lobe epilepsy (4) Anterior temporal lobectomy recommended (5) First epilepsy surgery (6) English is first language. Patients filled out the Frequency of Forgetting 10 questionnaire assessing subjective

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memory (FOF -10), the Centre for Epidemiology Studies Depression Scale (CES-D), and the Positive and Negative Affect Scale (PANAS), a measure of the personality trait, neuroticism. Subjective memory testing results were correlated with illness- related variables and results of presurgical investigation. *Results:* The cohort comprised of 36 patients (14 males, 22 females). Mean age = 38 yrs, age at epilepsy onset = 14yrs. 22 (66%) had left temporal and 14 (39%) had right temporal lobe epilepsy. Mean FOF-10 score for the epilepsy group was 44 indicating poorer perceived memory than in a non-epilepsy population (mean=52; $p<0.05$). History of depression was obtained in 8 (22%) while CES-D results suggested depression in 16 (44%). The depressed patients by CES-D had significantly worse FOF-10 scores (mean=39) than the nondepressed group (mean=48; $p=0.007$). FOF-10 scores did not correlate with any other parameter including side of seizure origin. *Conclusion:* Perceived memory impairment is a problem in temporal lobe epilepsy before surgery. This is particularly so when depression is a co- morbidity.

P-019

Prolonged EEG-Video monitoring in psychogenic non-epileptic seizures

AM Al-Kaabi (Winnipeg), N Yahmad (Winnipeg), AE Yankovsky (Winnipeg), Y Aghakhani (Winnipeg)*

Background: Psychogenic nonepileptic seizures (PNES) are often misdiagnosed as epileptic seizures particularly if routine EEGs show interictal abnormalities. We conducted a retrospective case series of patients with PNES admitted for prolonged EEG-Video monitoring. *Methods:* We reviewed the charts of 23 patients with PNES admitted for prolonged EEG-video monitoring at the University of Manitoba between April 2004 and July 2007. We included patients who had at least one clinical event atypical for an epileptic seizure and not associated with any ictal epileptiform discharges. *Results:* Five patients were thought to have both PNES and epileptic seizures. Of the 18 patients with only PNES, 22% had normal interictal EEGs during the admission, 11% had only non-specific slowing and 67% had epileptiform abnormalities. The most common locations of the epileptiform abnormality were bilateral temporal independently, followed by right or left temporal, frontal, and multifocal, in descending order. *Conclusions:* We found a higher percentage of interictal epileptiform abnormalities compared to previous studies. This is most likely due to selection bias as our patients were admitted after an extensive outpatient workup including outpatient EEG-video recording that failed to establish a firm diagnosis. Our study emphasizes the significance of detailed analysis of ictal semiology and EEG-video monitoring.

P-020

A novel *LIS1* mutation in a child with lissencephaly and identification of somatic mosaicism in his mildly affected mother

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Background: Several genes are responsible for normal neuronal migration. Mutations in *LIS1* result in isolated lissencephaly or subcortical band heterotopia. Patients present with developmental delay and seizures. *Methods:* A 3 year old male presented with possible seizures and mild global developmental delay. An EEG revealed prominent right occipital epileptiform activity. An MRI was performed demonstrating posterior lissencephaly with subcortical band heterotopia. His mother had a history of epilepsy with onset in her teenage years. Her MRI revealed no abnormalities. Sequence analysis of the *LIS1* gene was carried out for both the patient and his mother. *Results:* Sequence analysis of the *LIS1* gene in the patient revealed a novel mutation in exon 11 at p.H389Y (c.1165C>T). The patient's mother was found to have the identical mutation with the signal intensity of the mutant allele being much lower than the normal allele suggesting somatic mosaicism. *Conclusions:* This patient has a novel mutation (p.H389Y) in the *LIS1* gene that presents as posterior lissencephaly/subcortical band heterotopia, seizures, and developmental delay in the child, but due to somatic mosaicism, as seizures with normal neuroimaging in his mother. When inherited, mutations in the *LIS1* are transmitted in an autosomal dominant fashion and therefore the recurrence risk for the mother is as high as 50%.

P-021

Aggravation of myoclonus by caffeine in juvenile myoclonic epilepsy

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Introduction: Juvenile myoclonic epilepsy is the commonest primary generalized epilepsy syndrome affecting teenagers. Sleep deprivation, alcohol and missing the antiepileptic drug can result in aggravation of myoclonus and generalized tonic clonic seizures. We report a 14-year-old girl with juvenile myoclonic epilepsy who has caffeine sensitive myoclonus. *Method:* We describe the clinical and EEG features. A review of the role of caffeine in myoclonus is also discussed. *Result:* 14-year-old girl presented to the pediatric neurology clinic with 3-year history of daily generalized myoclonus. The usual frequency was 3-4 per day. She had fallen on three occasions due to myoclonus. She never had loss of consciousness or generalized tonic clonic seizure. The frequency of the myoclonus increased 300-400% when she consumed caffeine (coffee or other caffeinated beverages). Her neurocognitive status and neurological examination were normal. EEG showed generalized poly spike and wave discharges. She was started on Levetiracetam. Her maternal aunt has myoclonus aggravated by coffee. *Discussion:* Caffeine is implicated in restless leg syndrome. Caffeine is responsible for the increased nervous system arousal as well as for the direct peripheral contractile effect on the striated muscle. We postulate that caffeine can decrease the seizure threshold and can result in aggravation of myoclonus. This is the first report on caffeine sensitive myoclonus in epilepsy with a possible genetic link.

P-022

First-line treatment failures in children newly diagnosed with epilepsy

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Background: Several studies have suggested that less than 50% of epilepsy patients become seizure-free with the first antiepileptic drug (AED) prescribed. However, this question has not been fully addressed in children. *Methods:* We conducted a chart review of 220 children who presented with "seizures" to our pediatric neurology clinic between January 1st, 1999 and December 31st, 2002. *Results:* Ninety children were diagnosed with epilepsy and treated with an

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AED. Thirty-two percent of the children failed treatment with their first AED; 38% failed due to side-effects, 38% failed treatment due to lack-of-efficacy, and 24% due to a combination of side-effects and lack-of-efficacy. Twenty-nine percent of children with idiopathic epilepsy failed treatment, 29% of children with cryptogenic epilepsy failed treatment, while 50% of children with symptomatic epilepsy failed treatment. There was no difference between children treated with valproic acid and those treated with carbamazepine. *Conclusions:* Approximately one-third of children newly diagnosed with epilepsy in our pediatric population failed first-line AED treatment. The cause of treatment failures was divided almost equally between lack-of-efficacy and intolerable side-effects, while the etiology of epilepsy and the particular AED used by these children did not appear to significantly influence first-line treatment outcomes.

P-023

Hemispheric Epilepsy (HE) redux

RM Sadler (Halifax), SR Rahey (Halifax)*

Background: HE was initially described by Blume (Brain, 1998). A Web of Science Citation Index search failed to disclose a single additional report of this syndrome. *Methods:* We identified two patients from our centre that fulfill Blume's criteria for HE. Patients were evaluated with video-EEG telemetry. *Results:* Two female patients, aged 26 and 22 years, were admitted for video-EEG telemetry. Both are of normal intelligence, normal neurological exam and MRI and have non-progressive therapy resistant epilepsy. Age at seizure onset was age 2 and 18 years respectively. Seizure semiology includes absence-like seizures and absence-like seizures evolving to secondarily generalized tonic-clonic seizures. One patient may have simple partial seizures; neither have myoclonus.
The EEG of patient #1 demonstrated "generalized" spike waves/polyspikes of consistently higher voltage right frontal plus isolated right frontal spike waves. Ictal absence-like seizures consisted of altered awareness with left head deviation; the EEG pattern was that of diffuse spike waves and rhythmic waves maximum right hemisphere plus right hemisphere postictal slowing. EEG of patient #2 showed right posterior temporal spike waves, right frontal-temporal spikes, polyspikes and trains of rhythmic waves. Ictal behavior during an absence-like seizure consisted of an arrest of behavior accompanied by irregular bilateral delta and right hemisphere spike waves on EEG. *Conclusion:* We describe the first two cases of HE reported since the original description by Blume 10 years ago. This unusual entity is under-recognized and/or under-reported.

P-024

Pediatrics trainees need an EEG handbook: an online survey

*R RamachandranNair (Hamilton)**

Introduction: Textbooks and atlas on EEG are mainly targeted for the neurology trainees and neurologists. Pediatricians and pediatric residents are the front line physicians of seizure management in children. The study was undertaken with the hypothesis that there is a need for an EEG handbook targeted for the pediatric residents. *Aim:* Aim of the online survey was to elicit the residents' opinion on the need of an EEG handbook. *Methods:* An online questionnaire survey was conducted among the residents in an accredited pediatric residency program in the country. Questions included the level of training, knowledge on the availability of EEG handbook, principles of EEG recording, indications for regular, repeat and sleep deprived EEG, differences between the ictal and interictal EEG patterns, EEG patterns of four important pediatric epilepsy syndromes (infantile spasm, benign Rolandic epilepsy, absence epilepsy & juvenile myoclonic epilepsy), practice of writing a specific question in the EEG request, need for an EEG handbook and the utility of incorporating illustrative cases in the EEG handbook. *Statistics:* Correlation of level of training and response to questions was assessed using Kendall's tau-b correlation. *Results:* 118 residents from 8 accredited pediatrics residency programs responded (R1- 41, R2-37, R3-26, R4-14). 81% residents opined that currently an EEG handbook is not available or they do not know. The responses were: the principle of EEG recording (good understanding:4%), indications for EEG referral (good understanding: 20%), indications of repeat EEG (good understanding:1.7%), indications for sleep deprived EEG (good understanding:5.9%), knowledge of EEG pattern in epilepsy syndromes (1 or none: 55%), writing a specific question in the EEG request (always: 22.9%), need for EEG book (very useful: 76.3%). Knowledge about the indications for EEG, repeat EEG and sleep deprived EEG and EEG patterns in epilepsy syndromes increased with higher level of training ($p < 0.05$ in all) *Conclusion:* Significant weakness was observed about the knowledge on various aspects of EEG among residents, though the knowledge increased with the level of training. Majority of the residents opined that a handbook on EEG is very useful.

P-025

Adaptive behavior in children presenting with a first afebrile seizure

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Background: Cognitive and behavioral co-morbidities are common in children with epilepsy. Our goal was to assess adaptive behavior in children presenting with first afebrile seizure. *Methods:* Children with a first unprovoked seizure, ages 1 to 17 years, were prospectively seen in our First Seizure Clinic. Parents completed the Vineland II adaptive behavior questionnaire. *Results:* Parents of 23 children (mean age 10 ± 4.1 yrs, 12 F/11 M) participated: generalized seizures (6), partial seizures (15) and unclassified (2). Seven (30%) developed epilepsy over a 9-month follow-up. Although children showed no significant difference in overall adaptive functioning ($p = 0.66$) when compared to the normative sample (four (18%) had low/moderately low scores), they had significantly higher maladaptive ($p=0.02$), specifically internalizing ($p<0.0001$) behaviors. Those who went on to develop epilepsy were more likely to have maladaptive behaviors ($p=0.01$). *Conclusion:* Although most children presenting with a first seizure have normal adaptive function, they show significantly greater maladaptive behaviors than expected based on population norms. Our results are in keeping with published data in children with epilepsy suggesting that these symptoms may be present at time of first seizure presentation. If a larger cohort substantiates these results, screening for these at the time of epilepsy diagnosis would be important.

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P-026

Epidemiology of epilepsy during one year at Ashayer Hospital in Khorramabad

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Background: Epilepsy is one of the most common and serious neurology disorder and health problems in developing countries. About 40 million people in the world are affected by epilepsy. Lack of good control and supervision of this disease in addition to poor economic and social effect can lead to some complications such as education, learning and behavioral problems and even death. One of the helpful factors of diagnoses and treatment of this disorder is to identify prevalence, epidemiology and effective factors of epilepsy. *Methods:* This was a cross - sectional study and method of sampling was census and data was obtained via questionnaire by using of information in patients hospitalized files on Ashayer Hospital in Khorramabad(01/08/2006-31/07/2007). Data were analyzed with SPSS program. *Results:* In this study 510 Patients referred to hospital due to seizure and 318 Patients had epilepsy (192 patients had provoked seizure). Mean age was 28.4 years old and 34.4% of them had age of seizure's onset between 11-22 years old. 59.7% of patients were male and 40.3 % were female.(This study not included children) 58.7% were single and 41.5% were married. 68.9% were urban and 31.1% were rural. Family history of seizure was present in 15.1% of the cases. 67.6% had generalized tonic clonic seizure, 10.4% had complex partial partial seizure and 5.7% had focal seizure secondary generalized 62.3% had idiopathic or cryptogenic epilepsy, 6.7% had head trauma, 8.8% had cerbrovascular disorder and 6.9% had solid organ lesion. 67.3% had abnormal EEG, 58.2% had abnormal CT scan and 10.7% had abnormal MRI. *Conclusion:* Epilepsy was more common in 22 - 65 years old and in males . Idiopathic epilepsy (62.26%) was more than symptomatic epilepsy (27.74%) and most common cause after idiopathic was head trauma. At the end, giving information about this disease and the ways to prevent and remove the predisposing factors are the most important part of treatment that causes to prevent of psycho - social problems.

P-027

Psychogenic non-epileptic seizures and associated disorders in Manitoba

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Background: Psychogenic nonepileptic seizures (PNES) are, by definition, a physical manifestation of a psychological disturbance and better understanding of the underlying factors is crucial for physicians, patients and their family. *Methods:* We conducted a retrospective review of the patients whom were diagnosed with PNES at the University of Manitoba between April 2004 and July 2007.We included those who had at least one clinical event that was atypical for an epileptic seizure and not associated with any ictal epileptiform discharges on prolonged EEG-Video monitoring. *Results:* Forty-four patients, 33 female, with a mean age of 39.2 and a mean age of onset of 27.3 years were reviewed. Associated conditions were; a history of head trauma in 17 (38.6%), educational difficulties in 14 (31.8%), a dysfunctional family in 14 (31.8%), mental retardation 3 (6.8%), and psychiatric disorder in 25 (56.8%) including depression in 13 (29.5%), personality disorders in 8 (18.1%), suicidal ideation in 9 (20.4%), and suicidal attempt in 5 (11.3%), sexual abused in 5 (11.3%), physical abuse in 2 (4.5%), PTSD in 3(6.8%), bipolar mood disorder in 2 (4.5%), and somatoform disorder in 1 (2.3%). *Conclusions:* Our results confirm that PNES is part of a wide-spectrum psychosocial disorder and a multidisciplinary management is warranted.

P-028

Is migrating partial seizures of infancy an under-recognized early epileptic encephalopathy syndrome?

R RamachandranNair (Hamilton), M Zaazou (Hamilton), GM Ronen (Hamilton)*

Introduction: Migrating partial seizures of infancy (MPSI) is considered a rare malignant epilepsy syndrome of early infancy. So far 32 cases have been reported in the literature. Onset was reported from first day of life up to 7 months of age. Diagnostic criteria proposed by Coppola et al have been widely accepted, though the prognosis for psychomotor development may not be universally poor.[1,2] We report the seizure characteristics and EEG findings in an infant with MPSI and suggest including this syndrome in the early epileptic encephalopathies. *Results:* Seizures developed on the day 17 of a term baby girl who had no perinatal insults. Eye deviation, nystamus, focal clonic movements and tonic seizures in clusters characterized the seizure semiology. Neurodevelopment showed microcephaly, lack of visual attention and hypotonia. We recorded multiple seizures in various localizations on numerous EEGs. Seizures with clear or absent clinical manifestations were localized to the right occipital regions, right frontal region, left temporal region and right frontal spreading successively to left frontal, left temporal and finally right temporal region. The patient failed to respond to any of multiple antiepileptic drugs or the ketogenic diet. Her MRI brain and various metabolic investigations including CSF neurotransmitters assay were normal. *Discussion:* This case represents the typical migrating focality in seizure origin. It has been hypothesized that neurotransmitter dysfunction with persistent, pronounced excitatory or cytotoxic mechanisms may explain the continuous, erratic epileptic activity and the poor developmental outcome. The electrolinical picture should alert clinicians to recognize early this rare epileptic encephalopathy syndrome and counsel the family accordingly.

References:

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P-029

A proposal to improve epilepsy care in Haiti.

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Background: Haïti ranks 150th of 175 countries on UN Human Developmental Index. We do not know the exact prevalence of epilepsy in Haiti, but it is estimated at 10-12/1000. The goal of this project is to develop access to proper epilepsy care in Haïti. *Methods:* Haïti has no neurologist and one private EEG-imaging centre that sends recordings to the Dominican Republic for interpretation. We are helping them built the first epilepsy clinic, re-

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instate a neurology course in the local universities and educate the population about epilepsy. *Results:* The project is supported by the International League Against Epilepsy and the Canadian Neurological Sciences Foundation. We rented room for an EEG laboratory and Stellate will provide us with a machine. A paediatrician will come to Montreal to train in EEG. Four Canadian and 2 US neurologists will start teaching the neurology curriculum at the Medical Schools starting in the fall of 2008 over a 6-week period. Our project is under review by the WHO. *Conclusion:* Improving epilepsy care in Haïti could better the quality of life of up to 800 000 people. We hope that the leadership of the CLAE in this project will serve as basis of many similar projects.

P-030

Non-convulsive status epilepticus; a Manitoba experience

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Background: Non-convulsive status epilepticus (NCS) is a heterogeneous electroclinical syndrome with diverse causes, clinical features and course. We conducted this study to examine NCS at Health Sciences Center in Manitoba. *Methods:* A chart review of patients with NCS between Jan 1, 2006 to Dec 31st 2006 was performed. *Results:* Thirty patients, 15 males, with a mean age of 50.7 (range 17-80 years) were reviewed. Fifteen (50%) had clinical seizures consistent with complex partial seizures and nine had a combination of complex partial and generalized seizures. The mean GCS on presentation was 8. Twenty-one (70%) had various focal neurological abnormalities on exam. The most common cause of NCS was EtOH withdrawal (20%) followed by subtheraputic anti-epileptic medication levels (16.7%). Fifteen had a history of previous seizure disorder and sixteen (53%) had a history of alcohol abuse. Twenty-two (73.3%) required three or more drugs to control their seizures and twenty-seven (90%) required ICU admission. Eighteen patients (60%) returned to their baseline, and five (16.7%) died. *Conclusion:* Alcohol abuse and alcohol withdrawal were common factors in this group of individuals, and NCS should be strongly considered in a patient with an altered level of consciousness and a history of alcoholism. Keywords: Status Epilepticus, alcohol, EEG, ICU

P-031

3T MRI, MRS and glutamate levels in temporal epilepsy

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Background: Epilepsy results from an imbalance between excitatory (glutamate) and inhibitory (GABA) neurotransmitters. In a previous study using 1.5T MRI, we demonstrated that NAA, an excitatory amino acid metabolite, was significantly decreased in children with chronic temporal lobe epilepsy (TLE) compared to those with new onset TLE. In the present work, we used 3T imaging to test our hypothesis that glutamate levels determined by magnetic resonance spectroscopy (MRS) could be used to localize epileptic activity in children with a new TLE diagnosis. Furthermore, we evaluated the clinical benefits of using 3T MRI versus 1,5 T. *Method:* Thirteen patients, aged between 8 and 38 years, presenting TLE, were analyzed with 3T MRI combined with surface coil spectroscopy. Glutamate levels were measured in both hippocampi and in a parieto-occipital area that served as a control. *Results:* We observed a significant increase in glutamate levels on the side of the hippocampi showing structural abnormalities (mean 1,35 vs 1,20 p=0.0351). This elevation was observed both in patients with chronic and newly diagnosed TLE, but was more pronounced in patients with chronic TLE. The use of 3T MRI increased the diagnostic yield compared with 1,5T MRI. *Conclusion:* Increased glutamate levels were lateralized to the lesional side early in the course of TLE and remained elevated. 3T MRI appears to be more sensitive in detecting subtle structural abnormalities.

P-032

Clinical neurophysiological investigation of acquired auditory-visual synesthesia

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Background: Neurophysiologic evidence of auditory visual synesthesia (AVS) exists in neonates and blind patients. We present neurophysiologic evidence of AVS in a healthy 42-year old woman. She had two migraine headaches in her early thirties, persistent positive and intermittent negative visual phenomena starting at age 37, followed by AVS of light flashes with auditory stimuli. Neurological and ophthalmological work up has been negative. *Method:* Magnetoencephalographic evaluation (Elekta-Neuromag whole head system) was done twice with dense array EEG in the second trial. 700 Hz auditory tones of 50 milliseconds duration were given at 60 db above the hearing threshold at 2 per seconds rate in a dark room. *Results:* Patient had bilateral symmetrical Auditory Evoked Fields followed in 10 msec by bilateral Occipital Evoked Fields. The second MEG/EEG confirmed the result. The patient had a 14 seconds electrographic event in the left posterior temporal area several minutes after cessation of auditory stimuli. *Conclusions:* We have shown neurophysiologic evidence of activation of occipital cortex following auditory stimuli. This may represent recruitment of existing cross-modal sensory pathways in an adult without visual deafferentation. Further work up as to the diagnosis of migraine vs partial epilepsy is ongoing.

P-033

Reduced sensitivity of a bedside 4 channel continuous EEG monitor to detect seizures: subhairline montage versus standard technology

M Sharpe (London), L Norton (London), C Davies-Schinkel (London), B Young (London)

Background: Continuous EEG (cEEG) monitoring is often unavailable or delayed in application in patients at risk of seizures. Using a subhairline montage, sensitivity of seizure detection is ~ 72% . We compared recordings from a cEEG bedside monitor, using a subhairline montage to a standard 16 lead EEG to determine possible causes of failure of seizure detection with this new technology/montage. *Methods:* Simultaneous EEG's were independently analyzed for seizures from a Datex-Ohmeda bedside, 4 channel cEEG (sampling rate 100 Hz) and a standard 16 lead EEG (XLTEK; sampling rate 250 Hz). *Results:* Seizures were detected in

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31% (n=22) of patients (std EEG) but only 14 seizures were detected using the bedside technology (sensitivity = 64%). Non-detection of seizures in the bedside cEEG was not related to location of seizure. *Conclusions:* The subhairline montage appears to be adequate for detection of seizures, although non-specific in location. Factors affecting quality of bedside cEEG thereby increasing the difficulty in detecting seizures includes EKG, EMG and 60Hz (electrical) contamination, and a low sampling rate which potentially will not detect some spikes. We recommend future EEG bedside technology to include EKG, low and high pass filters, and to utilize a higher sampling rate (>250).

P-035

Localization of the right insular cortex cardioinhibitory centre

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Background: This study was conducted to identify the regions of right insular cortex (IC) involved in cardiac bradyarrhythmia because of its potential role in the pathogenesis of sudden unexpected death in epilepsy (SUDEP). *Method:* The sympathetic neuronal activity (SNA) and cardiovascular regulatory centers at the right insular cortex were monitored and mapped by fMRI and low intensity cortical stimulation using stereotactically implanted depth electrodes whose locations were confirmed by CT/MRI super-imposition, in a patient with a small lesion in the right posterior IC and intractable epilepsy. *Result:* The right posterior superior IC was involved when both heart rate and sympathetic neuronal activity increase reflexively. Stimulation of the posterior superior IC at rest produced inhibition of heart rate (3 beats /minute) and a fall in blood pressure. During handgrip contraction the stimulation attenuated the normal heart rate response to exercise to only a 1 beat/minute increase. Therefore, the posterior superior IC appears to play an important role as a cardioinhibitory centre. *Conclusion:* The posterior superior right IC plays an important role in cardiac bradyarrhythmia. This challenges the previously held notion that anterior IC carried out this function. Further investigations are required to determine a connection between this region and SUDEP. Words: Insular cortex- Epilepsy -Depth electrodes- FMRI-Stimulation

P-036

Injuries in patients with self-reported epilepsy - a population based study

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Background: To identify the prevalence of injuries in people with epilepsy (PWE) in the general population. *Method:* We examined the prevalence of injuries obtained through the previously validated, door-to-door Canadian Community Health Survey (N = 130,882). Among those reporting injuries, variables of interest were compared in people with epilepsy and in the general population. *Results:* The 12-month weighted prevalence of injuries was not different in PWE (14.9%) and in the general population (13.3%) (RR 1.1, CI95 0.90 - 1.3). Among individuals reporting injuries, the only significant differences were a lower frequency of sports-related injuries in PWE (RR 0.7, CI95 0.4-0.9), and a three-times higher frequency of hospitalization following injuries in PWE (RR 3.0, CI95 1.3-4.7). No significant differences between PWE and the general population were seen with regard to place where injury occurred, mechanism of injury, and number of injuries. *Conclusions:* The overall rate of injuries limiting activities did not differ between PWE and the general population. A higher rate of injury-related hospital admissions was seen in PWE, which could indicate that hospitalization was related more to seizures and comorbidities than injuries alone. Alternatively, this trend may reflect a more cautious attitude of clinicians toward injuries in PWE.

P-037

High incidence of severe hypoxemia associated with partial seizures

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Background: Asphyxia with non-convulsive partial seizures was first described by Hughlings Jackson. Ictal-associated hypoxemia has been documented in a small number of patients. This study was designed to examine the incidence and severity of ictal-associated hypoxemia in patients with medically refractory partial seizures undergoing inpatient video-EEG telemetry. *Methods:* We studied 56 consecutive patients with localization-related epilepsy admitted for inpatient video-EEG telemetry. Respiratory parameters including pulse oximetry data, nasal airflow and plethysmographically-monitored abdominal excursions were recorded synchronized with EEG, video and single channel EKG. *Results:* Fifty-six patients with medically refractory partial seizures (34 female, 22 male) with a mean age of 38.6 years (range 16-63 years) were monitored. Median seizure duration was 64 seconds (range 3-610 seconds). Oxygen saturation data was available for 304 partial seizures prior to, or without, secondary generalization. 101 of these were associated with desaturations below 90%, 31 below 80% and 11 below 70%. The median delay of desaturation below 90% was 59 seconds (range 6-226 seconds) after seizure onset. The median saturation nadir occurred 86 seconds after seizure onset (range 8-521 seconds). The median desaturation duration below 90% was 47 seconds (range 2-296 seconds) but recovery of oxygen saturation to within 2% of baseline was prolonged, with a median of 90 seconds (range 8-407 seconds). The majority of seizures associated with desaturations were of temporal onset, 60 right (59.4%) and 23 left (22.8%). Eleven patients had no desaturations below 90% with any of 64 recorded seizures, 45 of which (70.3%) were of extratemporal onset. Nasal airflow and abdominal excursion data were available in 93 seizures, revealing evidence of central apnea (39), hypopnea (6), obstructive apnea (2) and mixed apnea (7). There was no apnea in 39 seizures. *Conclusions:* Oxygen desaturations occurred in association with partial seizures without, or prior to, secondary generalization in 80.4% of consecutively monitored patients with medically refractory partial seizures, most commonly in seizures of temporal origin. In many cases the desaturations were prolonged and pronounced. Ictal apnea or hypopnea was also detected in some patients. Ictal-associated hypoxemia and respiratory dysfunction may be a factor in sudden unexpected death in epilepsy.

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P-038

Epilepsy surgery in a 75-year old man with recurrent status epilepticus

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Background: Epilepsy surgery is increasingly well-supported as an effective treatment for patients with intractable epilepsy. It is most often performed on younger patients. The safety and efficacy of epilepsy surgery in elderly patients are not frequently described. *Methods:* We report a case of a 75 year-old man who had intractable complex partial seizures despite treatment with multiple combinations of anti-epileptic medications. He had begun to have seizures seven years earlier, at which time a meningioma over the left frontal area was identified and resected. He continued to have frequent seizures, presenting in status epilepticus every two or three months, and requiring long hospital admissions on each occasion for post-ictal confusion and aphasia. *Results:* Scalp EEG showed continuous spikes and polyspikes and persistent slowing in the left temporal area, as well as less frequent spikes in the left frontal area. EEG telemetry recorded multiple seizures, all with a clear focus in the left temporal area. MRI scan showed left mesial temporal sclerosis and an area of encephalomalacia in the left temporal lobe, as well as encephalomalacia in the area of the previous meningioma resection. Neuropsychological testing showed bilateral memory impairment with no significant cognitive decline expected after unilateral temporal lobe resection. The patient was found to be an acceptable surgical risk. A left anteromesial temporal lobectomy was performed, guided by intra-operative electrocorticography. There were no peri-operative complications. Since surgery, the patient is not seizure-free, but has had no further episodes of status epilepticus. *Conclusions:* This is the oldest patient reported in the literature and supports the possibility of epilepsy surgery in elderly patients in cases where an indication exists. On the other hand, few cases with this malignant evolution of temporal epilepsy have been described in this age group.

P-039

Malformations of cortical development: Histopathological subtypes and clinical outcomes after pediatric epilepsy surgery

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Background: Malformations of cortical development (MCD) are common in children undergoing epilepsy surgery but have not been well studied from a clinical standpoint. The goal of this study was to examine the concordance between MCD histopathological subtypes and clinical markers of severity such as IQ, quality of life and seizure outcome using a well-known histopathological classification system (Palmini et al., 2004). *Methods:* A retrospective pilot series of 10 children who underwent epilepsy surgery for intractable seizures was reviewed. Cases were classified into MCD subtypes based on post-surgical histological analysis of resected tissue. *Results:* Histopathology subtype severity did not relate to clinical markers: children with severe intellectual disabilities occurred in the mildest MCD category, and children with normal IQs were represented in severe focal cortical dysplasia subtypes. Quality of life was high in even the more severe MCD subtypes despite incomplete post-surgical seizure control. *Conclusions:* Our preliminary results indicate a variety of clinical outcomes in MCD histopathological subtypes in pediatric epilepsy and suggest that children with brain malformations may enjoy good quality of life after epilepsy surgery despite incomplete seizure control. Methodological issues relating to interpretation of results in studies of pathological subgroups of brain malformations in epilepsy will be discussed.

P-040

Two cases of Neurofibromatosis type I and medically intractable complex partial seizures

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Background: Neurofibromatosis type I (NFI) is a neurocutaneous disorder associated on occasion with epilepsy. We report two patients with complex partial seizures (CPS) and NF1 one of whom also has Moya-Moya disease. *Method:* A review of our epilepsy database at University of Manitoba revealed two patients with NFI and medically intractable CPS. *Result:* Patient 1 was a 26-year-old right-handed male with history of seizures since age 7. Presurgical assessment suggested seizures originated in the left atrophic mesial temporal structures. Interestingly, the patient was found to have asymptomatic Moya-Moya disease during WADA test. He underwent a left selective amygdalo-hippocampectomy (SAH) with seizure freedom at three-month follow-up. Patient 2 was a 25-year-old right-handed male with history of seizure onset at age 12. His presurgical assessment including Stereo-EEG revealed his habitual clinical seizures originated from MRI negative right mesial temporal structures. However, several pure electrographic seizures were recorded from the contralateral temporal lobe. A right SAH was preformed which has led to a significant seizure reduction at four-month follow-up. *Conclusion:* Epilepsy surgery could be considered as a therapeutic option in patients with NF1 and intractable CPS. A longer follow-up period to demonstrate durability and additional similar cases are needed to draw firm conclusions.

General Neurology

P-041

Evaluation of memory, disability and psychological disturbance in Iraqi multiple sclerosis patients

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Background: Cognitive impairment is a recognizable aspect of multiple sclerosis (MS), memory is impaired at an early stage of the disease, besides MS is associated with variable degrees of disability, this greatly affects patients mood through the course of the disease. *Patients and Methods:* Sixty relapsing remitting multiple sclerosis patients were recruited from MS clinic, Baghdad teaching Hospital and matched to forty controls for demographic variables. Rey auditory verbal learning test (RAVLT) was used for memory assessment, for disability assessment the pain disability index was used (PDI), and hospital anxiety and depression scale (HADS) was used to assess psychological aspect of the MS patients. *Results:* RAVLT results indicate statistically significant difference between

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MS and control group in the 1st recall trial, proactive interference and recognition memory (hits and correct rejections). Impaired recall memory was reported in 18.03% of MS patients and impaired recognition memory in 30% of them. Major disabilities were in recreation, family/home responsibilities social activity and occupation. The mean of PDI for all activities was 3.628 ± 0.318 (mean ± S.E), HADS shows 55 % of MS patients suffers anxiety and 63 % suffers depression. Euphoria was also reported in many patients despite the disability and the pain. *Conclusion:* It was concluded that Iraqi MS patients suffer impaired immediate memory and some sort of impaired verbal long term memory.Higher disability score were obtained in certain domains while less scores in others (sexual behavior, self care and life support activity). Denial may play a role in reducing the score of these items.Mood disturbance was reported in higher percentage than it might be for biological, social and psychological factors .

P-042

Nitric oxide is affective in stress-induced prefrontal cortex

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Objective: In this research we study the effects of nitric oxide on prefrontal cortex of rat brain which impressed by stress to define the synchronous impression of stress and nitric oxide on evolution after the birth of rats' prefrontal cortex. *Materials and Methods:* In this study, three materials include: L-arginine(200 mg, kg) as No pre cursor, L-NAME (20 mg, kg) as nonspecific No synthrase inhibitors and 1-nitroindazole(25 mg, kg) as specific No synthrase inhibitors were injected to 48 wistar male rats during one month. The experiment was done on two groups' rats, with stress and without stress. The kind of stress was immobilization type. The brain of rat was divided into two, frontal part for histological studies with H&E staining and posterior part for determining the measure of No by spectrometry method with 540 nmë. *Results:* This study results indicated that the thickness of prefrontal cortex, number of cells, and measure of No production in rats influenced by stress, is decreased in comparison with rats without stress, under the receiver stress of L-NAME and 7-nitroindazole in the way that these two materials caused damages of stress become worse but L-arginine increase damages with producing NO. *Conclusion:* According to this study we can conclude that the stress of immobilization damages the prefrontal cortex and also NO inhibitors can aggravate the cortical damage. On the other hand although No precursor decreases the cortical damage in rats impressed by stress, it can result in these damages in rats' brain without stress.

P-043

Utility of pulsatility index in idiopathic intracranial hypertension

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Background: Idiopathic intracranial hypertension (IIH) can be an elusive diagnosis, and poor visual outcomes may occur. At present, the only means of diagnosing and following these patients is with lumbar puncture and direct manometry, with many patients being subjected to repeated testing. Previous work has shown that transcranial doppler (TCD) measurements of pulsatility correlate accurately with elevated intracranial pressure (ICP) of other etiologies. Our primary objective was to assess whether patients with IIH had elevated pulsatility indices (PI) compared with controls. Secondary objectives included assessment of CSF withdrawal effects on PI in newly diagnosed patients. *Methods:* A search of health records disclosed 26 patients with a diagnosis of intracranial hypertension, of whom 13 met inclusion criteria. TCD measurements from 13 patients with IIH were compared to 13 similar controls. In 4 patients, TCD measurements were performed immediately before and after lumbar puncture. *Results:* Measurements of PI were significantly higher in the IIH group (0.83 vs. 0.76, p = 0.04). In 4 patients for whom CSF withdrawal was performed, PI dropped by an average of 11% after withdrawal of CSF, with a corresponding average drop in CSF pressure of 19 cm H_2O as measured by direct manometry. *Conclusions:* These results suggest that TCD measures of PI vary according to intracranial pressure in patients with IIH. This technique may provide an effective means of following patients with known IIH, offering less invasive means of documenting trends in ICP over time as compared with repeat lumbar puncture. For patients with papilledema and visual symptoms, lumbar puncture offers additional therapeutic advantages and remains standard of care.

P-044

Progressive multifocal leukoencephalopathy in a chronic lymphocytic leukemia patient after treatment with rituximab: a case report

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A 66-year-old man presented with confusion, dysphasia, frontal headache and personality changes. His neurological condition deteriorated rapidly over the next 3 months. Three years previously, he had been treated with conventional chemotherapy for low-grade follicular B-cell lymphoma. Six months prior to his acute presentation, he had been treated with rituximab; an anti-CD20 monoclonal antibody. MRI revealed a focal, right frontal lobe, heterogeneously enhancing lesion suspicious for neoplasm. The patient underwent an urgent stereotactically-guided brain biopsy. Microscopy revealed demyelination, oligodendrocyte viral inclusions, gliosis and bizarre astrocytes. Polymerase chain reaction (PCR) was positive for JC virus. These findings were consistent with progressive multifocal leukoencephalopathy (PML). This is one of the first reports in Canada of PML occuring in a patient treated with rituximab.

P-045

The functional role of the brain finger protein, BFP/ZNF179, in neural differentiation of embryonic carcinoma P19 cells

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Background: Brain finger protein, ZNF179, is a member of the RING finger protein family. The expression of ZNF179 is accompanied by the embryogenesis and sustains high expression level in the adult brain. It has been found that the expression of ZNF179 was significantly decreased in the neurodegenerative diseases such as Huntington's disease and amyotrophic lateral sclerosis (ALS). Therefore, the functional role of ZNF179 in neural cells is worthwhile for further investigation. *Methods:* We used Real-Time Quantitative RT-PCR to detect the expression profile of ZNF179 during neural differentiation of P19 cells. Then we established the stable ZNF179 knock-down cell line and to

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investigate whether ZNF179 plays a role in neural differentiation and/or in neural function. *Results:* In this study, we found that the expression of ZNF179 was remarkably increased in the RA-induced P19 cells neural differentiation and knock-down of ZNF179 significantly attenuated neural differentiation. *Conclusion:* We provide evidence for the functional role of ZNF179 in neurons and the detailed mechanism will be further clarified.

P-046

A squirrelly sensation in a postcentral gyrus infarction

MJ MacDonald (London), MJ Strong (London)**

Background: Formication is an abnormal perceived sensation of ants or animals crawling on the skin. A literature review revealed no cortical localization for formication. *Methods:* We report a case of a seventy year old, right hand dominant male who presented with sudden onset of geographical agnosia, followed by the sensation of a squirrel crawling on his trunk, back, arms and legs bilaterally. He also described right hand asomatognosia, dressing apraxia and expressive aphasia. Complete resolution of symptoms occurred after thirty minutes. *Results:* On examination there was no evidence of substance use or withdrawal. There was left eye dominance, dysgraphaesthsia in the right hand and decreased two point discrimination in the right arm to ten centimeters. Magnetic resonance imaging (MRI) revealed a small area of restricted diffusion on diffusion-weighted imaging within the left postcentral gyrus. *Conclusion:* The history of geographical agnosia, asomatognosia, dressing apraxia and the physical findings of dysgraphaesthia and impaired two point discrimination is consistent with a nondominant parietal lobe syndrome. MRI findings of acute left parietal lobe infarction support this diagnosis. The combination of left eye and right hand dominance suggests mixed hemispheric dominance. Therefore the left parietal lobe may be nondominant. Formication is not a usual symptom of parietal lobe infarction. To our knowledge this is the first case report of formication having a clear cortical localization in the nondominant parietal lobe.

P-047

Cranial nerve palsies associated with influenza B

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Background: Influenza B is a relatively common cause of influenza worldwide, although the reported incidence of neurological complications in adults is very low. To our knowledge, there are no reported cases of isolated cranial nerve palsies associated with influenza B infection. *Methods:* Case report. A 42 year old man presented with a 1 day history of diplopia, left eyelid droopiness and headache, preceded by a 2 day history of cough, coryza, myalgias, and fever. There was no alteration in level of consciousness and no other focal neurological symptoms. He was an otherwise healthy man and was on no medications. Initial examination revealed a temperature of 39.3ºC. He was not encephalopathic and had no nuchal rigidity. Examination of his eyes was consistent with complete left third and fourth nerve palsies. The remainder of his neurological exam was normal. MRI of the brain with gadolinium enhancement and MRA were normal. CSF studies were normal. A nasopharyngeal swab was positive for influenza B. Extensive serological and CSF studies were all negative. During his stay in hospital, there was marked improvement in his systemic symptoms and a significant improvement in his eye movements was also observed. *Conclusions:* With increasing concern in our population about influenza and its sequelae, heightened vigilance for associated neurological deficits such as we observed is important.

P-048

Akinetic mutism with waxy flexibility and increased spontaneous blinking: a case report

AM Al-Kaabi (Winnipeg), JL Johnston (Winnipeg), AE Yankovsky (Winnipeg)*

Background: Anterior cerebral artery (ACA) infarction is a known cause of akinetic mutism. *Methods:* We studied a case of ACA infarction causing akinetic mutism and two clinical signs not previously reported. *Results:* A 66-year old female presented with akinetic mutism and increased spontaneous blinking. She blinked rhythmically and almost continuously up to 120 blinks per minute. A video clip will demonstrate the blinking. She also demonstrated waxy flexibility of all limbs. Electroencephalography (EEG) was normal including normal posterior alpha. Diffusion-weighted magnetic resonance imaging (MRI) showed an acute left ACA infarct involving the medial frontal gyrus. *Conclusions:* Akinetic mutism with waxy flexibility is difficult to differentiate from catatonia. The lack of a psychiatric history or any other features of catatonia, such as peculiar motor mannerisms or repetitive limb motions, made this diagnosis unlikely. Waxy flexibility has not been previously reported in ACA infarction. The normal EEG in the setting of continuous rhythmic blinking ruled out seizure activity. As the act of blinking requires both activation and inhibition, we hypothesize that neurons in the medial frontal gyrus excite subcortical structures that are inhibitory to the blink process. Loss of these frontal neurons causes release of inhibition and increased spontaneous blinking.

P-049

High yield of clinically relevant abnormalities beyond the cervical carotid using arch to vertex CT-angiography in TIA and minor stroke: the ideal emergency department vascular screening test?

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Background: CTA has potential advantages over other modalities due to availability and extent of vascular assessment when investigating for carotid stenosis in TIA and minor stroke patients. *Methods:* CTA head and neck radiology reports of patients with TIA or minor stroke (NIHSS score of <6) investigated within 24hours of symptom onset were screened for any symptom relevant vascular pathology even beyond cervical carotid. *Results:* 504 (59.4%) of 849 patients from CTA database had NIHSS score <6. Brain relevant aortic arch abnormalities seen in 8 (1.6%) patients. Extracranial vessel pathology: 77 (15.3%) patients with ipsilateral, 46 (9.1%) with contralateral carotid stenosis, 15 (3.0%) with nonstenotic carotid ulcerated plaque or intraluminal thrombus, 3 (0.6%) with carotid dissection, 18 (3.6%) with symptom relevant vertebral stenosis.

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Intracranial large artery stenosis relevant to symptoms present in 79 (15.7%), typical patterns for vasculitis and AVM found in 2 (0.4%) patients, respectively. Incidental findings requiring further investigation reported in 25 (5.0%) cases. *Conclusion:* CTA identifies large number of clinically relevant vascular abnormalities well beyond cervical carotid, especially intracranially. Given the practicality of this modality and its vascular yield it should be considered the standard vascular imaging investigation of TIA and minor stroke in the emergency department.

P-050

Could adenocarcinoma of prostate be a cause of epilepsia partialis continua?

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Background: A diverse list of pathological processes has been identified as cause of Epilepsia Partialis Continua (EPC) including paraneoplastic disorders involving anti-Hu antibodies. *Method:* We report a case of EPC associated with adenocarcinoma of prostate (AP). *Result:* A 49-year-old right-handed man presented with an acute mild expressive dysphasia, headache, a generalized tonic-clonic status epilepticus followed by EPC involving left upper limb. EEG recordings displayed diffuse slow activity and low amplitude epileptiform activities over the right central-parietal regions associated with the left arm jerking. Serial brain MRIs, an angiogram/venogram, and a SPECT study all yielded unremarkable results. Routine CSF analysis and bacterial, viral, and fungal, assessment were non-contributory. Duodenal biopsy for Whipple's disease, vasculitis work up and anti-Hu antibodies were negative. Combination of four antiepileptic medications and three courses of IVIG had a limited effect. Nine months later the patient developed left lower limb edema, and lymphadenopathy. Subsequent investigations revealed AP with bone and abdominal metastasis. *Conclusion:* Association of EPC and AP and lack of other explanation despite extensive work up, raise the question of paraneoplastic nature of EPC in this case, but further studies are needed to draw a firm conclusion. Keywords: Epilepsia Partialis Continua, Prostate Cancer, Paraneoplasia, MRI, EEG.

P-051

A novel 33bp duplication of the *ARX* gene causes Partington Syndrome

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Background: Mutations in the *ARX* (Aristaless-related homeobox) gene are associated with several X-linked neurological disorders. A common 24 bp duplication mutation is associated with infantile spasms, non-syndromic intellectual disability (ID), and Partington syndrome (ID and hand dystonia). *Methods:* Two brothers with a novel *ARX* duplication are described. *Results:* The proband presented at 5 months with infantile spasms and delay. Hand dystonia was noted by 2 years. At 15 years he has generalized dystonia and moderate ID. The proband's younger brother presented with delay and hand dystonia before one year. His dystonia has progressed more slowly. He developed generalized epilepsy at 9 years, currently controlled on lamotrogine. At 10 years he has limited speech and moderate ID. We found a novel 33 bp duplication (426_458dup33) within exon 2 of *ARX* in both boys. This occurred in the same region of polyalanine tract 2 as the common 24 bp duplication (428_451dup24). *Conclusions:* The location of this larger duplication mutation supports this region as the *ARX* mutation 'hot spot.' Clinical features to date are consistent with reports for the common 24 bp duplication. Supported by Epilepsy Canada (Demos), CIHR-IG (Gibson), Australian NHMRC (Fullston, Gecz).

P-052

A novel treatment algorithm for neuropathic pain

*MP Namaka (East St. Paul)**

Neuropathic pain is a chronic pain syndrome of unknown etiology. The hallmark cellular characteristic involves hyperexcitability of dorsal horn neurons. Characteristic clinical symptoms include numbness, burning, tingling or stabbing pain. Symptoms vary in intensity, duration and severity making diagnosis often problematic. Patients also suffer co-morbid conditions such as sleep and mood disorders. Henceforth, clinicians are faced with the overwhelming task of selecting appropriate treatment. Although the primary goal is to alleviate pain, clinicians recognize that even the most appropriate treatment strategy may be, at best, only able to reduce pain to a more tolerable level. The use of diagnostic screening tools such as the DN4 questionnaire assist clinicians in differentiating between neuropathic and nociceptive pain. Targeted treatment strategies aimed at the 4 main focal points of the pain-processing loop will assist clinicians in achieving realistic treatment outcomes that are personalized for each patient. A novel treatment algorithm involving numerous drugs from several drug classes such as the tri-cyclic antidepressants, selective serotonin reuptake inhibitors, antiepileptic drugs, topical antineuralgics, narcotics, cannabinoids and other treatment options will be addressed. Recognizing the strengths and limitations of the various treatments will assist clinicians in the decision process to start treatment with the end in mind.

P-053

Hyperbaric oxygen therapy in neurological diseases: a ten years retrospective study from Toronto General Hospital-University Health Network

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Background: Hyperbaric oxygen therapy(HBO) has been found to be of clinical benefit in certain neurological disorders such as acute carbon monoxide(CO) poisoning, decompressive illness, brain and spinal cord injuries due to radiation-induced necrosis. *Method:* A ten years (1995 to 2005) retrospective analysis of patients treated at the hyperbaric oxygen unit at Toronto General Hospital(TGH)was reviewed systematically. *Results:* 1,114 patients were identified: 533 cases was due to carbon monoxide poisoning, 127 due to decompressive illness(Bends), 454 cases of bone and soft tissue injuries with 164 of these cases being due to radiation necrosis of the central nervous system. 85 cases of CO poisoning was identified in which 5 were excluded due to chronic exposure. Their mean age was 40.9 years (3 to 80)and 62.4% were male. Details of their clinical presentation and treatment outcome will be presented. *Conclusions:* This is the first long term retrospective study of the utilization of HBO therapy in patients with neurological disorders at a large Canadian teaching teritary referral center. Future research in HBO therapy at TGH will focus on its appropriate use, clinical outcome and prognosis in these patients.

P-054

Diffuse hemangiomatosis with predominant central nervous system involvement

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Background: Diffuse neonatal hemangiomatosis (DNH) presents with multiple cutaneous hemangiomas associated with widespread visceral hemangiomatosis. *Methods:* We report a case of DNH with predominant central nervous system involvement. *Results:* A 3-month-old female presented with bilateral leg weakness, decreased rectal tone, constipation, and four skin lesions. The skin lesions were characteristic in appearance of cutaneous hemangiomas. Brain MRI revealed six non-enhancing multiloculated lesions of heterogeneous signal intensity. Spinal cord MRI showed three lesions from T4 to T12 with a syrinx. The appearance of the CNS lesions initially resembled cavernous malformations. Chest CT revealed three small nodules in the lungs. Abdominal CT was normal. Repeat MRI, done when the patient deteriorated clinically, revealed enlarged lesions with increasing hemorrhage and associated vasogenic edema. The lesions appeared more cystic with sedimentation levels, and more typical of intracranial hemangiomas. Steroids were started with clinical improvement and the CNS lesions were smaller on repeat MRI. *Conclusions:* The early MRI appearance of intracranial hemangiomas can significantly overlap with cavernous malformations. This has not been previously reported in the literature. Their rapid growth rate, response to steroids, cystic appearance with sedimentation levels of the mature lesions, and involvement of other visceral organs can help confirm the diagnosis.

P-055

Self management group workshops assist in headache management

KM Sauro (Calgary), WJ Becker (Calgary)*

Background: There is evidence that multidisciplinary treatment teams and patient mastery of self management skills can contribute to the care of patients with chronic headache. *Methods:* We assessed patient outcomes after completion of a self-management group workshop facilitated by an occupational therapist or psychologist. The workshops consisted of five 2-hour sessions over a 5 week period Results were analyzed for thirty patients from the Calgary Headache Assessment & Management Program (CHAMP). HDI scores, HIT-6 scores, and number of headache days / month were collected prior to the workshop, at workshop completion, and 3 months post workshop completion. Comparisons were made using repeated measures ANOVA. *Results:* Significant improvement in all 3 outcome measures was present by 3 months post workshop. Mean HIT-6 scores improved from 63.76 at baseline to 57.59 at 3 months (P<.001). Mean HDI scores improved from 54.86 at baseline to 38.64 at 3 months (P< .05). Mean Headache days / month improved from 15.92 at baseline to 9.83 at 3 months (P< .05). *Conclusions:* Our data suggest that participation in group self-management workshops can assist in reducing headache days/ month and headache-related disability, and that these gains are sustained for at least 3 months following workshop completion.

P-056

Measurement of headache-related disability: comparing the

KM Sauro (Calgary), WJ Becker (Calgary), SN Christie (Ottawa), R Giammarco (Hamilton), GF Mackie (Richmond), AG Eloff (Calgary), MJ Gawel (Toronto)*

Background: The degree of headache-related disability is an important factor in treatment planning but it is unclear which of the available disability measures is the most helpful. *Methods:* We compared HIT-6 and MIDAS scores from 833 patients from the Canadian Headache Outpatient Registry & Database (CHORD). Correlation and regression analyses were used to analyze the HIT-6 and MIDAS total scores, headache frequency and intensity, and BDI-II scores. *Results:* A positive correlation was found between HIT-6 and MIDAS scores (r=.423; p<.001). The BDI-II scores correlated equally with the HIT-6 (r=.423) and the MIDAS (r=.448). Headache frequency correlated more with MIDAS scores (r=.381), than with HIT-6 scores (r=.257). Headache intensity correlated more with HIT-6 scores (r=.460), than MIDAS (r=.232) scores. Eighty percent of patients fell into the most severe HIT-6 disability category, compared to the 58% of patients that fell into the most severe MIDAS disability category. *Conclusions:* The HIT6 and MIDAS appear to measure headache related disability in a similar fashion. However, some important differences may exist. For example, compared to the MIDAS, the HIT6 has a narrow scoring range and it categorizes the majority of patients referred to headache specialists into the top disability category.

P-057

Palliative neurology

TE Gofton (London), MS Jog (London), V Schulz (London)*

Background: There has been increasing interest in the value of a palliative approach to neurological disorders and their symptomatic management concurrent to active disease management and therapy. The concept of palliative care was developed in and has traditionally been applied to the management of terminally ill cancer patients. However, the definition of palliative care, its role in symptom management of slowly progressive and degenerative neurological disorders, over the course of an illness has been evolving. Indeed, the very fundamentals of how we define palliation in non-terminal illness have to be revisited. Such an approach has not been available in the literature to guide physicians, allied health professionals, patients or caregivers, during the course of disease. Questions such as when we start palliation, how we deliver it, with what resources and tools remain unanswered. *Objective:* A systematic review was undertaken to determine the scope of the existing medical literature in palliative neurology. It sought to identify existing studies and examine current opinions on palliative care in neurology. *Methods:* A search was performed within PubMed, SUMSearch and the Cochrane using the terms: neurology, neurology [MeSH], palliative, palliative care [MeSH], hospices [MeSH], terminal care [MeSH] and withholding treatment [MeSH]. *Results:* 115 publications were found using the above search strategy with 31 being directly relevant to the scope of this review. A summary of the results is provided outlining the existing publication types and major results or viewpoints therein. *Conclusion:* The authors' opinions with respect to the questions posed above in terms of early palliation of symptoms in conjunction with active disease management are outlined.

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P-058

Deep brain stimulation for chronic cluster headache: a case report

*WJ Becker (Calgary)**

Background: Diencephalic deep brain stimulation (DBS) may benefit patients with medical refractory, disabling chronic cluster headache. *Methods:* A 44 year old male developed episodic cluster headache at age 20, which progressed to chronic cluster by 30. Headaches were right-sided, maximal around the eye, of 2-3 hours duration, with conjunctival injection. He failed methysergide, valproate, lithium, topiramate, gabapentin, and verapamil prophylaxis. Neither cranial nerve surgery nor stereotactic radiosurgery provided long-term benefit. In May 2006, a right diencephalic DBS system was implanted, and a series of stimulation patterns were trialed. *Results:* Continuous bipolar high frequency (185 Hz) stimulation was applied to each electrode pole sequentially and the effects tested for 1-3 months. Amplitude was set to a level at which side effects (blurred vision, dizziness) were transient. This produced some benefit with more headache free days and shortening of attacks. However, after the pulse width was increased to 90 ìs and stimulation was applied through poles 0- 3+ (leading to 1 week of dizziness), dramatic improvement ensued and has persisted for >6 months. His attacks decreased to 1-2 headaches lasting 15 minutes every 5 days, and he has been pain-free for up to 10 days. *Conclusions:* Diencephalic DBS may benefit well-selected patients with intractable chronic cluster headache. The clinical response is dependent upon stimulation settings applied.

P-059

A rare case of cytomegalovirus associated transverse myelitis in an immunocompetent patient

N Chaudhary (Hamilton), F Martha (Hamilton), N Shalini (Hamilton)*

Introduction: Cytomegalovirus (CMV) induced transverse myelitis (TM) is rare in immunocompetent patients. We present a case of concurrent TM, viral meningitis, cerebellitis and hepatitis resulting from the uncommon etiology of CMV and mycoplasma. *Method:* A 33 year gentleman presented with a progressive headache, bilateral lower limb weakness and urinary retention. Neurological examination revealed mild dysdiadokinesia, decreased pinprick sensation up to T7, impaired proprioception in the lower limbs, only bilateral wiggling of the toes and upper motor neuron signs in the lower limbs. *Results:* MRI with contrast revealed cerebellitis and an ill-defined signal in thoracic spine. Serology and blood cultures were positive for mycoplasma, and antigens were positive for CMV. Our patient was treated empirically with IV Gancyclovir and Methylprednisilone for two days, before being switched to oral prednisone for two weeks. Prior to being transferred to a rehabilitation unit, his muscle strength improved to 4+ in the lower limbs, he was ambulating independently and neurogenic bladder was treated with urecholine. *Conclusion:* Though uncommon, CMV can cause significant morbidity in immunocompetent patients. The literature does not provide guidelines for the treatment of CMV associated TMV. Our case report demonstrates good recovery following a combination of antiviral and anti-inflammatory treatment regimen.

P-060

Postoperative severe serotonin syndrome resulting from co-administration of paroxetine, fentanyl and ondanserton

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Background: The serotonin syndrome(SS) is a potentially lethal complication of therapeutic drug use, intentional self poisoning or inadvertent interaction between proserotonergic medications resulting in excessive serotonergic stimulation of central and peripheral serotonergic receptors. SSRIs are often implicated. Fentanyl is a weak serotonin reuptake inhibitor and ondansetron is a 5-HT3 antagonist which may increase availability of serotonin at other receptors. We report a case of severe SS in a postoperative ICU patient treated with fentanyl, ondanseton and paroxetine perioperatively. *Methods:* A 49 year old woman, on longterm paroxetine, received fentanyl and ondanseton perioperatively during an elective mitral value replacement. Postoperatively she was comatose, with muscle rigidity (lower extremities > upper extremities), tremor, clonus, hyperreflexia, fever, rhabdomyolysis, acute renal failure and elevated liver enzymes. *Results:* Her findings were consistent with severe SS. All signs and symptoms resolved following discontinuation of proserotonergic agents and treatment with cyproheptadine (a 5-HT2 > 5-HT1 receptor agonist) and benzodiazepines. *Conclusions:* SS is a potentially fatal condition that may be overlooked in ICU patients who may have other apparent causes for their symptoms. Clinicians should be aware of the potential development of SS as a complication of co-administration of proserotonergic agents in patients treated with SSRIs.

P-061

Extinction is not a natural consequence of unilateral spatial neglect: evidence from contrast detection experiments

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Background: Cases where a unilateral spatial neglect (USN) patient is able to detect the stimulus on the neglected side when presented unilaterally, but fails in the case of bilateral stimulation, are termed “extinction”. We examine here whether the expression of extinction is dependent upon the contralesional low saliency existing in neglect. *Methods:* Patients and normal controls were tested on detection of a peripheral Gabor patch, while a competing patch was presented simultaneously on the other side. To compensate for uneven saliency we set the contrast level relative to the detection threshold on each side. *Results:* Patients differed from controls in their sensitivity to changes in relative contrast between sides, showing stronger tendency for extinction and requiring much higher contrast increments in the target patch in order to eliminate extinction. This difference, shown despite compensation for contralesional perceptual attenuation due to neglect, suggest an additional extinction-specific deficit related to an abnormal interplay between the bilaterally presented stimuli. *Conclusion:* The results have important implications concerning the relevance of data derived from extinction studies for neglect, and vice versa. The theoretical concept of ‘attentional gradient’, taken to explain reduced saliency of contralesional stimuli in USN cannot fully account for the phenomenon of extinction.

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P-062

Prefrontal cortex neurochemistry in amyotrophic lateral sclerosis - relationship to cognitive impairment

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Background: Amyotrophic lateral sclerosis (ALS) is a heterogeneous disorder and not a pure motor neuron disease. Up to 50% of patients with ALS have some degree of cognitive impairment. Biomarkers associated with clinical subtypes would assist with understanding varying pathogenic mechanisms and with drug evaluation. Our objective was to study prefrontal cortex (PFC) neurochemistry and its association with cognitive impairment in ALS. *Methods:* Magnetic resonance spectroscopy (MRS) was used to quantify in vivo PFC glutamate, glutamine, GABA, N-acetylaspartate, and myo-inositol in patients with definite or probable ALS (El Escorial criteria) and controls. Subjects underwent standardized cognitive and behavioural evaluations. Eleven patients with ALS and 11 healthy controls have been studied to date. *Results:* Comparing ALS to control subjects, myo-inositol was increased (6.12±0.9 vs 5.10±0.9, p=0.03); a reduction in N-acetylaspartate did not reach statistical significance (9.2±1.8 vs 10.2±1.8, p=0.1). Glutamate, glutamine, and GABA were unchanged. However, glutamine correlated with a sensitive marker of frontal executive dysfunction in ALS, letter F verbal fluency (r = -0.64, p=0.03). *Discussion:* Cerebral neurochemical abnormalities exist beyond the motor cortex in ALS and correlate with performance on frontal lobe psychometric testing. PFC neurochemistry profiling with MRS may provide a biomarker for cognitive function in ALS.

P-063

Objective sleep quality and nocturnal limb movements are correlated with cerebral white matter disease burden

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Background: Obstructive sleep apnea (OSA) is a risk for stroke and is associated with white matter hyperintensities (WMH). Recently, limb movements (LM) were shown to be associated with increases in blood pressure. We hypothesized that intrinsic sleep abnormalities might be associated with WMH. *Methods:* Patients assessed in a memory clinic were referred for polysomnography for various sleep problems. Hyperintensities were rated using Age Related White Matter Changes Score (ARWMC) from MRI-FLAIR and microbleeds counted from gradient echo. Polysomnographic results were correlated with ARWMC. *Results:* Participants (N=22; 64% male) were 66.3+/- 11 years, with hypertension (27%), dyslipidemia (32%), diabetes (5%), stroke (14%). Cognition was mildly affected in 86% with three patients demented. Sleep efficiency (time asleep/bed time) highly correlated with WMH (r=-0.65, p<0.001) as did LM per hour, (r=0.55, p=0.004). Of the 2 with microbleeds, one had severe restless legs and OSA (lowest oxygen = 68%); the other had very poor sleep efficiency (53%). *Discussion:* Sleep efficiency had the highest correlation, unexpectedly, with WMH. This may reflect disrupted intrinsic sleep control. The relative importance of LM was also surprising but consistent with emerging suggestions that LM are not completely benign. Further exploration of microbleed association with sleep disorders is warranted.

P-064

Protein therapy for Unverricht-Lundborg disease using cystatin B transduction by TAT-PTD. Is it that simple?

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Background: Unverricht-Lundborg disease (ULD) is a chronic and debilitating autosomal recessive form of progressive myoclonus epilepsy, caused by expansion of a dodecamer repeat in the promoter of the EPM1 gene, which dramatically reduces the level of its ubiquitously expressed protein product named cystatin B (CSTB). Replacement of CSTB in brain could lead to an improvement of symptoms or, at least arrest disease progression. Recently, it was demonstrated that the TAT protein transduction domain (TAT-PTD), derived from the human immunodeficiency virus (HIV-1), is able to transport proteins fused to it across the blood-brain-barrier (BBB) and transduce them into neurons and other brain cells. Confirmation of this finding could cause a major impact in the development of new therapies for neurological diseases. Here, we test whether TAT-PTD can transduce CSTB into cultured cells. *Methods:* Plasmids were constructed containing the EMP1 gene with or without the TAT-PTD sequence. The proteins produced, TAT-PTD-CSTB and CSTB were expressed in bacterial cells, purified and incubated with COS-7 cells and human lymphoblasts. Whole cell lysates and cellular fractions were obtained and studied by polyacrylamide gel electrophoresis and immunoblotting (western blot analysis).In addition, cells were analysed through immunofluoresnce microscopy. *Results:* Apparent time and concentration dependent transduction of TAT-PTD-CSTB was seen. However, immunofluorescence microscopy using special techniques to preserve the cell's membrane, demostrated that TAT-PTD-CSTB localizes to the plasma membrane: *Conclusion:* TAT-PTD-CSTB does not penetrate the cells despite initial evidence of time and concentration-dependent transduction. Therefore, it cannot be used as a form of replacement of the intracytoplasmic protein missing in ULD. Importantly, we discuss precautions to avoid false-positive results when working with TAT-PTD for protein therapy of neurological diseases

P-065

Delayed onset orolingual dystonia following Wernicke's encephalopathy

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We report delayed development of orolingual dystonia in a 55 year old man who fasted for 86 days at the age of 23. Immediately following the fast he had mild slurring of speech and staggering gait which improved markedly over time. Over the last 6 years he developed mild chewing difficulty with no difficulty for swallowing. There is a history of depression for which he was treated with a variety of SSRI antidepressants, currently managed with citalopram and bupropion. There is also a history of REM sleep behaviour disorder and a remote history of marijuana use as well as occasional PCP and cocaine. He was the product of a non-consanguineous marriage and there is no history of ataxic disorder in the family. Examination revealed nystagmus, and dystonic dysarthria with blepharospasm and lower facial dystonia on attempted speech. There

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was no KF ring, no release reflexes and no tremor or rigidity. There was mild finger nose incoordination and heel-shin incoordination. He walked with wide base with mild opisthotonus and scoliosis. Tandem walking was impossible. There was no sensory involvement and Romberg was negative and there was no orthostasis.His memory and intelligence were normal Routine blood work including serum ceruloplasmin and peripheral smear for acanthocytes was normal apart from mild normocytic anemia.Trinucleotide analysis for SCA 1,2,3,5 and 7 was negative. MRI brain revealed marked cerebellar atrophy, predominantly vermian and a few areas of non-specific increased white matter hyperintensity, as well as generalized atrophy that had increased since the previous examination 5 years earlier. *Conclusion:* Delayed onset of movement disorder following Wernicke's encephalopathy has not been reported to our knowledge. In this case, there are other potential contributing factors including antidepressant use, but the patient appears to have a progressive degenerative disorder without other identified cause. The presence of REM sleep behaviour disorder is of interest and may suggest an underlying synucleinopathy.[Video is available]

P-066

Importance of detailed retinal exam in neurology clinic

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Patients with visual field defects are very often referred to neurology clinics even when the cause may be ophthalmological. Neurologist should also focus on detailed retinal examination beside looking at the optic discs. Our case is a 57 year old male who presented with blurred vision through his right eye only in the center of his right visual field and he had no difficulty seeing in the periphry of his right visual field. His near VA was O.D. 20/200 uncorrected and O.S. 20/20, with no improvement on pinhole. His visual fields to confrontation were intact and there was no enlargement of the blind spot. His pupils were 2.5 mm, equally round ,reactive to light and accomodation,color vision was normal. There was no papilledema but retinal exam was difficult because of small size of pupils. On dilation of pupils a branch retinal vein occlusion in superior temporal aspect between 9 and 11'o clock postion with retinal hemmorrages and cotton wool spots, engorgement of vein and macular edema was seen. Macular edema was the cause of his central loss of vision. This case underscores the importance of detailed retinal examination beside routine fundoscopy in neurology clinics. Pictures available.

P-067

Rapid recovery following dexamethasone in *Cryptococcus gattii* meningitis

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Introduction: Cryptococcus neoformans var. *gattii* (CNVG) causes meningitis, often in immunocompetent hosts. It is endemic to Vancouver Island, British Columbia, with 176 reported cases between 1999 and 2006. The use of corticosteroids is not recommended in current guidelines. *Methods:* We report a patient with CNVG meningitis treated with dexamethasone. Evidence supporting the use of steroids is reviewed. A summary of CSF and imaging response of 4 additional cases is presented. *Results:* A 46 y.o. immunocompetent female presented with headaches, nuchal rigidity and rapid neurological deterioration. CSF analysis revealed increased opening pressure (32 cm), 607 WBC, glucose 2.9 mmol/L, protein 1.2 grams/L, positive India ink and cultures for CNVG, CrytoAg titer> 1:1024. Neurologic status deteriorated despite standard treatment with Amphotericin B/flucytosine. Prior to starting steroids, she was obtunded, aphasic and had right-sided UMN signs. Within 24 hours of dexamethasone she was speaking and moving to command. Clinical improvement continued. Neuroimaging and CSF profile improved. *Conclusion:* This patient with CNVG meningitis showed clinical and radiological improvement following high-dose steroids. Clinicians should consider addition of dexamethasone in cases of CNVG meningitis associated with poor response to anti-fungal treatment and imaging evidence of ongoing inflammatory lesions, despite sterilization of CSF and normalization of ICP.

P-068

Bilateral phrenic nerve paralysis following endoscopic maze procedure

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Background: Phrenic nerve dysfunction is a known complication of cardiac surgery, due either to cold or mechanical trauma. Heat damage has not been reported. Our patient underwent an endoscopic maize procedure (bilateral isolation of the pulmonary veins, autonomic denervation, stapling of the left atrial appendage, and radio-frequency pulse application) for atrial fibrillation related to hypertrophic cardiomyopathy. *Methods:* Bilateral phrenic nerve conduction, and needle electromyography (EMG) of right chest wall and diaphragm, were performed. *Results:* The patient had clinical signs of severe paralysis of both diaphragms, with paradoxical respiration. The right phrenic nerve conduction studies showed a prolonged latency of 13 ms (normal <8.1ms) with a diminished motor response of 100 uV (normal >300 uV). The responses were less affected but still abnormal for the left phrenic nerve (13 ms and 300 uV, respectively). Needle EMG findings were normal in chest wall muscles, but there was no denervation or motor unit potentials recorded in the diaphragm. *Conclusions:* Our patient is unique for the bilateral nature of the phrenic nerve paralysis post maze procedure. Results were consistent with severe phrenic nerve injury (right worse than left), primarily demyelinating. The mechanism for the phrenic nerve dysfunction may have been either mechanical (stretch) or thermal injury due to the radio- frequency pulse.

P-069

Pendular nystagmus, a floccular syndrome and saccadic dysmetria associated with a developmental medullary anomaly

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Introduction: Gaze-evoked nystagmus, rebound nystagmus and saccadic dysmetria are associated with cerebellar or brainstem dysfunction, sometimes on the basis of hereditary degeneration, as with various spinocerebellar atrophies. Structural anomalies of the pons and medulla have also been associated with horizontal gaze palsy, pendular nystagmus and progressive scoliosis (HGPPS) syndrome, due to ROBO3 mutations. *Methods:* We describe the clinical features and imaging of a patient with nystagmus and

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saccadic dysmetria, associated with a new structural abnormality of the medulla. *Results:* This patient presented with transient blurry vision associated with gaze shifts, and an autosomal dominant family history of a parkinsonian syndrome. Examination showed a fine horizontal pendular nystagmus in primary position, gaze-evoked and rebound nystagmus, impaired pursuit and VOR cancellation, and saccadic dysmetria. MRI showed an unusual medullary anomaly, with diffuse medullary volume loss, hyperintense signal in the medullary olives, and vertical clefts transecting the medulla in the anterior-posterior direction. *Conclusion:* This patient has pendular nystagmus, a floccular syndrome and saccadic dysmetria, ocular signs associated with cerebellar or medullary dysfunction. His imaging disclosed a structural anomaly of the medulla, distinct from that seen in HGPPS syndrome. The unusually strong family history of parkinsonism raises the possibility that this is an autosomal dominant disorder with variable expression.

P-070

Dissociated palsy of vertical saccades

JA Sharpe (Toronto), J Kang (Toronto)*

Background: Palsy of vertical saccades is variably associated with paresis or sparing of smooth eye movements. Palsy of vertical voluntary and visually guided saccades, with preserved vertical quick phases of vestibular nystagmus had not been recognized. *Methods:* Vertical and horizontal saccades, smooth pursuit and the vestibulo-ocular reflex were recorded by magnetic search coil technique in 21 patients with clinically evident vertical saccade palsy. *Results:* Absent upward and downward voluntary and visually guided saccades with spared vertical vestibular quick phases were recorded in a patient after bilateral midbrain and thalamic infarction in the distribution of the posterior thalamo-subthalamic paramedian artery. Upward, downward and torsional quick phases of the vestibulo-ocular reflex (VOR) were detected by three dimensional recording, in the absence of cerebrally generated upward or downward saccades. Vertical smooth pursuit was paretic, having very low velocity, upward and downward, without catch-up saccades. Vertical and torsional vestibulo-ocular reflex (VOR) gains were normal. *Conclusions:* Preservation of vertical and torsional VOR quick phases signifies integrity of the rostral interstitial nucleus of the medial longitudinal fasciculus (riMLF), in the face of paralysis of all other vertical saccades. This provides evidence that disruption of descending cerebral corticofugal pathways to the riMLF, with preserved ascending projections from the paramedian pontine reticular formation to the riMLF can cause dissociated palsy of vertical fast eye movements.

P-071

Acute fulminant hepatic failure: clinical, CT and laboratory associations with mortality

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Introduction: We reviewed 25 cases of acute fulminant hepatic failure (AFHF), noting the incidence of cerebral edema and factors associated with mortality. *Methods:* Patients were captured through HMRI classification of acute liver/hepatic failure. Chart review included tabulation of: demographics, INR; serum bilirubin, creatinine, albumin; in-hospital mortality. CT scans were re-read with blinding to clinical information and catalogued for changes in sulcal markings, ventricular size and grey-white differentiation (GWD). Encephalopathy, hepatic failure within 8 weeks of onset of liver disease, CT scans of head performed. *Results:* Acetaminophen toxicity was the most common etiology (9 cases). Twelve patients had cerebral edema on CT, including 8 of the 9 with acetaminophen toxicity. Decreases in sulcal markings and ventricular size preceded conspicuous alterations in GWD. Fourteen died, including all 12 with cerebral edema. None of the hematological or biochemical variables correlated significantly with mortality. *Conclusions:* Acetaminophen toxicity is a common cause of AFHF; this combination has a strong association with cerebral edema. Cerebral edema occurs in almost half the AFHF cases and is strongly related to mortality.

P-072

Visual fixation stability in Chiari Type II malformation

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Background: Chiari type II malformation (CII) is a congenital deformity of the cerebellum and brainstem. Square wave jerks (SWJ) are horizontal, conjugate, involuntary saccadic intrusions, each followed after an interval by saccadic refixation. SWJ interrupt fixation. Cerebellar disorders may be associated with frequent SWJ or saccadic oscillations such as ocular flutter. The effects of the deformity of CII on fixation stability had not been investigated. *Methods:* We recorded eye movements using an infrared eye tracker in 21 children with CII, aged 8-19 years while they fixated a target for one minute. Patients were excluded if nystagmus was present within 30ºof central gaze on clinical examination. Thirty-eight typically developing children served as controls. The frequency of SWJ, their amplitudes, durations, and peak velocities of their saccades were calculated and compared between the two groups. *Results:* SWJ occurred less commonly in the CII group (66.7% of participants) in comparison to the control group (89.5%). The median frequency of SWJ in CII was 3.5/ minute, median amplitude was 0.74º, median peak velocity was 54 deg/s, and median duration was 284 milliseconds. These values were not significantly different from the control group values. Saccadic oscillations were not seen. *Conclusions:* The deformity of CII is not associated with pathological SWJ or abnormal saccadic oscillations. The chronic and congenital nature of CII may permit compensation that preserves stable visual fixation. Alternatively, the deformity of CII may spare parts of the cerebellum that usually cause fixation instability when damaged.

P-073

Rabies: clinical presentation and pathological features of an Edmonton case

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Background: Rabies virus encephalitis is a fatal zoonotic disease, rare in developed countries, with a characteristic clinical diagnosis. *Methods:* Case report. *Case Report:* A 73 year old man sustained a bat bite on his left arm but did not seek medical attention. Six months later, he developed severe, progressively worsening left arm

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pain and weakness. He subsequently developed generalized weakness, left arm "spasms", dysphagia and "gasping" breaths. He became obtunded, with significant autonomic instability. On examination, he had hypersalivation, ophisthotonus, upper extremity myoclonus and generalized hyperreflexia, but preserved brainstem reflexes. His CSF had elevated protein and white blood cell count. MRI of his brain showed diffuse cerebral atrophy but no brainstem lesions. Diagnosis of rabies was confirmed by direct fluorescent antibody testing of a nuchal skin biopsy and by detection of viral RNA in his saliva and CSF. He was given rabies immune globulin and treated with the Milwaukee protocol (experimental therapeutic coma). Despite peripheral clearance of the virus and prolonged survival in intensive care, there was no neurological recovery. Repeat MRI, at day 68 of clinical illness, revealed thickened and edematous cortex and brainstem, with marked T2 hyperintensities diffusely in the cortex, basal ganglia and brainstem. Histopathology showed abundance of virus within the brainstem and extensive loss of cortical neurons. *Conclusion:* 'Furious' rabies is a fatal disease, with progressive neurological deterioration that does not respond to current experimental therapies.

P-074

Immune Reconstitution Inflammatory Syndrome manifesting as spinal tuberculous arachnoiditis in a patient with HIV

J Oh (Toronto), J Rodrigues (Edinburgh), J Schneiderman (Toronto)*

Background: Immune reconstitution inflammatory syndrome (IRIS) describes inflammatory reactions manifesting as paradoxical worsening of a patient's clinical condition, attributable to initiating anti-retroviral (ARV) therapy in patients with HIV. IRIS has been reported with various opportunistic infections. *Case Report:* A 40 year old HIV positive man developed intermittent urinary retention and progressive bilateral lower extremity weakness with signs of myelopathy 8 weeks after starting treatment for pleural Mycobacterium tuberculosis (Tb). ARV therapy had been started a few days after initiating anti-Tb treatment. MRI of his thoracic spine showed spinal cord compression due to an extensive, enhancing, dorsal plaque extending from T3-T11. CSF showed: protein 47.23 g/L (normal range: 0.15 - 0.45 g/L); 560 x 106/L WBCs with 83% lymphocytes; normal glucose; sterile for infectious agents, including Tb. He was diagnosed with IRIS in the context of Tb, manifesting as spinal tuberculous arachnoiditis. *Discussion:* In the current literature, there are a limited number of descriptions of neurological manifestations of IRIS in the context of Tb, and no previous reports of IRIS manifesting as spinal tuberculous arachnoiditis. We review the existing literature, and discuss the pathophysiology, epidemiology, and management of IRIS in the context of Tb.

P-075

Autoimmune autonomic ganglionopathy with late-onset encephalopathy

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Background: Autoimmune autonomic ganglionopathy (AAG) is an acquired channelopathy of the autonomic ganglia. Antibody-mediated blockade of the ganglionic nicotinic acetylcholine receptors (nAChR) impairs fast synaptic transmission between the first- and second-order neurons of the sympathetic and parasympathetic chains. *Case Report:* A 47-year-old female presented with a 4 month history of early satiety, constipation, light sensitivity, orthostatic intolerance, sicca, and anhydrosis. Her examination revealed dilated, unreactive pupils with dry eyes and mouth but normal strength, phasic reflexes, and sensation. After 3 minutes of quiet standing her systolic pressure dropped 70 mmHg with a fixed heart rate of 74 bpm. Her ganglionic *f*nnAChR antibody was 2060 pmol/L (normal = 50). Orthostatic symptoms significantly improved within 10 days of completing 2.0 g/kg IVIg. Her supine norepinephrine (NE) level improved over baseline but remained low (i.e., 0.36 – 0.61 nmol/L). Persisting gut inertia prompted a trial of plasma exchange (PLEx) which restored her supine NE level (2.18 nmol/L), bowel patterns, and pupillary reactivity. Five months later, while her AAG was controlled, she developed gait unsteadiness, confusion, horizontal and vertical nystagmus, bladder retention, and long tract motor signs. A contrast MRI head was normal. Further serum testing demonstrated antibody binding for CNS nAChR subtypes in addition to ganglionic AChR. She responded to high-dose steroid and PLEx. *Discussion:* This is the first report of AAG presenting with antibodies directed against both ganglionic and central nAChRs. It is tempting to speculate that antibodies against CNS nAChR may have precipitated the treatment-responsive encephalopathy.

P-076

Arthralgia as an adverse effect of rasagiline. a report of two cases

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Background: Rasagiline mesylate is a selective and irreversible inhibitor of monoamine oxidase type B used in the treatment of Parkinson's disease. A 7% rate of arthralgia as an adverse event but not felt to be significant when compared to placebo. *Methods:* This is a report of two cases of both older women with idiopathic parkinsons disease treated with levodopa and later on a combination of medications. They presented with muscle and joint pains and swelling which began soon after rasagiline was started, and resolved when it was discontinued. *Results/Conclusions:* We report two cases where the occurrence and resolution of arthralgia was closely time-locked to rasagiline intake. These cases comprised about 10 % of the total number of patients on rasagiline in our setting. The true incidence of arthralgia from rasagiline has yet to be determined. Further data collection on the serious adverse events of this medication is needed whether as monotherapy or adjunctive treatment. Drug interactions that may further enhance the side effects of this class of medication has to be looked into.

P-077

A nutrition therapy needs assessment; Is there a need for a dietitian in a Parkinson's disease (PD) clinic?

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Goal: To identify the need for a dietitian in a PD clinic using a validated nutrition risk screening tool. *Background:* Preliminary review of 100 PD patients, in our clinic, identified many reasons for potential dietitian involvement including sialorrhea (48%), weight change (31%), constipation (25%), dysphagia (21%), postural

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dizziness (20%), abdominal bloating (13%), and anorexia (12%). Other issues include falls, fractures, GI side effects of medication and protein intake impairing levodopa absorption. Although arguably all PD patients should see a dietician, no systematic study attempting to quantify this need using a validated nutritional screening tool has been undertaken. *Methods:* We reviewed 223 consecutive pre appointment questionnaires completed by PD patients attending our clinic. These included a "Patient-Generated Subjective Global Assessment", a validated nutrition risk scale in geriatrics and oncology. A score of > 3 on this scale indicates the need for a dietitian. *Results:* Scores ranged from 0 to 18. The score was 4 or higher in 44.4% of the patients. If we removed scores relating to sense of smell and reduced those relating to motor activity (common issues in PD) this still resulted in 32.3% needing dietician assessment. *Conclusions:* One third of patients attending a PD clinic require dietitian services.

P-078

Dysphagia and dysphonia as presenting symptoms of sarcoidosis

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Background: Vagus nerve palsy is usually secondary to tumor or trauma. We describe a case of vagal neuropathy secondary to sarcoidosis, an unusual presentation of the disease. *Methods:* We reviewed the case records, imaging and pathologic findings of a 41 year old woman who presented with a 1 month history of dysphagia, dysphonia and palatal weakness. A Medline search was conducted using vagus nerve palsy and sarcoidosis as MeSH terms. *Results:* Endoscopy revealed bilateral vocal cord and pharyngeal weakness. CT showed hilar and paratracheal lymphadenopathy without interstitial changes. Contrast-enhanced CT and MRI of the head and neck were normal. Biopsy of a paratracheal node demonstrated noncaseating granulomas. Treatment with prednisone led to complete resolution of symptoms and deficits over 4 months. Most previously described cases involved compression of the recurrent laryngeal nerve by mediastinal lymph nodes. The clinical features in this case imply a more rostral lesion, not clearly described in other cases. *Conclusion:* Sarcoidosis should be considered in the differential diagnosis of isolated vagal neuropathy. Although compression by intrathoracic adenopathy is the most common mechanism, more rostral vagal injury can occur in the absence of structural changes in the head and neck on imaging studies.

P-079

Transient global amnesia following Inadvertent Epinephrine Injection: A case report

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Epinephrine is a nonselective alpha and beta receptor agonist with rapid but short duration of action. Known neurological sequelae include headache, nervousness, tremor and side effects related to accelerated hypertension and cardiac dysrythmia. We report a 49 year old woman who presented with an acute amnestic disorder following an inadvertent epinephrine pen puncture of her thumb. Almost instantaneous with the puncture she experienced palpitations, and bifrontal throbbing headache followed within 15 minutes by an abrupt and dense anterograde and retrograde memory impairment. There was no loss of self identity, focal deficits, or involuntary movements during the episode. Bedside assessment revealed temporal disorientation and profound impairment of new learning as well as recall of recent events. Semantic memory, visuospatial, executive, language function and neurological examination were normal. She had transient multifocal PVC's and a minor increase in troponin I. Neuroimaging including CT, CTA, MRI, MRV did not show any correlative lesion, and EEG did not demonstrate any epileptiform activity. Over 12-18 hours this transient global amnesia (TGA) fully resolved. *Discussion:* TGA associated with epinephrine has not been previously reported. While the mechanism is unclear, it may be related to transient arterial vasospasm or to transient increase in venous pressure.

P-080

European Lyme neuroborreliosis in Canada

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Background: Lyme neuroborreliosis is defined as *Borrelia* infection with neurological involvement. There are few published reports in North American literature of the clinical features and radiological findings of foreign-acquired disease likely leading to under-recognition. *Case:* A 12-year-old girl presented to our hospital with 10 days of mid-scapular pain and four hours of unilateral facial weakness two weeks after returning from France. Physical examination revealed unilateral facial nerve palsy, bilateral upper motor neuron lower extremity weakness, and a suspended mid-thoracic sensory level. MRI showed increased T2-weighted signal in the spinal cord, mild spinal cord edema and meningeal and nerve root enhancement. Antibodies to European *Borrelia* strains were detected in serum by ELISA but not by Western blotting. Three weeks of intravenous ceftriaxone and two weeks of oral prednisone resulted in marked improvement of neurological symptoms. *Discussion:* In this case report we highlight important clinical differences between European- and North American-acquired Lyme neuroborreliosis. We also discuss the challenge of laboratory confirmation of this condition when available diagnostic tests have been optimized for North American strains. Diagnostic methods routinely employed in Europe such as calculation of the cerebrospinal fluid to serum antibody index may prove to be useful in the future. Timely diagnosis is imperative in order to initiate appropriate treatment and to prevent significant neurological sequelae.

P-081

Phenotypic heterogeneity in novel MFN2 mutations

SK Baker (Hamilton), AF Hahn (London), S Raha (Hamilton), PJ Ainsworth (London)*

Background: Charcot-Marie-Tooth disease (CMT) is amongst the most common inherited disorders of the peripheral nervous system and is broadly categorized into demyelinating–type 1 or axonal–type 2–forms based on nerve conduction studies. Similar to mutations in or duplication of peripheral myelin protein 22 which account for the majority of CMT1 cases (CMT1A ~70%), mutations in mitofusin 2 (MFN2) are disproportionately represented in cases of CMT2 (CMT2A ~19-33%). To date, 50 mutations have been identified in MFN2 [http://www.molgen.ua.ac.be/CMTMutations/]. MFN2 is a

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dynamin family GTPase involved in regulating mitochondrial fusion through docking and tethering events. Altered axonal mitochondrial transport has been proposed as the primary pathophysiologic insult leading to peripheral nerve degeneration. *Case Reports:* We report 3 mutations in MFN2 [1 novel (796G>A, E266K) and 2 once-previously reported (V244M, V705I)] associated with CMT2. The de novo V244M mutation was associated with a severe pediatric phenotype, right ambylopia, and chronically loose stools. By contrast, the E266K mutation displayed autosomal dominant inheritance with milder phenotypes, significant intra-familial variability, and chronic constipation. Muscle biopsies from the probands of the V705I and E266K kindreds revealed normal electron transport chain activities. Normal MFN2 sequencing in an affected bother of the V705I proband suggests that this is a benign polymorphism. This contradicts an earlier report where pathologic significance was ascribed to this mutation in an isolated patient. *Conclusions:* These additional CMT2 families with MFN2 mutations clarify the non-pathogenicity of the V705I mutation and further support the extreme phenotypic variability ranging from severe pediatric- to mild adult-onset forms.

P-082

Novel 95G>A (R32K) somatic mosaic connexin 32 mutation

SK Baker (Hamilton), PJ Ainsworth (London)*

Background: Charcot-Marie-Tooth disease (CMT) is amongst the most common inherited disorders of the peripheral nervous system. Mutations in discrete genes usually segregate into a single phenotype. However, mutations in connexin 32 (Cx32) can produce both axonal and demyelinating CMT phenotypes. To date, 289 mutations in Cx32 have been reported [http://www.molgen.ua.ac.be/CMTMutations/]. Somatic mosaicism has been multiply reported in CMT1A and once-previously in CMT1B and CMTX. *Case Report:* We report a 39-year-old man who was referred for electrodiagnostic evaluation due to a history of bilateral carpal tunnel syndrome. Physical examination revealed normal cranial nerve and motor examinations. Specifically, there was no evidence of distal atrophy, pes cavus, or toe dysmorphisms. Sensory examination revealed stocking pin hypesthesia normalizing 2 inches above the talocrural joint and reduced vibration perception at the first metatarsophalyngeal joints (8s). Electrodiagnostic findings demonstrated, absent orthodromic median and superficial peroneal sensory nerve action potentials (SNAP). The radial (5.0 γV), ulnar (2.5 γV), and sural (2.3 γV) SNAP amplitudes were reduced with slowed conduction velocities (42, 38, and 37 m/s, respectively). Routine ulnar, peroneal, and tibial motor responses were normal. Needle electromyography demonstrated large, long-duration motor potentials with reduced recruitment in distal muscles of the upper and lower extremities. Denaturing hplc analysis of the PCR-amplified coding sequence of the Cx32 gene identified a G>A transition at nucleotide position 95. This novel mutation involved approximately 1/3 of leukocyte-derived genomic DNA. He has 2 asymptomatic daughters who would be obligate recipients of the mutation unless germ-line mosaicism were also present. *Conclusion:* This case highlights the phenotypic diversity amongst CMTX patients.

P-083

Analysis of body max index in a cohort of patients with migraine

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Background: Previous studies support the concept that obesity is an exacerbating factor for migraine. On the other hand some studies have found no clear association between severity of migraine and overweight. In this study we explore the body max index (BMI) in a large cohort of patients with migraine. *Methods:* This cross-sectional study was performed in two tertiary centers in Mexico City and affiliated hospitals. Through a standardized interview according to the criteria of the IHS and a physical examination performed by a physician, we evaluated the presence of migraine. We used the MIDAS questionnaire to evaluate headache-related disability. In all the patients the weight and the height was measured. A descriptive analysis was used in accordance with the level of measurement of the variables. Mann-Whitney or t-test and Chi-square tests were performed to evaluate associations with quantitative and categorical variables respectively; the significance was adjusted at $p<0.05$. *Results:* We studied 1127 patients. The mean age was 37.1±13.6 (6-77) years. Eighty percent of patients were females. The age of onset of migraine was 19.4±10.3 (1-69) years. Fifty three percent of patients had migraine with aura and 47% without. The female/male ratio was 4:1. 42 (3%) patients had a BMI <18.5, 487 (43%) [BMI, 18.5-24.9], 440 (39%) (BMI, 25-29.4), 118 (10%) [BMI, 30-34.9], 40 (3%) [>35]. Body max index was similar between patients with and without aura ($p <0.05$). No relation was found between disability measured with the MIDAS and the body max index ($p <0.05$). Overall in this cohort the percentage of overweight (BMI 25-29.4) was 39% and obesity 13% (BMI >30) *Conclusions:* A large percentage of patients in this sample had overweight (39%). Obesity was found in 13%. This finding is important, considering the potential comorbidity associated with obesity in patients with migraine. In contrast with other studies no association was identified between severity of migraine and body max index.

P-084

Effect of prophylactic treatment with botulinum toxin type A on the cost of acute headache medication and health-related quality of life in patients with chronic migraine

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Background: Patients with chronic migraine headaches (HA) rely heavily on acute medications. Botulinum toxin A (BoNTA) may be effective prophylactic therapy. We assessed BoNTA treatment effects on acute medication costs and health-related quality-of-life (HRQoL) parameters. *Methods:* This is a multicentre open-label study where patients (N=53) with chronic migraine (≥15 HA days/mo.) classified as triptan overusers (IHS; triptan intake ≥10 days/mo. for ≥3 mos.) received BoNTA (95-130U) at Baseline and Month 3. HA diaries assessed number of headache days, headache severity and dose and cost of all acute medication use for 6 months. Migraine impact questionnaire (MIQ) evaluated HRQoL by general health/HA history, proactive approaches to managing symptoms,

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treatment satisfaction, and economic variables for non-prescription and prescription HA medications. MIDAS and HIT-6 evaluated migraine-associated disabilities. *Results:* Prescription costs decreased significantly (month 3: -$252.92 ±618.89, p-value <0.0001; month 6: -$269.15 ±656.10, p-value <0.0001). Triptan costs also significantly decreased (-$106.32 ± 122.87 /mo, p-value <0.0001). Headache diaries showed significant decrease in mean number of headache days. MIQ indicated patient satisfaction with costs of migraine medications increased significantly. There was a significant decrease in days worked with migraine symptoms and a reduction in the influence of migraine symptoms on daily activities. MIDAS and HIT-6 scores significantly decreased after BoNTA, indicating an improvement in headache-associated disability. *Conclusions:* BoNTA therapy decreased total cost of prescription migraine medications and improved parameters of HRQoL.

P-085

Mycobacterium avium complex intracerebral abscess in a patient with pulmonary sarcoidosis

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Background: The Mycobacterium avium complex (MAC) is a group of acid-fast bacilli commonly found in soil, dust, and water. MAC may colonize the pharynx of normal humans and animals, but these organisms are seldom pathogenic in immunocompetent individuals. MAC is known to cause pulmonary infection in immunocompetent individuals as well as disseminated disease in the immunocompromised, particularly in patients with AIDS. MAC infection of the central nervous system is rare. In this report , we describe the case of a 56 year old, HIV- negative male who developed an isolated MAC intracerebral abscess. He had been on long-term, low-dose prednisone for sarcoidosis, but was otherwise immunocompetent. Over a two month hospitalization, he was treated with combination antimycobacterial medications and underwent seven surgical procedures. Despite these efforts, the infection remained refractory to therapy and the patient eventually succumbed on post-admission day 63. Although the immunosuppressive effects of corticosteroids and a sarcoid-induced immunological imbalance likely contributed to this patient's susceptibility to MAC, the pathogenesis of his isolated intracranial MAC infection remains uncertain. *Methods:* A thorough literature review for reported cases of MAC intracerebral abscess was performed. Our case was reported in detail. Existing guidelines for treatment of these infections was examined and discussed. *Conclusions:* Isolated intracranial MAC infection remains exceedingly rare. However, MAC should be considered as a potential etiological agent in intracerebral abscess, especially in immunocompromised patients and patients with sarcoidosis. Indeed, sarcoidosis may be etiologically linked to MAC. More study is needed on the efficacy of various antimicrobial regimens in MAC CNS disease. Abscess excision in the earlier stages of abscess formation may be indicated in patients infected with more resistant pathogens.

P-086

The development and resolution of syringomyelia in spontaneous intracranial hypotension: a case report

*J Zwicker (Ottawa)**

Background: Several cases of tonsillar herniation and syringomyelia after placement of lumbar subarachnoid fluid shunts have been reported. Only one case of syringomyelia in spontaneous intracranial hypotension has been previously reported. This resolved with surgical treatment. *Method:* A Medline search was performed to identify case reports of syringomyelia in intracranial hypotension since 1996 and identify articles describing the pathophysiology of syringomyelia. *Results:* A 19 year old female presented with a 5 month history of daily severe headaches relieved by lying flat. The MRI of the brain initially demonstrated abnormalities typical of intracerebral hypotension, including tonsillar herniation, without any cervical spine abnormality. A repeat study 1 month later demonstrated more pronounced tonsillar descent and new hyperintense signal on T2-weighted images in the spinal cord from C3-T1 despite therapy with bedrest and fluids. The patient was treated with two sequential lumbar epidural blood patches with resolution of the cervical cord signal abnormality and improvement of the cerebellar tonsillar herniation. *Discussion:* The case demonstrates that cervical cord signal abnormality associated with SIH may develop and resolve rapidly without surgery. The most likely mechanism is edema within the cord due to partial disruption of the blood-spinal cord barrier.

General Neurosurgery

P-087

Minimally invasive equipment: does it make sense? Cost analysis comparing minimally invasive surgery with standard instrumented open surgery

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Objective: The purpose of our study was to determine whether Minimally Invasive (MI) surgery was more cost-effective than the current standard of care: a traditional Open (Open) spinal procedure. *Methods:* A retrospective chart review was performed on six MI and six Open patients. The variables collected from the patient charts included: pre-operative demographics, operative room data and the post-operative treatment course. Specific costs including cost of surgery, equipment, instrumentation, post-anaesthesia care unit (PACU) stay, hospital stay and post-surgery medications were also compiled and analyzed. *Results:* The length of surgery, length of PACU stay, length of hospital stay, intra-operative and postoperative complications, mean dosage of postoperative pain medications and total costs were significantly less for those undergoing the MI procedure. The total hospital costs amounted to $15,102 for the MI group and $64,968 for the Open group resulting in a highly significant difference of $49,866. *Discussion:* No previous research has compared the specific costs of MI and Open procedures. Significantly lower costs for the MI surgery were found when comparing the following factors: operative room, instrumentation, PACU stay, hospital stay and mean dosage of post-operative

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medications. The overall cost for the surgery for the MI group amounted to roughly a quarter of the Open group, $2,517 versus $10,828, respectively. Acquiring the skills necessary to perform MI surgery is worthwhile given the observed improvements in patient outcome and substantially lower institutional costs. *Conclusions:* MI is a significantly less expensive alternative to the commonly performed Open surgery. Coupled with its many additional advantages, such as shorter operative time, shorter hospital stay, less blood loss and superior cosmesis, MI warrants further investigation as a potential alternative to Open surgery.

P-088

The surgical management of Choroid Plexus Hyperplasia

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Introduction: Choroid plexus hyperplasia (CPH) is a rare cause of CSF overproduction and shunt resistant hydrocephalus in infants. The surgical management of hydrocephalus seen in this condition is not as clearly defined as in choroid plexus papilloma (CPP) or carcinoma (CPC). *Case Report:* A healthy 8 day old male patient presented with bulging fontanelle, HC = 42 cm (> 98th %ile) and U/S demonstrating communicating hydrocephalus and enlarged choroid plexuses. A VP-shunt was inserted and MRI suggested CPH. Shunt resistance ensued with persistent HC growth, progressive hydrocephalus, shunt tract fluid and ascites. The patient underwent unilateral craniotomy and plexectomy and is tolerating CSF diversion. The pathology confirmed CPH. *Literature Review:* There are 11 case reports of CPH; treatment modalities include CSF shunting, endoscopic coagulation, and craniotomy with plexectomy. CSF shunting was required in 7/11(4VP/3VA). Shunt-free patients had bilateral craniotomy and plexectomy. 3 cases demonstrated pathology similar to that seen in CPP. *Conclusions:* This case illustrates that CPH should be considered in the situation of hydrocephalus in infancy when enlarged choroid plexuses are identified. Multiple options should be considered in the management of such patients given that shunt independence is a possible outcome. An algorithm for the surgical approach is proposed.

P-089

Use of intrathecal bupivacaine in refractory chronic non-malignant pain

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Background: The use of bupivacaine in pain control is reported in a small series of cases. The purpose of our study is to show the efficacy and safety of the addition of bupivacaine in restoring pain control in patients with chronic non-malignant pain who prove refractory to intrathecal opioids. *Methods:* From our database of 84 patients, we extracted 17 patients whose pain control was diminishing with the use of intrathecal opioids. We added bupivacaine to the opioid infusion in order to restore pain control. The benefits of adding bupivacaine was evaluated by the Visual Analog Scale, Oswestry Disability Index, Beck Depression Inventory, EuroQol 5D and SF-36. *Results:* The mean daily dose of bupivacaine was 4.83 mg/day. The mean VAS score decreased by 32.19 mm, the ODI score decreased by 19.1%, the BDI score increased by 18.0%, and the EQ-5D score increased by 0.56. SF-36 showed the most statistical improvement in body pain and vitality. *Conclusions:* The addition of intrathecal bupivacaine restores pain control, improves activity level and quality of life, and reduces depression in this group of patients.

P-090

Transnasal endoscopic approach for skull base meningiomas

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Background: It is important to evaluate the transnasal endoscopic approach for skull base meningiomas. *Methods:* A retrospective review of patients with transnasal endoscopic treatment of skull base meningiomas between 1998 and 2007. *Results:* Six females and three males underwent transnasal endoscopic approach for skull base menigiomas. Six patients presented with visual symptoms, two with headache, and one with behavioural changes. Tumour diameter ranged from 2.5 to 5.5 cm in eight patients, and one patient had a very large tumour. Two patients had complete resection of their meningiomas, one patient had a biopsy only, and the rest had partial resection. Blood loss ranged from minimal to 5300mL. There were no deaths. Subsequent craniotomy was performed in three patients. Revision closure of CSF leak was needed in two patients. No patients reported deterioration in their vision and most reported improvement. *Conclusions:* The transnasal endoscopic approach appears to be safe in selected cases. Equipment limitations and a high rate of CSF leak are the main problems. Total resection of tumours can be achieved, especially small tumours in the planum sphenoidale. Even where subsequent craniotomy was required, the endoscopic transnasal approach can be considered to decompress the optic canals to achieve better visual results.

P-091

An approach for management of an orbital tumor with intracranial extension

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Background: We describe an approach for management of an orbital tumor with intracranial extension, in the setting of an orbital mass excised 13 years prior. *Methods:* A patient presented with a frontal mass and progressive right-sided proptosis with visual loss. Imaging revealed a tumor with intraorbital and intracranial components. He had undergone excision of an orbital mass 13 years previous from which a pathological diagnosis was unavailable. A two-staged approach to surgically manage the tumor was undertaken: biopsy and orbital decompression, potentially to be followed by a definitive second stage complete excision and reconstruction pending the pathological diagnosis. *Results:* Pathology revealed a benign pleomorphic adenoma (lacrimal gland origin) with no evidence of malignant transformation. The second stage definitive excision and reconstruction was undertaken. *Conclusion:* Intracranial extension of a benign pleomorphic adenoma is very rare. Only three other cases of intracranial extension have been reported in the literature. It is not possible to differentiate benign from malignant lacrimal gland lesions with MR imaging. In this patient, a two-staged surgical approach to the intraobital tumor with intracranial extension provided a diagnosis with the potential to save the patient from an aggressive surgery had the pathology suggested a malignancy not amenable to surgery.

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P-092

Pin-site epidural hematoma in chronic hydrocephalus

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Background: The pin-type head fixator is a commonly used device in neurosurgery providing stability and flexibility in securing the head. There are few reported complications of this device including venous air embolism, depressed skull fracture and middle meningeal arteriovenous fistula. *Case Presentation*: A 22-year-old man presented with a fourth ventricular tumour and associated chronic obstructive hydrocephalus leading to thinning of the cranium. He underwent a craniotomy for tumour resection. *Management:* The patient's head was secured using a Mayfield C-clamp with the customary force. The operation proceeded in usual approach until the cerebellum was exposed where outward herniation was noticed. The procedure was aborted as all efforts to decrease persistent brain herniation had failed and the patient was noted to have a fully fixed and dilated pupil. Immediate radiological investigations revealed an epidural hematoma formed secondary to a fracture of the temporal bone by application of the three-point skull fixator. *Conclusion:* This is the third reported case of an iatrogenic epidural hematoma secondary to pin-site complications. Despite the rare instances of such complications, we propose assessing bone quality/thickness or consideration of an alternate fixator in cases of chronic hydrocephalus and cortical bone thinning prior to surgical intervention.

P-093

Transplanted adult spinal cord derived neural stem/progenitor cells promote early functional recovery through neuroprotection after rat spinal cord injury

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Background: Neural stem/progenitor cells (NSPCs) have the ability to self-renew and are multipotential for both neurons and glia. We examined the effect of spinal cord derived NSPCs after delayed transplantation into the injured adult rat spinal cord with or without earlier transplantation of bone marrow derived mesenchymal stromal cells (BMSCs). *Methods:* Either BMSCs or culture medium were transplanted immediately after clip compression injury, and then 9 days after injury, NSPCs or culture medium were transplanted. Cell survival and differentiation, functional recovery, retrograde axonal tracing, and immunoelectron microscopy were assessed. *Results:* A significant improvement in functional recovery based on three different measures was seen only in the group receiving NSPCs without BMSCs, and the improved recovery was evident within one week of transplantation. In this group, NSPCs differentiated mainly into oligodendrocytes and astrocytes, there was ensheathing of axons at the injury site by transplanted NSPCs, an increase in host oligodendrocytes, and a trend toward an increase in retrogradely labeled supraspinal nuclei. Transplantation of the BMSC scaffold resulted in a trend toward improved survival of the NSPCs, but there was no increase in function. *Conclusions:* Thus, transplantation of adult rat NSPCs produced significant early functional improvement after spinal cord injury, suggesting an early neuroprotective action associated with oligodendrocyte survival and axonal ensheathment by transplanted NSPCs.

P-094

Skin necrosis in a scalp arteriovenous malformation following treatment using Onyx: case report

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Introduction: Congenital scalp arteriovenous malformations (AVMs) are rare. They have been treated with NBCA (N-butyl-cyanoacrylate) in the past. Onyx (Onyx Liquid Embolic System, Micro Therapeutics, Irvine, California) is an ethylene vinyl alcohol co-polymer, which has recently become available for embolization. Skin necrosis is reported as a complication of its use in this case report. *Methods:* A 49 year-old woman presented with a recurrent forehead AVM which was previously resected. Embolization was performed successfully with complete occlusion after the injection of a single feeding scalp vessel with 2 ml of Onyx. *Results:* Signs related to skin necrosis were seen within days of the procedure including tenderness and wound discharge. Three weeks post embolization, a 2.0 x 1.5 cm elliptical necrotic skin area was noted at the location of the previously treated AVM. *Conclusion:* Skin necrosis has been previously reported in cases when the total arterial supply of a territory was affected. In this case, the arterial supply to the forehead may have been reduced due to the previous surgery. The mechanism of the necrosis may be related to the ability of Onyx to occlude collateral flow to the region. Also angionecrosis has been described with the use of the dimethyl sulfoxide solvent.

P-095

A look beyond the sella: the expanded endonasal approach and a systematic arrangement of the coronal plane in skull base surgery

R Madhok (Pittsburgh), AB Kassam (Pittsburgh), P Gardner (Pittsburgh), D Prevedello (Pittsburgh), R Carrau (Pittsburgh), C Snydermand (Pittsburgh)*

Background: For the last century, transphenoidal approaches have been used to access pathology around the sella. Recently this approach has been expanded in the rostral, caudal and coronal plane. We have divided the coronal plane in to various zones (1-7) based on relationships to the carotid artery, cavernous sinus and clivus. This modular approach to the skull base in its coronal axis has been useful in systematically approaching a large variety of lesions in the skull base. *Methods:* We have reviewed the pathology as well as complications associated with accessing lesions in the coronal plane of the skull base. *Results:* From 1998 to 2007, over 700 patients have undergone an expanded endonasal approach to skull base pathology. In 76 patients we have utilized the modular approach to 112 zones in the coronal plane of the skull base. Nineteen (17%) lesions were in zone 1, 41 (36.6%) in zone 2, 25 (22.3%) in zone 3, 8 (7.1%) in zone 4, and 19 (17%) in zone 5. The coronal plane modules were used to access 35 (46%) benign, 28 (36.8%) malignant, 7 (9.2%) traumatic, 2 (2.6%) miscellaneous, 2 (2.6%) infectious, and 2 (2.6%) inflammatory lesions. The most common lesions have been chordomas/chondrosarcomas (14/18.4%), angiofibromas (9/12%), and meningiomas (8/10.5%). We have had a complication rate of 14% with 5 (6.6%) patients having a permanent deficit. We have had no deaths. *Conclusions:* Dividing the coronal plane into specific zones situated in relationship to the carotid artery, cavernous sinus and clivus, allows the neurosurgeon to systematically and safely

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approach a variety of skull base lesions in the coronal plane through a purely endoscopic approach.

P-096

A direct corridor to the clivus: the expanded endonasal approach: a review of the transclival module in endoscopic skull base surgery

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Background: Traditionally surgical approaches to the clivus have been limited by the presence of critical neurovascular structures within the surgical field. With the development of the endoscopic endonasal approach to the clivus, we have used a corridor that places the majority of these neurovascular structures on the perimeter of the surgical field. The transclival plane has been useful in approaching lesions deep in the midline of the skull base providing direct access to the clivus. *Methods:* We have reviewed the pathology as well as complications associated with the transclival approach to the skull base. *Results:* From 1998 to 2007, over 700 patients have undergone the expanded endonasal approach to skull base pathology. In 87 patients we have utilized the transclival module for malignant (42.5%), benign (34.5%) miscellaneous (19.5%) trauma (2.2%) and inflammatory (1.1%) pathology. The most common lesions have been chordomas/chondrosarcomas (20) and meningiomas (11). We had a major complication rate of 9.2% with only 3.4% having a poor outcome - 2 deaths (1 neuro related) and 1 permanent neurologic deficit. We had a minor complication rate of 12.6%. *Conclusions:* The expanded endonasal approach affords the neurosurgeon with direct access to the clivus. Through a minimally invasive approach, the transclival module can be used safely to access a variety of pathologies located at the cranial base.

P-097

Seizures as a symptom of acute cerebrospinal fluid shunt malfunction, valid or not? A systematic review.

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Background: Patients who have a cerebrospinal fluid (CSF) shunt sometimes experience seizures. It is unclear if a seizure represents a symptom that should prompt clinicians to suspect a shunt malfunction. We carried out a systematic review of the literature in order to examine the relationship between seizures and cerebrospinal fluid shunt malfunction. *Methods:* A literature review was performed using Pubmed with the following search strategy: "cerebrospinal fluid shunt" or "ventriculoperitoneal shunt", AND "hydrocephalus", AND "seizures" or "epilepsy", AND "malfunction". Out of 17 publications, 5 addressed the issue of seizures with shunt malfunction; two papers were added after bibliographic review. Data were extracted from published results and analyzed using StatsDirect (England) to allow calculation through a fixed and random effect model. *Results:* Pooled proportion of confirmed CSF shunt malfunction presenting with a seizure episode was 6.0% (95% CI 5.0 to 7.2%) on a fixed effect model and 8.0% (95% CI 2.7 to 15.8%) on a random effect model. New onset seizures with CSF shunt malfunction were 2.3% (95% CI = 1.5 to 3.2%) obtained from data available in 4 publications only. Three publications provided results of seizures as the sole sign of CSF shunt malfunction, yet results widely ranged from 0 to 14%. *Conclusion:* The occurrence of a seizure in the patient with a CSF shunt does not usually indicate shunt malfunction. We suggest that work-up of CSF shunt malfunction in post-ictal patients should be reserved for those patients who also have additional symptoms or signs of elevated intracranial pressure.

P-098

Late presentation of an abdominal pseudocyst

S Yuh (Ottawa), M Vassilyadi (Ottawa)*

Background: Abdominal pseudocyst (APC) is a rare manifestation of a ventriculo-peritoneal shunt (VPS) that is attributed to an inflammatory response, usually as a result of infection. *Methods:* The medical chart and radiological imaging were reviewed for a patient that was diagnosed with an APC nine years after surgery. *Results:* A 13 year-old girl presented with progressive abdominal distention, pain and vomiting. Her VPS was inserted at infancy for congenital hydrocephalus. At three years of age, she had a shunt infection that was treated with externalization of the shunt, antibiotics and subsequent shunt replacement. One year later the shunt was revised for a distal malfunction. Abdominal CT at presentation nine years later demonstrated a large multiseptated cyst. The VPS was externalized and 1.8 liters of sterile, xanthochromic peritoneal fluid was drained. The CSF was clear, colorless, acellular and sterile with a normal protein and glucose. Two days later the distal portion of the shunt was replaced into the pleural cavity. The patient remains well with no pleural effusion 18 months later. *Conclusions:* APC can occur in patients with VPS within four years of surgery. There is only one other case in the literature has been reported with such a delayed presentation.

P-099

Diagnostic and therapeutic paradoxes in tuberculous meningitis: case report and review of literature

M Lee (Hamilton), BW Lo (Hamilton), G Belovay (Hamilton)*

Background: Of all reported cases of tuberculosis in Canada, only about 1% involve the CNS. Prompt treatment of suspected cases is imperative. Although some antituberculous medications can readily penetrate CSF, patients can demonstrate an initial paradoxical clinicopathologic deterioration during treatment. *Methods:* Review of literature shows that at least one third of patients with stage III (advanced) TB succumb to their illness. *Results:* We report a case of a 33-year-old male, originally from the Philippines, with past history of testicular epididymitis, colitis and positive TB skin test who presented to McMaster University Medical Center with stage II disease. Although negative for TB PCR, he was started on anti-TB medications. However, the patient progressed to disseminated TB with basal ganglia and pontine infarcts, vasculitis, meningeal inflammation as well as communicating hydrocephalus. His lymphocyte count paradoxically increased during the initial month of treatment. Only after two months of antituberculous therapy were his urine and bronchoalveolar lavage positive for isolated Mycobacterium TB complex. He further progressed to advanced disease with obtundation and dystonia. Ten months after presentation, the patient remains persistently vegetative. *Discussion:* Despite effective antituberculous therapy, disseminated CNS TB can paradoxically present with increased lymphocyte count and clinicoradiologic deterioration. This reaction may be secondary to a massive delayed release of tuberculoproteins.

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P-100

Cerebral mantle reconstitution after shunting infants with severe hydrocephalus

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Background: Various degrees of cerebral mantle reconstitution (CMR) have been observed in infants born with severe hydrocephalus after insertion of a ventriculo-peritoneal shunt. *Methods:* Neuro-imaging studies and neuro-developmental information of infants with hydrocephalus shunted at CHEO between 1996 and 2006 were reviewed and Evan's ratios (ER) calculated. With ER ≤ 0.3, there was significant CMR (SR), partial (PR) with ER between 0.5 and 0.3, and no CMR (NR) with ER ≥ 0.5. *Results:* Fifty-one neonates with shunted hydrocephalus were identified. Nineteen had severe hydrocephalus with shunts inserted between birth and 9 months of age. CMR occurred as early as 18 days and as late as 24 months. There were nine patients with SR, nine with PR and one with NR. Compared with the SR group, the PR group had a variety of conditions such as IVH, subdural hematomas, infection, shunt revisions, and congenital lesions. The NR patient had dysplastic brain and ventricles. All patients had various degrees of neuro-developmental delay, but this was more severe in the PR and NR groups. *Conclusions:* CMR may be related to the timing of shunt surgery. It may be partial or not occur at all if there are associated neuro-development malformations such as cerebral dysplasia.

P-101

Chiasm compression by an elongated anterior cerebral artery - The benefit of microvascular decompression

N McLaughlin (Montréal),A Weill (Montréal), MW Bojanowski (Montréal)

Background: Elongation of the anterior cerebral artery and subsequent compression of the chiasm has been rarely reported as a cause of visual field deficit. The surgical strategies are not well described. *Methods:* Case report and review of the literature. *Results:* A 56 yr-old male presented with progressive right nasal visual field deficit. MRI revealed a lateral chiasm compression by the right anterior cerebral artery. A microvascular decompression was proposed. The right A1 was dissected on all its lenght up to the lamina terminalis cistern. Right A1 appeared larger than usual and tortuous transmitting its pulsations into the chiasm. A piece of Teflon was inserted between the A1 and chiasm. Following surgery, visual field deficit improved progressively. At two months, the patients visual fields were normal. *Conclusion:* An elongated anterior cerebral artery may compress the chiasm and result in a visual field deficit. Timely microsurgical dissection of ACA and insertion of Teflon may decompress the chiasm and improve vision.

P-102

The telovelar approach to the fourth ventricle for vascular pathologies

N McLaughlin (Montréal), M Laroche (Montréal), MW Bojanowski (Montréal)

Background: Access to the fourth ventricle achieved by opening the tela choroida and the inferior medullary vellum provides a panoramic view without incising or removing any part of the cerebellum. We describe three patients with vascular lesions that were operated through this approach and with the aid of video present the operative findings. *Methods:* Case series, operative description, literature review *Results:* One patient was operated for a ruptured distal PICA aneurysm and two others for ruptured pontine cavernous angioma. All patients had a favourable outcome following this approach. In the literature, the telovelar approach has been used mostly to expose fourth ventricular tumors but only occasionally for vascular lesions. *Conclusion:* The telovelar approach offers a corridor through non eloquent arachnoid planes and a safe and capacious working environment. Detailed knowledge of the normal vascular anatomy of this region and its variations is needed to prevent cerebellar and truncular lesions.

P-103

Lymphocytic hypophysitis caused by a ruptured intrasellar Rathke's cleft cyst: Case report and review of the literature

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Background: Ruptured Rathke's cleft cyst (RCC) is a rare cause of hypophysitis. Spilled cyst content into adjacent gland may cause an inflammatory infiltrate, most frequently of granulomatous type. *Methods:* We present a case of lymphocytic hypophysitis caused by a ruptured RCC and review the literature. *Results:* A 31 yr-old female presented with amenorhea and galactorhea for the last 4 months. She noticed progressive decrease in left eye visual acuity and more recent polydypsia and polyuria. MRI revealed a cystic sellar mass with suprasellar extension. The initial diagnosis was pituitary adenoma with a cystic component. Through a transphenoidal approach, a creamy whitish content poured out from the cyst. Intra-operative histophathology assessment of the gland identified an inflammatory reaction and absence of adenoma. Further examination revealed that the lymphocytic hypohysitis was associated to a ruptured RCC. *Conclusion:* RCC rupture may induce a lymphocytic type of hypophysitis. Intraoperative recognition of this entity allows surgical strategies for pituitary gland preservation.

P-104

Trochlear to oculomotor nerve anastomosis provides long-term functional recovery after deliberate third nerve resection for large schwannoma

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Background: A 34 year-old female presented with brainstem compression due to a large left third cranial nerve schwannoma. Clinically, she presented with progressive right sided facial and limb weakness and hemiparetic gait. No third nerve findings were evident preoperatively. Extensive tumour invasion of the third cranial nerve prohibited its preservation during tumour resection. *Methods:* Due to pre-existing and unrelated impairment of visual acuity in the contralateral eye, an attempt was made to surgically reinnervated the distal third nerve. The trochlear nerve was divided at its entry into the tentorium and anastomosed to the distal stump of the oculomotor nerve with the intention of restoring levator palpebrae superioris function. The anastomosis was secured with gelfoam and Tisseel. *Results:* Successful partial restoration of oculomotor nerve function

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occurred over several months post-operatively. The affected (left) eye improved from complete ptosis to being open at rest. Voluntary activation of the right trochlear nerve by looking downward and inward resulted in complete elevation of the eyelid and partial adduction of the left eye. Functionally, there was some degree of useful vision particularly while viewing television. *Conclusion:* We have demonstrated successful reinnervation of the third cranial nerve by direct trochlear to oculomotor nerve anastomosis. Despite variable diplopia during binocular vision, overall quality of life was improved with the ability to open the left eye. Functional recovery persists after nearly three years. Similarly, neurosurgeons in Sweden reported good functional recovery of a trochlear to oculomotor nerve anastomosis in an infant. Unfortunately, the functional recovery was short-lived reportedly as a result of tumour recurrence. These encouraging results provide a potential surgical option during procedures requiring sacrificing of the oculomotor nerve.

P-105

Management of a locked strata ventriculoperitoneal shunt valve

K Bullivant (Calgary),A Mitha (Calgary), M Hamilton (Calgary)

Background: The PS medical® Strata™ valve is a programmable shunt valve used for treatment of hydrocephalus that allows for non-invasive changes in the pressure setting using a magnet (PS medical). The Strata valve is sensitive to magnetic fields with reprogramming frequently necessary following any Magnetic resonance imaging (MRI). A known but rare complication of the Strata valve is that the rotor can become locked causing shunt malfunction. This complication can only occur in a first generation Strata valve. *Methods and Results:* A 65 year old man with a diagnosis of obstructive hydrocephalus (longstanding overt ventriculomegaly in adults (LOVA)) with a ventriculoperitoneal shunt was seen in the Adult Hydrocephalus Clinic because of clinical deterioration in balance and a decline in his ability to walk. He denied any headache but did have worsening of his short-term memory. A CT scan demonstrated a slight increased dilatation of the lateral ventricles. A nuclear medicine (NM) shunt scan demonstrated no flow of radiotracer. The Strata valve programmer was unable to read a valve setting, compatible with the shunt rotor being locked in an effectively off position. A 0.4 Tesla magnet provided by Medtronic PS Medical was used to unlock the shunt and return it back to a Delta 0.5 setting. After unlocking the Strata valve an immediate repeat NM shunt scan confirmed a return of flow to the system although it continued to be slightly delayed. He experience complete clinical improvement (back to baseline) over the following week and a repeat NM shunt scan one month later showed normal flow through the system. This patient is one of 5 who have required this technique to unlock a Strata valve. *Conclusions:* All patients should have their Strata valve setting reassessed after any exposure to a strong magnetic field. Physicians involved in the care of patients with hydrocephalus treated using a VP shunt with the Strata valve should be aware that this potential issue can occur after an MRI scan.

P-106

Intraoperative motor evoked potential monitoring of vagus nerve function during skull base surgery

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Background: Vagus nerve injury is one of the complications associated with skull base procedures resulting in hoarseness and dysphagia. Myogenic motor evoked potentials (mMEP) with transcranial electrical stimulation (TCES) have been successfully used for intraoperative facial nerve monitoring. In this study, we extended the TCES mMEP methodology to vagus nerve (VN) monitoring during skull base surgery. *Methods:* Eighteen patients undergoing skull base procedures for resection of large cerebellopontine angle tumors with VN compression were included in the study. VN mMEP were produced with TCES and recorded from the ipsilateral cricothyroid muscle. The amplitude of VN mMEP was calculated as a percentage of baseline and correlated with postoperative VN function. Anesthesia was maintained with propofol and narcotic infusion without neuromuscular blockade. *Results:* Reliable VN mMEP were obtained from all the patients. These responses, with an average onset latency of 14.8ms, tended to be polyphasic and exhibited large amplitude variability. In all the patients, however, VN mMEP never reduced below 50% of baseline during the procedure and were above 70% of baseline during closure. The morphology and latency of these responses remained relatively stable. No clinical signs of VN injury were revealed in the postoperative neurological examination. *Conclusions:* Our results suggest that VN mMEP can be reliably recorded during skull base procedures. Preservation of VN amplitude above 70% of baseline correlates with normal postoperative VN function.

P-107

Skull osteomyelitis caused by Eikenella corrodens in 66 y old male. Case report and literature review

FE Alotaibi (Riyadh), KN Almusrea (Riyadh)*

Of all the case of bacterial osteomyelitis Eikenella corrodens is rare causative agent. We report a case of bacterial skull osteomyelitis by Eikenella corrodens in 66 y old man which has no risk factor or direct trauma apart from diabetes mellitus.

P-108

Synchrotron microbeam radiation therapy in rat glioma

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Background: Human glioma is a devastating disease; conventional treatments are temporizing at best. We studied a novel treatment technique applying synchrotron-based microbeam radiation therapy (MRT) in a rat model. *Methods:* C6 and F98 glioma were implanted into adult Wistar and Fisher rats, respectively. Thirteen days after implantation, animals were either exposed to MRT or served as non-irradiated controls. Some of the animals received buthionine sulfoximine (BSO) injections into the tumour site prior to MRT. Controls without brain tumour were also exposed to MRT. Radiation

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was delivered bi-directionally, centered on the tumour, in an array of 50 parallel microbeams, each measuring 24.75γm and separated by 211γm. The skin entry dose was 350Gy. Object recognition tests were performed at various stages to assess the capacity for new memory formation. *Results:* In both Wistar and Fischer rats with gliomas, survival time significantly increased with MRT. Animals subjected to BSO injection prior to MRT had poorer object recognition but prolonged survival. *Conclusions:* Synchrotron MRT significantly increases survival of animals with malignant brain tumours. BSO may provide additional survival benefit at the cost of measurable adverse effects. Further investigation with a view to clinical trials in humans is needed.

P-109

Methylmethacrylate cranioplasty through dental impression-casting - an old idea with modern relevance

EE Dyer (London), S Lownie (London), J Armstrong (London), M McDonald (London)*

Background: Acrylic cranioplasty for cranial defects is frequently used when the original bone flap is infected. Typically this is performed by manually shaping the acrylic polymer at the time of implantation. An alternative option to produce duplicates of the original bone flap is presented. *Methods:* A retrospective review of thirteen patients was conducted. The shape of the patients' original bone flap was captured through dental impression - casting technique for accurate replication. The impressions were filled with methyl methacrylate, heat treated and pressurized to form the prosthesis. Gas sterilization completed the procedure and implantation occurred in a second operation 3-5mths later. *Results:* This process takes less than 48 hrs to complete, and a preformed flap reduced intraoperative time. Additional contouring was performed to accommodate a dynamic wound bed. Both patients and staff were satisfied with the cosmetic results. No prosthesis has been removed secondary to infection. *Conclusions:* Acrylic replicas through impression casting techniques yielded excellent structural and cosmetic results; an improvement over our prior technique. This process has only been described in scattered case reports, yet remains a simple and cost effective option, when the bone flap of any size is considered unusable.

P-110

Neuropsychological and quality of life outcome after endoscopic

WJ Hader (Calgary), L Ozen (Calgary), L Hamiwka (Calgary), E Sherman (Calgary)*

Background: Gelastic epilepsy associated with hypothalamic hamartoma is a well characterized clinical syndrome of refractory seizures associated with behavioural and developmental decline. Surgical removal of the hamartoma can result in improved seizure frequency and resolution of behavior disturbance. However, detailed neuropsychological outcome has rarely been reported. We present two children with gelastic epilepsy who underwent endoscopic resections of a HH. *Methods:* Detailed clinical histories, results of neuroimaging, pre- and post-operative neuropsychological and quality of life evaluation was completed for two patients with gelastic epilepsy who underwent endoscopic resection of hypothalamic hamartoma. *Results:* A 10-year-old with severe cognitive and behavioural disturbances, including impaired memory for verbal and visual material, had subtotal resection of a 1 cm hypothalamic hamartoma. At two year follow up he has had 90 % reduction in seizure frequency with dramatic improvement in behaviour and very good quality of life on parental ratings. Post-operatively, memory for both visual and verbal material are within the normal range. An 11-year-old boy with normal cognitive function had complete resection of a 5 mm hamartoma and has remained seizure free at 2 years. Severe impairment of executive functions in daily life, as indicated by scores on the BRIEF, were significantly improved post-operatively. Post operatively he developed a permanent verbal memory deficit felt to be the result of left forniceal system injury as a result of surgical approach through the left foramen of Munro. *Conclusions:* Endoscopic removal of hypothalamic hamartoma can result in a significant improvement in gelastic seizures, behaviours and quality of life. Significant risk of decline in memory exists with resection of hypothalamic hamartoma, although improvement in memory function is also possible. Our results suggest that a reversible cognitive impairment may exist in some patients with gelastic epilepsy-hypothalamic hamartoma syndrome.

P-111

Towards a classification of surgical error

D Louw (Edmonton), S Brien (Ottawa), R Barrett (Calgary)*

Background: The Baker/Norton study in Canada confirmed a high local prevalence of medical error. In particular, the heart of the hospital, the OR, subtends a disproportionate 'slice' of serious cases - up to 50%. Nevertheless, there is no standardized system of classifying surgical error. *Methods:* Two neurosurgeons and an Airbus pilot with expertise in safety systems performed an extensive literature search. This included review of multiple electronic data bases as well as a hand search. In addition, the pilot attended neurosurgical procedures to analyze operative flow and contrast its safety 'ecology' with that of the aviation industry. *Results:* The literature review and the surgical studies were integrated. The high-velocity of the OR and the fluid nature of its anesthetist and surgeon leadership were evident. The role of diagnostic, surgical planning and technical error was clarified, and cognitive overload in the context of fatigue and distraction was determined as a critical factor in our proposed classification. *Conclusions:* The increasing number and complexity of procedures performed, and the increasing intrusion of technology, have contributed to 'hazard creep' in the OR. A coherent and comprehensive blueprint to categorize and analyze error is a necessary step in harm interception and reduction.

P-112

Post-operative cerebellar mutism: traumatic brain injury

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Background: Mutism is a complication of posterior fossa tumor resection. Onset is typically 1-3 days after surgery although the cause remains unclear. *Methods:* Patients were included in the retrospective study if; 18mos-18yrs old at diagnosis with a midline, posterior fossa tumor. Exclusion criteria: disease relapse or severe,

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premorbid language impairment. Medical records and MRI films (pre/post-operative) were reviewed. Pons antero-posterior (AP) distance was measured on axial T2WI (level of middle cerebellar peduncles), from the most posterior portion of basilar artery to most anterior portion of cystic or solid tumor. *Results:* Mutism was seen in 13/51 (25%) patients. Medulloblastoma was more common in the mutism group. No difference was seen in vermian incisions, surgical approach taken, intraoperative drain placement or tumor size/volume. Pre/post-op MR films were available for 9/13 mutism, 27/38 non-mutism patients. Pre-op pons AP distance was less in mutism group ($p<0.05$). Post-op pons AP distance was similar (p=NS). Change in pons AP distance was greater for the mutism group ($p<0.005$). *Conclusions:* Mutism patients showed greater pre-op pons compression. They showed greater post-op change in pons AP distance. This may reflect a greater release of compressive forces associated with tumor resection and ensuing edema. Such force would represent a form of traumatic brain injury as a cause of mutism.

History, Education

P-113

International neurosurgical education: an experience from the Da Nang General Hospital, Viet Nam

*K Mukhida (Toronto)**

There is a scarcity of neurosurgical education, and therefore neurosurgical services, in some parts of the developing world. International medical education initiatives offer one manner of improving neurosurgical care in the developing world. Trainees from developing countries have traveled to developed countries to receive neurosurgical training with the objective being their return to their home countries to support indigenous programs. An alternative strategy involves neurosurgeons from developed countries working in the developing world to improve neurosurgical training locally so as to make that training relevant to local needs. This has been the strategy of the Foundation for International Education in Neurological Surgery, which has supported neurosurgical programs around the world, including the program at the Da Nang General Hospital in Viet Nam. In this paper, the origins of Neurosurgery in Da Nang and the status of neurosurgical education at the Da Nang General Hospital is described. The contributions that neurosurgical education provides to improving population health in Da Nang are also considered.

P-114

Wilder Penfield's contributions to neuro-oncology

*K Mukhida (Toronto)**

Wilder Penfield is perhaps most recognized for his contributions to the development of techniques for the surgical management of epilepsy. Less has been explored of Penfield's interests in neuro-oncology. In 1924, Penfield left Columbia University to work for six months in Madrid with Pio del Rio-Hortega and Santiago Ramon y Cajal. He perfected the Spanish metallic methods of staining the glial cells of the central nervous system and this facilitated his histological assessments of central and peripheral nervous system tumours upon his return to North America. In 1931, he published his own classification of brain tumours that added to that provided by Bailey and Cushing in 1926. He also studied the relationship between intracranial tumours and the development of epilepsy. Penfield's experiences in neuro-oncology extended beyond his research and into a personal realm when he operated on his sister to resect a frontal oligodendroglioma in 1931. Using primary source material from the Osler Library of the History of Medicine, Penfield's work in neuro-oncology is discussed, with particular attention on the contributions of his basic science studies to the development of his classification of brain tumours and his experiences with his sister's condition.

P-115

An apple on the doctor's desk: what motivates clinicians to teach? a survey in a neuroscience program

*M del Campo (Toronto)**

Background: Although much has been published in terms of teacher motivation and retention, little is available in the medical sciences and no papers specific to the neurosciences were found in a literature search. *Methods:* An anonymous survey was conducted amongst 15 full-time academic staff at the Toronto Western Hospital. Thirty statements with the headings: "what motivates you to teach", "what would enhance your participation in teaching" and "what turns you off from teaching" were scored on a 7-point Likert scale. Means and standard deviations of the responses were calculated. *Results:* The highest ranking stimuli to teach revolve around the formation of successful physicians. The least important issues are peer pressure and academic advancement. Some faculty are concerned with self-image, recognition and the type of students that motivate them to teach. Remuneration was considered by some as a potential motivator. Some dissatisfaction was found in the time sacrifice. The concept that teaching itself is a turn-off drew responses indicating ambiguity from one member and some degree of agreement from another. *Conclusions:* This relatively small sample of faculty members indicates a high level of altruistic values associated with neuroscience teachers. Remuneration is not considered essential. Concerns about time away from clinical and research endeavors was raised. Interestingly, no concerns were expressed about academic advancement, perhaps due to the heavy involvement of this faculty sample in research of all types.

Movement Disorders (Basic Science, Neurobiology, Imaging and Functional Neurosurgery)

P-116

Internet-based survey of physician referral patterns for Parkinson's disease patients

LW Ferguson (Saskatoon), ML Rajput (Saskatoon), A Rajput (Saskatoon)**

Background: An internet-based survey of Saskatoon Health Region (SHR) physicians was conducted to determine familiarity with Parkinson's disease (PD), comfort level with PD treatment, prescription patterns, and referral patterns to a neurologist. *Methods:* Family Physicians (FP), general internists, geriatricians,

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rehabilitation medicine, neurologists and locums in SHR (n=398) were invited to complete an internet-based survey concerning PD patients. About 11% of SHR physicians completed the survey; the majority were FP (52.4%). While the potential impact of physician specialty was investigated, all results were negative. *Results:* Most physicians reported lower comfort levels with differential diagnosis (66.7%) and prescribing anti-Parkinsonian medications (83.7%). Levodopa was the most frequently prescribed anti-Parkinsonian medication (57.1%). None of the survey respondents had ever prescribed MOA-B Inhibitors or COMT Inhibitors. Generally, patients with atypical symptoms, severe symptoms, or a major change in quality of life (74.6%) were selectively referred to a movement disorders specialist. The most common profile prompting referral to a neurologist was the presence of cardinal symptoms in conjunction with gait and/or balance problems, or poor drug response, or adverse drug response (58.1%). *Conclusions:* While physicians reported moderate comfort levels with initial diagnosis and Levodopa treatment, disease progression leads the majority to selectively refer PD patients to a movement disorders specialist.

P-117

Changes in binding of GABAA receptors in patients with Tourette syndrome studied with [^{11}C] flumazenil PET

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Background: The purpose of this PET study was to identify possible dysfunction of the GABA-ergic system in Tourette patients, especially in the basal ganglia-thalamo-cortical circuits and cerebellum. Such dysfunction could potentially be responsible for symptoms of motor disinhibition presenting as tics and some behavioral problems such as ADHD and OCD. *Methods:* We studied 11 patients with Tourette syndrome and 11 healthy volunteers. PET procedure: after injection of 20 mCi of [^{11}C]-flumazenil a 60-min dynamic emission image of the brain was acquired. For all subjects structural MRI was obtained for co-registration with PET. Analysis: binding potential (BP) images were created using the 2-step version of the simplified reference tissue model. BP images were then normalized, smoothed and analyzed using SPM2. *Results:* We found decreased binding of $GABA_A$ receptors in Tourette patients in putamen and caudate nuclei bilaterally, thalamus, amygdala and R insula. There was increased binding of GABAA receptors in the sulcus calloso-marginalis, periaqueductal grey and cerebellum. *Conclusion:* The results are consistent with the longstanding hypothesis of disinhibition of basal ganglia circuits and the thalamus in Tourette patients. Additionally there were abnormalities in binding of GABAA receptors in the insula and cerebellum, structures recently identified to possibly contribute to tic generation.

P-118

Nonsteroidal anti-inflammatory drug use and the risk of Parkinson's disease: an epidemiologic meta-analysis

A Samii (Seattle), M Etminan (Vancouver)*

Objective: To determine whether the use of non steroidal anti-inflammatory drugs (NSAIDs) modifies the risk of Parkinson disease (PD). *Background:* PD is a progressive neurodegenerative disease without a cure. Inflammation is one the proposed mechanisms in the etiopathogenesis of PD. A number of studies have suggested that NSAID use may reduce the risk of developing PD. *Design/Methods:* We systematically searched MEDLINE (1966-present) and EMBASE (1980-present) as well as references of retrieved studies that evaluated the use of NSAIDs and PD. We searched for randomized controlled trials or observational studies that looked at the association between NSAID use and PD. We made three separate analyses. In the first analysis, we selected studies that explored the risk of PD in NSAID users (all types). In the second and third analyses, we explored the risk of PD only in aspirin and ibuprofen users, respectively. We used the random effects model to calculate a pooled relative risk and its corresponding 95% confidence interval (CI). Odds ratios were considered an approximation of relative risks. We only combined relative risks (from cohort studies) and odds ratios (from case control studies) if the test of heterogeneity was negative. Heterogeneity was assessed using the Q statistic. *Results:* Data from 11 studies were included in the analyses. Nine studies had data on non aspirin NSAIDs. The pooled relative risk of PD among non-aspirin NSAID users was 1.01 (0.86 -1.09, P heterogeneity=0.01). The pooled relative risk of PD for aspirin users was 1.14 (0.98 -1.33, P heterogeneity =0.11). There were only two studies specifically looking at ibuprofen. The pooled relative risk of PD among ibuprofen users was 0.78 (0.62-0.99, P heterogeneity =0.40). *Conclusions:* NSAIDS as a class do not seem to modify the risk of PD. However, ibuprofen may have a protective effect in lowering the risk of PD. Future prospective studies are needed to address this question.

P-119

Chorea in iatrogenic hypocalcemia

A Rana (Toronto), F Khan (Toronto)*

Chorea, a movement disorder, characterized by involuntary, irregular, brief, fleeting and jerky movements moving from one body part to another is the result of a list of genetic and acquired disorders. Among these, one uncommon but important cause is prolonged hypocalcemia that can in fact be secondary to iatrogenic removal of parathyroid glands during total thyroidectomy as this interesting case of a 79 year old female originally from Sri Lanka highlights. Her total thyroidectomy was done 15 years ago after which she developed seizures followed by choreoathetoid movements. Corrected serum calcium was found to be significantly below the normal reference range and prompt improvement was noted with adequate calcium replacement therapy. This case thus underscores the fact that long term hypocalcaemia can not only cause recurrent seizures but o choreoathetoid movement disorder as well that has only partial if any recovery even after adequate therapy. Video is available.

P-120

Compulsive behaviours seen with dopamine agonists

A Rana (Toronto), F Khan (Toronto)*

The use of dopamine agonists in the treatment of Parkinson's disease have especially increased since the availability of non ergot dopamine agonists about a decade ago.Over last few years there have been increasing reports of compulsive behaviours as side effects of dopamine agonists. We present three patients seen in our

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Parkinson clinic who developed these side efffects. Mr.J.W. , a 70 year old male with stage II Parkinson's disease developed compulsive sexual activity reported by him and his spouse while on mirapex.The abnormal behaviour resolved on stopping mirapex. Mr.M.K.,49 year old male with stage II Parkinson disease developed compulsive gambling and lost $50,000 on permax.On stopping permax the abnormal behaviour resolved. Mr.N.V. 56 year old male with stage II Parkinson's disease developed compulsive eating on Mirapex , on lowering dose the abnormal behaviour improved. Physcians should always discuss these potential side effects not only with patient but with families as well on all encounters.

P-121

Task specific tremor type B but difficulty writing numbers more than letters

A Rana (Toronto), F Khan (Toronto)*

Task specific tremor especially writing tremor is an uncommonly seen condition even in movement disorders clinics. We present a case of writing tremor type B with difficulty writing numbers more than letters. Our patient Mr.A.H. was 50 year old right handed male with tremor of right hand which started about a year ago gradually only upon writing. There was no tremor present upon holding things, other activities such as using a screw driver or threading a needle. His hand writing had become slightly tremolous as well. Unusually he had more difficulty writing numbers than letters. The tremor would disappear when he would stop writing. He would also develop tremor even when his hand would adopt a writing position. There were no features of any other abnormal movement disorders. Most of the writing tremors would affect both numbers and letters writing but this was interesting as this affected number writing more than letter writing. Video is available.

P-122

Canadian survey to assess regional differences in the diagnosis and management of movement disorders responsive to botulinum toxin type-A (BoNTA)

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Objective: To assess diagnostic and treatment pathways of movement disorders responsive to BoNTA by geographic region and to review their relative frequency. *Methods:* Patients with BoNTA responsive movement disorders completed a 19-question survey developed by the Canadian Movement Disorder Survey Group in 13 Canadian centres. The survey included demographics, time to diagnosis, number of physicians seen and wait times. *Results:* This interim analysis includes 698 patients. 72% were female. The average age was 57 yrs, 29% being over 65. Average travel was 74 kms one-way, ranging from 44 (Quebec) to 99 kms (Atlantic provinces). Common diagnoses included cervical dystonia (53%), hemifacial spasm (20%), and blepharospasm (10%). The average number of physicians seen prior to diagnosis was 3.2, ranging from 3.0 (Ontario) to 4.0 (Atlantic provinces). Average time from onset of symptoms to diagnosis was 4.7 yrs, ranging from 2.7 (Western provinces) to 6.2 yrs (Quebec). 94% of patients were treated with BoNTA following diagnosis. Average waiting time to treatment was 3.2 months. Common reasons for delay were physician waiting lists (50%) or insurance paper work (20%). *Conclusion:* Regional disparity in diagnosis and treatment timelines in Canada may improve with selective awareness programs coupled with additional trained injectors in targeted regions.

P-123

Epilepsy - should always be in differential of movement disorders

A Rana (Toronto), F Knan (Toronto)*

A case of Unverricht - Lundborg Disease. We describe an interesting case of a 21 year old female who was seen in neurology clinic and referred to the Movement Disorders Clinic for assessment because she had myoclonus. On futher history in movement disorders clinic it was found that she had a generalized tonic clonic seizure only once at age 11 years while in Pakistan and was started on valprioc acid and never had any recurrant episodes. At 21 when she became pregnant she stopped taking valprioc acid and reported to get episodic jerks without any decline of consiousness, shaking, tongue biting or incontinence. These episodes were brought on by emotional stress, or other sudden movements. A differential diagnosis of hereditary myoclonic epilepsy versus proxysmal kinesogenic dyskinesia was entertained. Genetic testing confirmed the diagnosis of unverricht - Lundborg disease and she responded well to valproic acid. Our case underscores the importance of considering epilepsy in the differential of the movement disorders. Video is available.

P-124

Neuropsychological profile of five patients with recessive ataxia of Beauce, a newly discovered inherited pure cerebellar ataxia: further evidence for a role of the cerebellum in cognition

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Background: Beyond its role in motor control, several studies suggest that the cerebellum is involved in cognition. However, the nature and severity of cognitive deficits vary greatly between studies in part because authors have used patients with extracerebellar lesions. Recently, mutations in the SYNE1 gene have been shown to be responsible for Recessive Ataxia of Beauce (RAB) which is characterized by severe and circumscribed damage to the cerebellum. The goal of this study was to explore the role of the cerebellum in cognition using this unique clinical model. *Methods:* Five patients were tested using a neuropsychological battery of tests. Raw data were converted to Z-scores. Scores ≥ 2 were considered statistically significant. *Results:* Significant deficits in attention (speed of information processing, sustained attention), executive (deductive reasoning, mental flexibility, verbal fluency, working memory) and visuospatial skills (3-D drawings, copy of the Rey Complex Figure) were found. *Conclusions:* RAB is a unique model to study the non-motor role of the cerebellum. The nature of the deficits observed is in favour of an indirect participation of the dorsolateral prefrontal and posterior parietal cortical areas to the cerebrocerebellar circuit. These data will have a significant impact on the care of these patients.

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P-125

Image Co-registration technique for stereotactic localization of deep brain stimulation electrodes

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Background: Deep Brain Stimulation (DBS) has become a standard therapy for the treatment of Parkinson's Disease. Long term studies have demonstrated a robust and durable clinical response to stimulation of the subthalamic nucleus. Stimulation-related side effects may limit the selection of active contacts for stimulation, or limit the voltage that may be delivered. Clinicians performing the stimulator programming are usually not the clinicians that implanted the electrodes. Communication of the precise stereotactic coordinates of the DBS electrodes may aid understanding of the therapeutic limitations of DBS in an individual patient. We developed a protocol to combine MRI and CT imaging modalities to precisely define stereotactic coordinates of DBS electrodes. *Methods:* Patients were referred to University of Washington for troubleshooting of their DBS system, or for new DBS implantation. For this protocol, a volumetric MRI of the brain was required; this was obtained either prior to DBS implantation, or after implantation following safety guidelines published by Medtronic, Inc. In addition, patients underwent a CT scan of the brain in an "extended Hounsfield unit" mode. MR and CT images were coregistered using Normalized mutual information techniques (implemented in SPM). DBS electrode locations were then measured on this image-fusion study in the standard Anterior Commissure-Posterior Commissure (AC-PC) coordinate system. Registration error was estimated using coordinate locations of corresponding anatomical landmarks visible in both modalities. *Results:* This method has been used in both troubleshooting DBS implantations and in documenting the postoperative position of DBS electrode implantations. *Conclusions:* This method is successful in defining the accurate stereotactic coordinate locations for DBS electrodes. This information may be communicated between clinicians for an enhanced understanding of stimulation-related side effects of DBS surgery.

P-126

Hyperekplexia in two Omani families

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Introduction: Hyperekplexia is a rare non-epileptic paroxysmal neurogenetic disorder characterised by neonatal hypertonia and exaggerated persistent startle reflex. Several missense and nonsense mutations have been identified in hyperekplexia in the gene encoding the á1 subunit of glycine receptor (GLRAl). *Aim:* We report two large apparently unrelated consanguineous families with hyperekplexia. *Materials and Methods:* Patients were clinically examined and the probands in both families had EEG and MRI. Cognitive status of patients was quantified using formal Arabic version of Stanford-Binet Intelligence Scale1. Blood samples in EDTA tubes were obtained from all patients, parents and their unaffected children from family A and patients from family B. DNA was extracted using the standard phenol/chloroform method. *Results:* We report two large apparently unrelated consanguineous families with hyperekplexia who have a novel mutation in the ligand binding domain of GLRA1 gene. In addition, the patients have a mild mental retardation a feature that has not previously reported to co-segregate with hyperekplexia. *Conclusion:* A novel mutation in the ligand binding domain of GLRA1 gene was identified and we also observed that mental retardation was co-segregating with hyperekplexia in the studied families which might support the suggestion that GlyRA1 subunits participate in neurocognitive development in humans.

P-127

Preventing graft rejection by over-expression of XIAP enhances graft survival and behavioural recovery in the 6-OHDA rat model of Parkinson's disease

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Introduction: Outcomes of cell restoration strategies for Parkinson's disease (PD) are limited by poor survival of transplanted fetal dopaminergic neurons due to graft rejection and apoptosis. Although immunosuppressive drugs minimize graft rejection, they are not without adverse effects. Thus, studies were carried out to investigate whether transplantation of cells that over-express the X-linked inhibitor of apoptosis protein (XIAP) prevents their graft rejection and thus improves functional outcomes. *Methods:* Fetal dopaminergic neurons from either mice genetically engineered to over-express XIAP or wild type were transplanted into the dopamine denervated striatum of 6 hydroxydopamine lesioned rats. Transplanted animals received cyclosporine immunosuppression: 0, 1, or 10 mg/kg. Amphetamine-induced behavioural deficits and immunohistochemical analyses were assessed post-transplantation. *Results:* A significantly greater number transplanted fetal dopaminergic cells survived from transgenic compared to wild type mice survived regardless of whether they were treated with therapeutic (10 mg/kg) or sub-therapeutic doses (1 mg/kg) of cyclosporine. Only rats that received grafts from transgenic mice demonstrated significant improvement of behavioural deficits at both therapeutic and subtherapeutic doses of cyclosporine. *Conclusions:* Gene therapy strategies to over-express XIAP may be a novel method to prevent graft rejection and increase transplanted cell survival thereby improving the efficacy of neural transplantation for PD.

Multiple Sclerosis

P-128

Allocating resources along the continuing care continuum: perspectives from persons with MS

SA Warren (Edmonton), KV Turpin (Edmonton), G Wheeler (Edmonton), KG Warren (Edmonton)*

Background: This study examined how MS patients want government funds allocated to meet their continuing care needs. *Methods:* 43% of 158 patients randomly sampled from the Northern Alberta MS Clinic (41 living at home and 27 in supportive living/long term care facilities) answered a mail-out survey. *Results:* Financing ways to keep patients in their own homes was the at home

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group's greatest concern (88%), whereas the facility group was divided between ways to keep patients at home (27%) and improving care which patients receive in facilities (35%). Less than 12% per group supported facilities dedicated to MS patients. Increasing wages of healthcare workers to avoid staff turnover and job dissatisfaction was emphasized by both groups, more so by those in facilities (60%) than at home (44%). Slightly over 20% per group recommended hiring additional staff. Top 3 needs reported by patients were: at home —- more housework (44%), personal care (37%) and caregiver respite (37%); in facilities —- more personal care (59%), quality meals (44%) and physiotherapy (41%). *Conclusions:* Differences between the groups largely reflect their living arrangements, but there was a common theme of avoiding staff turnover/job dissatisfaction through increased wages. Responses from both groups suggest the need for services outside direct medical/nursing care.

P-129

Progressive lipoatrophy observed 24 months post cessation of glatiramer acetate

SA Hashimoto (Vancouver), H Tremlett (Vancouver), NJ Ball (Vancouver)

Background: Post-marketing studies have found lipoatrophy at the injection site of glatiramer acetate to be a common adverse event, affecting 45%-64% of patients. We have previously reported the pathology of this lipoatrophy. We now report a suspected chronic adverse reaction to glatiramer acetate with continued progression of lipoatrophy despite cessation of the drug for over 24 months. *Methods:* Case report from the University of British Columbia MS Clinic, Vancouver. *Results:* A 42 year old women with clinically definite RRMS was treated with glatiramer acetate (20mg daily, sc) for 41 months when lipoatrophy on her thighs and buttocks were observed. This was observed again one year later. After 4 years she discontinued treatment for pregnancy related reasons. Since that time, her lipoatrophy has continued to progress (last observation at 24 months). Photographs taken at 5 and 20 months post cessation of glatiramer acetate will be presented. She denied poor injection-site technique; her concomitant medication history was unremarkable. *Conclusion:* Lipoatrophy has only recently been identified as a common adverse effect of glatiramer acetate. We now also demonstrate that this lipoatrophy may be a chronic, progressive disorder. Examination of the injection sites maybe needed beyond the period of active treatment. We plan to observe this patient on a yearly basis. Patients must be made aware of this problem prior to starting medication. *Conflicts of interest:* Dr Hashimoto has recieved honorarium, travel assistance and has sat on advisory boards for: Biogen Idec Canada, Schering-Bayer, EMD-Serono and Teva Neurosciences.

P-130

Novel association of acute demyelinating encephalomyelopathy (ADEM) with PAAG (polyacrylamide aquagel, hydrogel) injections

KS Waspe (Langley), G Vorobeychik (Burnaby)*

Background: There is little information published on the association of PAAG(polyacrylamide aquagel, hydrogel) with ADEM (Acute Demyelinating Encephalomyelopathy), we intend to bring to light a recent novel association of ADEM caused by PAAG. *Method:* Case report *Results:* A 45 year old female presented 10 years after PAAG injections for breast augmentation having suffered recent onset of severe breast inflammation, which had required extensive surgical management. Four weeks later she developed bilateral intranuclear ophthalmoplegia, which spontaneously improved 3 weeks later. MRI confirmed ADEM with lesion in the midbrain. Positive oligoclonal banding was noted in CSF. *Conclusion:* Recently PAAG has been implicated in numerous cases of delayed foreign body reaction. However, this appears to be one of the first descriptions of a case of ADEM caused by PAAG.

P-131

Psychiatric symptoms as presenting symptoms in MS

J Spring (Burnaby), G Vorobeychik (Burnaby), KS Waspe (Burnaby)**

Background: There is little information published about patients who present with existing psychiatric diagnoses at the time of a Multiple Sclerosis (MS) diagnosis. Cognitive and emotional MS symptoms can mimic psychiatric symptoms and possibly delay a timely diagnosis of MS while only the psychiatric diagnosis is treated. *Method:* A retrospective chart review of patients (n=11) with major psychiatric diagnosis confirmed by a psychiatrist prior to a diagnosis of MS were included in the study. *Results:* The diagnosis of psychiatric illness was bimodal in distribution. Diagnosis of MS was delayed in patients < 25 years (n=7) by mean 18.2 years compared with patients > 40 years (n=4, 8.8 years). There was no difference in EDSS at time of MS diagnosis of the young group (3.5) compared to the older group (4.5). MRI data will be presented. Both groups presented with cognitive symptoms, depression, and fatigue. Two MS patients presented with sudden onset of depression, difficult to manage with multiple therapies and resulted in ECT at the age of 17 and 18. *Conclusion:* MS is often not considered as a differential diagnosis for patients presenting with psychiatric symptoms. Sudden onset of refractory depression, especially in young patients, may be a red flag for MS. Upon MS diagnosis, patients with pre-existing psychiatric disorders require unique care plans and collaboration with psychiatry for both adherence to treatment protocols and patient safety. A multi-disciplinary approach in an enhanced community based MS clinic can greatly increase chance for the successful management of these MS patients.

P-132

Tumefactive presentation of Multiple Sclerosis: a diagnostic and therapeutic challenge

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Background: Multiple Sclerosis (MS) is a common chronic disease of the central nervous system with variable clinical expression and pathological features. Tumefactive demyelinating lesions have been reported, often occurring in patients with an established MS diagnosis, but more rarely can occur as the presenting syndrome. Acute tumefactive MS (TMS) lesions have clinical and radiographic features indistinguishable from brain neoplasms, providing a diagnostic challenge. *Objectives and Methods:* We report on a tumefactive presentation of MS, ultimately diagnosed by brain biopsy, with marked progression in clinical and radiographic

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features despite empiric treatment with steroids and plasmapheresis. A review of the current literature, highlighting diagnostic and treatment options for this rare form of MS is provided. *Results:* TMS typically presents with progressive focal neurological deficits. Routine tests, including CSF studies, oligoclonal banding and evoked potentials are often unremarkable. Features on MRI include ill-defined lesion borders, signal inhomogeneity, sparing of U-fibers, and cresenteric ring enhancing patterns. Advanced techniques, such as spectroscopy and diffusion perfusion imaging may aid in etiological differentiation. Brain biopsy, despite potential risks, remains the gold standard for diagnosis. Unlike typical MS plaques, the pathology in TMS shows marked demyelination in the absence of significant inflammation. To date, most reported cases show a lack of steroid responsiveness, but promise with plasmapheresis, or mitoxantrone treatment. Overall, this variant of MS has a higher incidence of monophasic course with noteworthy remission, although persistent deficits may occur. *Conclusions:* The presentation of acute TMS can be dramatic. Differentiation from other intracranial pathology although challenging, is imperative for minimizing morbidity and initiating appropriate treatment.

P-133

Autoimmunity in family members of children with CNS demyelination

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Background: Acute demyelination of the central nervous system (CNS) in children may be a monophasic illness or the harbinger of the chronic autoimmune disease Multiple Sclerosis (MS). It has been hypothesized that development of MS may be more likely in individuals with a strong family history of autoimmune disease (AID), including MS. *Objective:* To determine the proportion of children presenting with acute demyelination who have a positive family history of AID. *Methods:* Comprehensive, standardized family medical history was obtained by a trained genetic counselor as part of the protocol for a Canadian five-year prospective study of acute demyelination in children. Informants were the parents of the children. *Results:* To date, family history data has been obtained from 76 of 190 children enrolled to date. Thirty three families (43%) reported a positive family history of AID: thyroiditis (55%), rheumatoid arthritis (39%), MS (9%), lupus (9%), inflammatory bowel disease (9%) and juvenile diabetes (6%). Males were more likely to have a positive family history of AID, as were children who were younger at first attack, and those with European ancestry. Twelve of the 76 children (16%) have so far been diagnosed with clinically-definite MS; five had positive family history of AID, and none had a family history of MS. *Conclusions:* A positive family history of AID was found in 43% of children with acute demyelination; however it is important to note that (1) larger patient numbers will provide greater power to compare familial MS and AID rates in children with isolated CNS demyelination versus those diagnosed with MS; (2) stratification of AID and MS by degree of relatedness is in progress and (3) family history of MS in first degree relatives may increase over time as most parents of subjects are still well into the "at risk" age group for developing clinical MS. The CIS/MS pediatric genetic data will be compared to existing data on MS patients who present to adult-oriented Canadian MSA clinics.

P-134

Selective Adhesion Molecule inhibition with monoclonal antibody treatment; Hull Multiple Sclerosis clinic experience

F Jacques (Hull), M Gangal (Mississauga)*

Background: Blocking Selective Adhesion Molecules with specific monoclonal antibodies (natalizumab) reduce clinical relapse rate and disability progression in MS. The safety profile of the drug was challenged after three cases of PML that appeared during a combination therapy clinical trial. Last year the drug was re-approved in Canada for MS patients that are progressing under other treatments or for patients that are treatment naive but develop a very aggressive disease. *Method:* More than 30 patients were treated with natalizumab in our clinic in the last year. Patients were evaluated in terms of: sex, age, number of infusions, previous treatment, EDSS, antibody status (after 3 to 6 infusions and before each infusion after the first determination) and observed/mentioned adverse effects. *Results:* Patients' evolution under drug was satisfactory. No major opportunistic infections were observed. Major Adverse Effects: one case of severe autoimmune hepatitis (stopped the drug) one persistent Ab status associated with hypersensitivity reaction, one case of elevated liver enzymes level and creatinine having unknown cause and no recurrence despite continuing therapy. *Conclusions:* In our study natalizumab had the expected efficacy and safety profile. Further studies are needed in order to understand the long term profile of the drug.

Neuromuscular (Basic Science, EMG/NCS and Peripheral Nerve Surbery)

P-136

The heterogeneity of peripheral nervous system disorders following cardiac transplantation

FJ Mateen (Rochester), D van de Beek (Rochester), RC Daly (Rochester), BS Edwards (Rochester), CG McGregor (Rochester), EF Wijdicks (Rochester)*

Background: Cardiac transplantation is a therapeutic option in end-stage heart failure. Peripheral nervous system (PNS) disorders have been described in cardiac transplant recipients but have not been fully characterized. *Methods:* This retrospective cohort review reports the PNS-related concerns of 313 cardiac transplant recipients (27% women; 8% children) from a single institution over nearly 2 decades. *Results:* Approximately one-third of patients (95/313; 30%) reported a PNS-related concern in the post-transplant period, but only 7% of patients had a concern in the first two months after transplant. The relative frequency of PNS-related complaints was polyneuropathy 33%, myopathy 26%, mononeuropathy 17%, radiculopathy 13%, small fibre polyneuropathy 4%, plexopathy 3%, herpes zoster 2%, and restless legs syndrome/periodic limb movements 2%. More than three-quarters of patients with polyneuropathy had abnormalities on risk factor screening, such as impaired renal function (64%), diabetes mellitus (38%), or history of amyloidosis or abnormal serum protein electrophoresis (31%), alcohol abuse (7%), or low serum B12 level (2%). The etiology of

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myopathy was medication-related in 21 of 31 patients (68%); in 11, this was statin-related. *Conclusion:* PNS disease is common after heart transplantation and can be divided into (1) immediate postoperative complications (e.g., brachial plexus stretch injury), (2) signs and symptoms related to the underlying disease prompting transplantation (e.g., polyneuropathy secondary to amyloidosis), (3) signs and symptoms related to necessary medications (e.g., diabetic polyneuropathy), and (4) signs and symptoms reflective of aging in a post-transplant population with enhanced survival (e.g., degenerative joint disease related radiculopathy).

P-137

Axillary nerve repair using radial nerve transfer from a posterior surgical approach

HM Al-Jehani (Montréal), L Jacques (Montréal)*

Background: The axillary nerve is a branch if the posterior cord of the brachial plexus. It is usually approached anteriorly through an infraclavicular approach. This dissection is quite laborious and involves the exposure of the three cords and the axillary artery. The posterior approach is possible and involves proximal axillary nerve and radial nerve *Methods:* We have retrospectively reviewed five cases of axillary nerve repair using this particular approach. Five axillary nerves along with the radial nerves were exposed and isolated with this approach. We used sural nerve interposition graft for the repair. *Results:* The functional outcome was measured by evaluating the sensory function and the Luisiana state university medical center (LSUMC) motor scale for axillary palsy. The sural nerve interposition grafts were short, ranging between 2 and five cm, with direct repair in one case. All patients showed short recovery period of 6 month to achieve at least 4 out 5 on the LSUMC scale. *Conclusions:* The posterior approach should be considered for isolated axillary nerve injury. The outcome is better with direct end anastomosis but interposition sural nerve grafts might be warranted. This approach is safer and its outcome seems to be superior to that of the traditional anterior approach. The extended Oberlin's procedure of this nerve repair is an interesting alternative but a larger sample is necessary to conclude the improved outcome.

P-138

Support needs of the families of children with neuromuscular diseases

JK Mah (Calgary), N Liu (Calgary), M Moore (Calgary)*

Background: This study examined the frequency of unmet support needs among families of children with neuromuscular diseases (NMD). Factors associated with unmet needs were explored. *Methods:* Parents of children aged 2-18 years followed at the Alberta Children's Hospital Neuromuscular Clinic completed the modified Family Needs Survey (FNS). The FNS scores ranged from 0 to 46, with higher scores indicating more unmet needs. *Results:* 57/114 (50%) of eligible families participated. The children's mean age was 13 (SD 4.7) years, and 40/57 (70%) were male. The mean FNS score was 12 (SD 9.7). Information regarding current and future services, information on the child's diagnosis, financial assistance, and help explaining their child's condition to school personnel were the needs identified most frequently. Families with lower household income (<$60,000) or non-Caucasian ethnicity had a greater number of unmet needs ($p<0.005$). The number of identified needs did not correlate significantly with the child's age, gender, disease severity, diagnosis, duration of illness, or other family sociodemographic characteristics. *Conclusions:* Parents of children with NMD have unmet needs related to information, financial support, and help explaining to others. The FNS is a helpful tool for on-going needs assessment and for tailoring services to meet individual families' needs.

P-139

A retrospective review of the effects of steroid treatment in Duchenne Muscular Dystrophy

A Michoulas (Vancouver), K Selby (Vancouver)*

Background: Despite the development of new technologies in gene therapy, steroids remain the only treatment being used in the majority of boys with Duchenne Muscular Dystrophy (DMD) that have been shown to be effective. Our primary objective was to determine the effects of corticosteroids in DMD on ambulation, pulmonary function and the need for scoliosis surgery. *Methods:* A retrospective review of BC Children's Hospital charts between 1984 and 2003 identified 35 boys, aged 12-19 years, with confirmed DMD. 20 were treated with steroids, 15 were not. The 2 groups were compared. *Results:* Treated subjects stopped ambulating at an older age. (12.4±0.6 years vs 10.4± 1.6 years) $p=0.002$. 5 patients are still ambulating at 13.9 ± 0.9years. 21% of treated boys had FVC < 30% at a mean age of 16.7±2.6 years compared with 73% of untreated boys at a mean age of 14.1 ± 2.9 years. BiPap was required in 10.5% of treated, compared with 53% of untreated subjects ($p=0.006$). 20% of treated boys required scoliosis surgery compared with 67% of untreated boys ($p=0.0006$). *Conclusion:* This retrospective study confirms that prolongation of ambulation, improved pulmonary function and reduced rate of scoliosis surgery occurs in boys with DMD on steroid therapy. We suggest that earlier treatment may improve the outcome further.

P-140

Duchenne muscular dystrophy: a pilot survey of Canadian clinical practice

HJ McMillan (Ottawa), JK Mah (Calgary), C Campbell (London)*

Background: Children with Duchenne muscular dystrophy (DMD) are commonly followed in multidisciplinary clinics to ensure optimal care. Practice guidelines have not yet been created to standardize DMD management. *Methods:* A standardized questionnaire was mailed to 15 Canadian child neurologists and physiatrists. The areas of enquiry included; i) multidisciplinary team members; ii) steroid use; iii) other medical and surgical management. *Results:* Surveys were returned by 13/15 (87%) physicians. Ten respondents followed DMD patients. All centers had multidisciplinary teams, including a respirologist (10/10), neurologist or physiatrist (10/10), occupational therapist (8/10), clinic nurse (8/10), orthopedic surgeon (7/10), and physiotherapist (7/10). Five teams followed pediatric patients only, while others served adult and pediatric patients. Deflazacort 0.9mg/kg/d was used at all centers; two also used prednisone 0.75mg/kg/d occasionally. Typically, steroid dosing was increased over time (8), continued indefinitely (8), with calcium and vitamin D supplementation (8). Night splints were prescribed at all centers. Routine studies included bone density (DEXA) scans (9); pulmonary function testing (9),

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scoliosis radiography (8); EKG/echocardiogram (7), sleep studies (5), and dietician referral (4). Other centers performed these studies only when clinically indicated. *Conclusions:* Children with DMD across Canada are receiving care in multidisciplinary clinics with relatively consistent treatment and management plans.

P-141

Acute myositis associated with ipilimumab treatment

GR Hunter (Saskatoon), C Voll (Saskatoon)*

Background: Treatment with anti-CTLA-4 antibodies (ipilimumab) can improve survival in patients with metastatic melanoma. Immune related adverse effects (IRAE) are common, and may be a favorable prognostic indicator. The most common IRAE include colitis and dermatitis. We present the first report of an acute and severe autoimmune inflammatory myopathy after treatment with ipilimumab. *Case Summary:* A 52 year female presented with dysphagia and weakness progressing over 2 weeks. She was unable to swallow and had been non-ambulatory for 7 days. Examination revealed severe bifacial weakness and dysarthria. Neck flexors and extensors, and proximal and distal muscle groups of all 4 extremities were severely weak, with preserved reflexes. Electrophysiology and biopsy were consistent with an inflammatory myopathy. CT scan of the chest and abdomen revealed no evidence of metastatic disease. After 2 courses of IVIG and 5 days of IV methylprednisolone she was much improved and discharged home. *Discussion:* This is the first reported case of polymyositis following administration of a very promising agent against metastatic melanoma. The acute presentation and distal weakness are atypical features. The presumed mechanism if IRAE's in this setting is upregulation of immune function through inhibition of CTLA-4. As in other reports, this patient's IRAE may indicate good response to the treatment. *Conclusions:* In addition to typical IRAEs associated with ipilimumab, myositis should now be recognized as a potential complication. It is important to distinguish this from dermatomyositis which could present in a similar fashion, and should prompt a screen for disease recurrence. As with other IRAE's, autoimmune myositis likely indicates a good response to treatment and more favorable prognosis. Whether the clinical findings of distal involvement are specific to this entity is unknown.

P-142

TMS neuro-cardiovascular coupling for diagnosis of vascular compression cranial neuropathy

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Background: Neurovascular compression (NVC) may cause cranial mononeuropathy but lacks a definitive diagnostic investigation. We hypothesized that the arterial pressure wave (APW) would interact at the neurovascular interface in NVC to inhibit transmission of transcranial magnetic stimulation (TMS) stimuli to affected muscles. *Methods:* We report a novel neurophysiological method coupling cardiovascular physiology with TMS. The electrocardiogram (ECG) and arterial pressure wave (APW) were coupled to triggering of cortical TMS in a patient with NVC-induced spinal accessory (CNXI) mononeuropathy. Outcome measures included motor evoked potential (MEP) amplitudes and firing probabilities of normal and affected trapezieus (TPZ). Values at intervals proximal to the APW (40/80/120/160ms) were compared to baseline (800ms) using ANOVA and student t-test. *Results:* ECG triggered TMS of CNXI pathways with 100% reliability. MEP amplitudes were decreased in proximity to the APW, particularly at 120ms (0.21±0.04 mV versus 0.39±0.10mV, p=0.003). TPZ firing probabilities were similarly inhibited (43.8% versus 88.2%, p=0.009). No effect of APW proximity was observed on the unaffected side (p=0.8676). Procedures were well tolerated. *Conclusions:* Vascular compression causes CNXI mononeuropathy. TMS-cardiovascular coupling may evaluate neurovascular junction interactions and non-invasively diagnose NVC.

P-143

Inclusion body myositis masquerading as amyotrophic lateral sclerosis

KL Schellenberg (Edmonton), L Resch (Edmonton), S Kalra (Edmonton), ES Johnson (Edmonton), WS Johnson (Edmonton)*

Background: Inclusion body myositis (IBM), a common myopathy of older adults, has been reported as a mimic of amyotrophic lateral sclerosis (ALS). *Methods:* We describe 2 patients with IBM initially diagnosed as ALS; their clinical, electrophysiologic, and biopsy findings and all prior reports of IBM mimicking ALS based on a systemic review of the literature. *Results:* Both patients were found to have hyperreflexia, fasciculations, and a pattern of weakness not typical of IBM on presentation. The electromyographic findings of spontaneous activity and large motor units contributed to the misdiagnosis. The literature search revealed only 3 relevant case studies yielding of a total of 13 patients with similar clinical and electrophysiological findings. *Conclusions:* While IBM is often cited as a common mimicker of motor neuron disease, there is a relative paucity of supporting evidence, or systematic evaluation as to why misdiagnosis occurs. IBM should remain within the differential diagnosis despite the presence of hyperreflexia, fasciculations, and an EMG that appears to be superficially "neurogenic". Additionally, the distinctive pattern of weakness in IBM, particularly the weakness of finger flexion, may be initially lacking, thus contributing to the misdiagnosis.

P-144

Determination of best electrode position for recording of the diaphragm compound muscle action potential (CMAP)

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Background: Several different electrode positions over the chest wall have been suggested in the literature for recording of the diaphragm CMAP. The different techniques reported have not been compared to determine the optimal electrode position. *Method:* Six different pairs of surface electrode were compared on 11 healthy volunteers (22 phrenic nerves). The mean amplitude, side to side difference and the number of studies with a small amplitude (below 300uV) were compared. *Results:* Placing the G1 electrode 5 cm above the xyphoid process and the G2 16 cm from G1 along the costal margin yielded the largest amplitude (650 +/-226 uV, range 300 to 1200 uV) and good right-left agreement (mean difference 150 uV). All diaphragm CMAPs were greater than 300uV with this electrode positioning whereas at least one of the CMAPs was less than 300uV with each of the remaining 5 techniques. It was also the most reliable technique to perform, as it doesn't involve rib

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counting, which may be difficult and inaccurate especially in overweight patients. *Conclusion:* Recording of the diaphragm CMAP is best performed by placing the G1 electrode 5 cm above the xyphoid and the G2 16 cm from G1 over the costal margin.

P-145

Eaton-Lambert Myasthenic Syndrome presenting with isolated difficulty breathing

*A Rana (Toronto)**

Nerve Muscle Junction disorders usually present with fluctuating weakness but these patients can develop respiratory muscle weakness much sooner than expected. We describe a case of Eaton - Lambert Myasthenic Syndrome who presented with isolated breathing difficulty. Mrs. V.C. was an 84 year old female who presented with shortness of breathing of relatively sudden onset over few days. She had normal chest X-ray, CT chest and cardiac investigations but very low oxygen saturation on ABG and was admitted to ICU and intubated. There was no history of neurological complaints and no ptosis, fatigibility, diplopia, speech or swollowing problems. Tensilon test was done and non conclusive. Neurologist saw her but she was sedated due to agitation. Extensive work up was negative, EMG with repetitive stimulation showed an incremental response consistent with Eaton -Lambert Myasthenic syndrome. Our case underscores the fact that Nerve Muscle Junction disorders should always be in differential diagnosis of breathing difficulties even if history of fluctuating weakness is not prominant.

P-146

Clinical characterization and mapping of the locus of a new form of chilhood-onset Limb-Girdle Muscular Dystrophy

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Background: Limb girdle muscular dystrophies are a heterogeneous group of pathologies characterized by weakness and wasting of the limb girdle muscles, with typical sparing of the face. To date, seven autosomal dominant forms (LGMD1A-G) and thirteen autosomal recessive forms (LGMD2A-M) have been characterised. All of the LGMD are rare diseases and some of them have only been described in a few families or in ethnic groups. *Methods:* We have recruited a group of 5 living and reviewed the records of 5 deceased distantly related French-Canadians of Acadian descent affected by a childhood-onset form of recessive limb-girdle muscular dystrophy (LGMD). All cases originate from the small archipelago of the Magdalen Islands (population: 13,000) isolated in the Gulf of St-Lawrence. Clinical characterization of the disease was performed on all affected individuals. A genome scan using illumina Hap300Duo was performed on all affected individuals and one parent to uncover the genetic locus of the disease. *Results:* All cases present with limb girdle weakness on average at the age of 7 years (5-11) but they lose walking at a wide range of ages (12-44 years). Children have normal motor milestones and intelligence. With time, they develop macroglossia, decreased pulmonary function, hyperlordosis, large calves and mild to moderate contractures. Creatine kinase levels are elevated (663-10,000 U/L) in the first decades, but are back to normal at later stages. Muscle pathology on two cases showed non-specific dystrophic changes without any specific histological findings. Homozygosity mapping was used for analysis based on the likely sharing of the same founder mutation. A chromosomal region of 0.6Mb not previously associated with a muscular dystrophy on chromosome 17q21.31 was uncovered (multipoint LOD score 3.1). *Conclusions:* This study presents the description of a new recessive childhood-onset limb-girdle muscular dystrophy and the mapping of its original chromosomal locus.

P-147

Calcinosis Universalis complicating Juvenile Dermatomysitis: Importance of early detection and aggressive therapy

*R Abdwani (Muscat), K Roshan (Muscat), Jain (Muscat), A Al-Futaisi (Muscat)**

Juvenile dermatomyositis (JDM) is a rare autoimmune disease that results in inflammation primarily affecting the proximal muscle and skin. We report a 4-year old girl with JDM who developed extensive painful hard lumps and bumps all over her body within one year of diagnosis. Radiological imaging confirmed the clinical suspicion of calcinosis universalis. The radiological appearance of such rare complication will be demonstrated in this report. In this report, we would like to highlight the importance of early detection and early aggressive treatment in juvenile dermatomyositis to avoid such devastating complication.

P-148

Isoniazid-induced encephalopathy in a patient with later diagnosed Hereditary Motor and Sensory Neuropathy Type X (HMSN-X)

MJ Esser (Calgary), JK Mah (Calgary), HB Sarnat (Calgary), K Barlow (Calgary)*

Methods: Single center case report. *Results:* A 13-year-old boy initially presented with leukoencephalopathy following two days of isoniazid treatment for a positive Mantoux test. MRI showed white matter changes in the internal capsule with extension through the corona radiata into the subcortical parietal white matter. These resolved within three months. Extensive neurometabolic and infectious work-up was negative. The patient clinically returned to normal. However in the ensuing years he developed protean symptoms and signs, including diffuse myalgia, muscle weakness, bilateral lower leg atrophy, pes cavus, numbness, tingling, burning dysesthesias, and subjective complaints of progressive visual loss. Nerve conduction studies identified symmetrically diffuse motor and sensory demyelinating polyneuropathy. Sural nerve biopsy revealed loss of large myelinated axons without “onion bulb” formation or endoneurial fibrosis. Muscle biopsy showed chronic neurogenic changes with reinnervation. A diagnosis of HMSN-X was confirmed by genetic testing. *Discussion:* HMSN-X1 is an X-linked disorder associated with defects in the Connexin-32 protein. Four additional forms of HMSN-X are now recognized. This case highlights the clinical heterogeneity of HMSN-X, as well as the utility in considering this diagnosis in young patients with transient CNS demyelination and chronic polyneuropathy.

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P-149

A boy with multi-minicore myopathy. A difficult diagnosis?

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Background: Multi-minicore myopathy is a rare congenital myopathy with characteristic muscle histopathology and a heterogenous clinical phenotype that includes hypotonia, proximal muscle weakness, scoliosis and respiratory compromise. We report a boy with multi-minicore myopathy in whom a confirmed diagnosis was delayed due to an initial negative muscle biopsy. *Methods:* Single center case report. *Results:* A developmentally normal 7-year-old Caucasian boy presented with a long-standing history of hypotonia, proximal muscle weakness, muscle pain and exercise intolerance. The patient also had pectus excavatum, aortic compression of his trachea requiring aortopexy, and adenotonsillectomy to help with moderate obstructive sleep apnea. Initial investigations were all normal, including an extensive metabolic and genetic workup, brain and spine MRI, electromyography and nerve conduction studies, creatine kinase measurements, and a muscle biopsy of his vastus lateralis. Gradually, the patient developed progressive scoliosis requiring spinal fusion, and respiratory compromise as evidenced by poor pulmonary function testing. A repeat muscle biopsy taken from his paraspinal muscle revealed type II atrophy and absent expression of oxidative enzymes and ATPase in several regions of the myofibres, consistent with multi-minicore myopathy and confirmed by electron microscopy. *Conclusions:* This case illustrates the challenge in confirming a diagnosis of congenital myopathy and the importance of repeating a muscle biopsy when clinical suspicion remains high.

P-150

The short and long exercise test in paramyotonia congenita

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Background: Paramyotonia congenita is a rare autosomal dominant sodium channelopathy. Cold-induced painful stiffness with transient weakness appears in the first decade. Genetic testing is costly and not widely available. Studies suggest provocative electrodiagnostic testing may correlate with genotype. *Methods:* A 54-year-old male with R1448H mutation in the SCN4A gene, his two daughters and sister were evaluated clinically and with a standardized electrodiagnostic protocol, including a short exercise test (SET), long exercise test (LET) and needle electrode examination. The Individualized Neuromuscular Quality of Life instrument was completed. *Results:* All subjects had characteristic clinical features with onset in the first decade. One subject had two episodes of prolonged paralysis after general anesthetic. Exam findings were heterogeneous: lid lag (n=1); paradoxical ocular myotonia (n=3); and grip myotonia (n=3) that improved (n=2) or worsened with repetition (n=1). Percussion myotonia and muscle hypertrophy were not seen. All subjects had electrical myotonia. The compound muscle action potential (CMAP) amplitude or area did not vary after SET. Cooling followed by SET produced a sustained CMAP decrement in the females. *Conclusions:* Clinical and electrophysiological heterogeneity was evident in individuals with known mutation in SCN4A, supporting the hypothesis that other genetic, epigenetic and environmental factors contribute to clinical phenotype.

P-151

Characterization of a novel C8 phasic muscle stretch reflex

*SK Baker (Hamilton)**

Background: Muscle stretch reflexes (MSRs), initially described by Erb and Westphal, represent a fundamental part of the routine neurologic examination. A restricted pattern of hyporeflexia may be particularly valuable in isolating a root or peripheral nerve lesion. While the 5th, 6th, and 7th cervical roots have appropriate and easily elicited MSRs the C8 level does not. *Methods:* The C8 thenar reflex was initially discerned when screening neuromuscular patients for percussion myotonia. Briefly, tapping the thenar eminence produces a flexion response at the interphalyngeal joints of the fingers (i.e., FDS, FDP, FPL). To confirm that the finger flexion response represented a MSR an eternally triggered hammer-skin contact set-up was employed. Surface recording electrodes were placed 1/3 of the distance between the medial epicondyle and ulnar styloid. This montage produced distinct T-waves with latencies compatible with a reflex arc. To distinguish between direct thenar versus FPL stimulation a carpal tunnel median nerve block was performed. Normative data was collected for 75 healthy subjects–15 from each of 5 age groups (i.e., 20-29, 30-39, 40-49, 50-59, ≥60). Distance 1 (D1) was measured from the FPL to the C7 transverse process and distance 2 (D2) from C7 to the G1 electrode. *Results:* The distal median block did not affect the evoked T-wave. Mean latencies (±SD) from the respective age groups are as follows: 21.73±1.16 ms, 22.50±1.70 ms, 22.19±1.52 ms, 22.66±2.13 ms, and 23.97±1.91 ms. Reflex latencies significantly correlated with age ($r=0.33$, $p=0.004$), height ($r=0.51$, $p<0.0001$), and D1+D2 or arc length ($r=0.74$, $p<0.0001$). *Conclusions:* This novel MSR is generated from the FPL tendon and stimulates contraction of the long finger flexors. It therefore represents a clinically useful C8 MSR.

P-152

A novel method for detecting cardiac dysfunction in Duchenne Muscular Dystrophy

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Background: Duchenne muscular dystrophy (DMD) is a pediatric neuromuscular disease with significant cardiac dysfunction. Myocardial Performance Index (MPI) is an echocardiographic measurement which is more sensitive at detecting global cardiac dysfunction than ejection fraction (EF) and left ventricular shortening fraction (LVSF). Evidence for using MPI to evaluate cardiac function in DMD patients is lacking. *Methods:* Cross-sectional study of DMD patients with no known congenital or acquired cardiac disease. Echocardiogram parameters including EF,LVSF,and MPI were measured. We compared obtained values against established normal values. *Results:* A total of 16 patients have been enrolled up to date. 7/16 patients (44%) demonstrated abnormal EF and/or LVSF, plus abnormal MPI. An additional 7/16 patients (44%) demonstrated abnormal MPI while EF and LVSF were still within normal range. Of these 7 patients, 4 were younger than 10 years-old. The remaining 2 patients, both under 10 years of age, had completely normal echocardiographic measurements. *Conclusions:* Preliminary results suggested that MPI is a more

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sensitive echocardiographic marker of early cardiac dysfunction than EF and LVSF. MPI can be easily and reliably obtained using Doppler echocardiography. A sensitive and reliable method of detecting early cardiac dysfunction has important implications on the therapeutic management of DMD patients.

P-153

A comparison of EMG and muscle biopsy in ICU weakness

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Background: Patients often become weak in ICU from various etiologies and mechanisms. Establishing the diagnosis is helpful in management and prognosis. We compared EMG and percutaneous muscle biopsy in results in a group of patients who developed profound muscular weakness in ICU. *Method:* We reviewed charts, EMG and pathology results of patients who underwent EMG and muscle biopsy (MB) in ICU. *Results:* EMG suggested axonal neuropathy in 3 cases; MB confirmed this in 1 case, but showed myopathic features in 2. EMG showed myopathic features in 3 cases; MB confirmed this in 2 cases, but showed neuropathic changes in 1. EMG suggested neuromyopathy in 1 case, confirmed by MB. One patient had myasthenia gravis on EMG and non-specific findings on MB. *Conclusion:* EMG and MB agreed completely in 4 cases but differed in 3 cases. We suggest muscle biopsy should be performed more frequently as it establishes the diagnosis with more certainty in a significant proportion of patients. EMG is indispensable for the diagnosis of neuromuscular transmission defects.

NEURO-ONCOLOGY

P-154

Pediatric thalamic glioblastoma associated with Ollier disease (multiple enchondromatosis): a rare occurrence with literature review

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Background: Ollier disease (OD) is a deforming dysplasia of cartilage, involving primarily the metaphyses and diaphyses of long bones with rare instances of sarcomatous degeneration or generalized neoplasms. Little is written about the association between OD and brain tumors, with only a few adult case reports. A related enchondromatous condition, Maffuci syndrome, is distinguished from OD by the presence of osseous or visceral hemangiomas and a greater propensity toward malignancies, including brain tumors. *Methods:* A 6 year old healthy girl with no family history of brain tumors or bone diseases presented with a one month history of tremor involving the left hand. Examination revealed a short left arm and radiographs demonstrated lesions involving the left distal radius and proximal humerus consistent with OD. Brain MRI revealed obstructive hydrocephalus caused by a hypointense left thalamic and upper brainstem tumor with ring enhancement. Biopsy yielded a diagnosis of glioblastoma multiforme. *Results:* She was treated with a VP shunt for the hydrocephalus. The tumor was deemed unresectable due to diffuse appearance within the upper brainstem. Given the high grade tumor histology, conformal radiotherapy and temazolamide were offered. She is still alive 6 months post-diagnosis. *Conclusions:* This is the sixteenth documented case with these co-morbidities and the youngest. There is a rare propensity for patients with dyschondroplasia to develop brain tumors. The etiology and molecular genetics remain unknown. Patients with OD are at lower risk for extra-osseous malignancies than those with Maffucci syndrome. If these conditions exist on a continuum, then patients with OD may be at higher risk than previously thought and should be investigated and monitored accordingly.

P-155

Angiosarcoma presenting as recurrent stroke-like episodes

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Background: A 64 years old man with a history of pharyngeal epidermoid carcinoma treated with surgery, chemotherapy and radiotherapy in 1997 presented in August 2006 with symptomatic stenosis of the left internal carotid artery for which he underwent percutaneous angioplasty with stenting. In March 2007 he experienced recurrent transient ischemic attack in the same vascular territory. Another left carotid angioplasty was done on a new more proximal stenosis. In October 2007, he presented three stroke-like episodes with partial recovery between episodes. A cerebral angioscan was normal. *Investigations:* Brain MRI showed fifteen new haemorrhagic lesions confined to the left carotid artery territory. A whole body PET scan was normal but for mild hypermetabolism at the sites of the angioplasties. *Results:* A lesion biopsy concluded to an angiosarcoma. *Discussion:* Angiosarcoma is a very rare tumour arising from vascular endothelial cells. Radiotherapy, foreign material and chronic lymphedema are known risk factors. Considering that the lesions were only in the left carotid territory, we strongly suspect that our patient had cerebral metastases from a left carotid angiosarcoma. An autopsy will be needed to confirm this hypothesis. Only eight cases of cerebral metastases have been reported, among which four spread hematogenously from the heart.

P-156

Necrotizing myelopathy secondary to combined CNS chemotherapy and irradiation in a child

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Background: Necrotizing myelopathy is a serious neurological disorder. We report a young girl with AML who, after concurrent CNS irradiation and chemotherapy, developed ascending sensory and motor deficits which progressed to respiratory failure and death within two months. *Methods:* Single centre case report. *Results:* A 6-year-old girl with CNS-positive relapsed AML received intrathecal (methotrexate, cytarabine, hydrocortisone) and intravenous (fludarabine, cytarabine) chemotherapy followed by cranio-spinal irradiation. One week after treatment, she experienced ascending paresthesia and weakness in her legs. Initial brain MRI showed multifocal leukoencephalopathy. Further deterioration with UMN signs prompted another MRI which revealed spinal cord edema. Her symptoms continued to progress, with urinary retention, a T4 sensory level, plus weakness of the upper extremities and intercostal muscles. Follow-up spine MRI showed signal intensity abnormality extending from the cervicomedullary junction to the conus medullaris. The patient deteriorated further despite

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intravenous immunoglobulin and dexamethasone, and died from respiratory failure. Post-mortem exam demonstrated coagulative necrosis of the entire spinal cord suggestive of necrotizing myelitis from radiation-induced injury. *Conclusions:* Necrotizing myelopathy is a rare complication of CNS irradiation and concurrent chemotherapy. Prompt recognition of its presentation should lead to changes in management, including avoidance of further irradiation and intrathecal chemotherapy to prevent potentially devastating outcomes.

P-157

Gamma knife surgery for patients with brain metastases

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Background: We wanted to determine the factors that might predict survival and morbidity in patients we have treated with Gamma Knife Surgery (GKS) for brain metastases, planning to use this information to improve the future selection of patients for this treatment. *Methods:* We retrospectively reviewed 162 patients who had GKS for brain metastases, totaling 207 treatments, from Nov 13, 2003 to Nov 1, 2006. Seventy-five patients had lung cancer, 38 breast cancer, 18 melanoma, and 31 had other cancers. Patient and disease characteristics, as well as treatment modalities (chemotherapy, surgery, whole-brain radiation, and GKS dosimetry) were recorded. We studied physical and neurological side effects, time to progression of disease after GKS, and survival. *Results:* The median survival from diagnosis of brain metastases to death was 9.9 months (range 1-53 months). Following treatment, survival was 12.4 months if the Karnofsky Performance Score (KPS) above 70, 3.6 months if KPS <70 ($p<0.0001$); 11.2 months if primary disease was controlled, 8.0 months if uncontrolled; 9.9 months for age <65, 11.3 months for age above 65; 6.8 months if systemic metastases were present, 12.4 months if the brain was the only site of metastases ($p=0.003$). The treated tumor volume averaged 6.6 cc (range 0.125 to 33.7 cc). The maximum single volume was 22.2 cc. Physical side effects were generally mild if any occurred; 59% of patients experienced no acute side effects, 29% had headache, 4% nausea, and 13% miscellaneous other symptoms. Neurological side effects were rare; 2 patients had seizures (one with a previous history of seizures), and one developed a new tremor. *Conclusions:* Gamma Knife Surgery for patients with brain metastases is a well tolerated procedure with rare serious side effects. Survival can be prolonged, particularly if patients are carefully selected .

P-158

Glioblastoma multiforme after radiotherapy for vestibular schwannoma: case report and review of literature

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Background: Indications of ionizing radiation (conventional or focused) in the treatment of benign intracranial lesions are increasing. Long term risks to be considered are malignant transformation of the original neoplasms and de novo secondary neoplasms. *Methods:* A 64 year old male has been followed for 12 years for a right vestibular schwannoma operated upon twice with subsequent recurrence and hydrocephalus. A VP shunt was performed. Radiation of the benign recurrent lesion was given with a total 54 cGy in 30 fractions, delivered with a lateral post pair with cobalt 7 1/2 x 8 1/2 and a posterior field. Six years later on regular follow up MRI, a large left frontal glioblastoma was discovered and removed. Subsequent radiotherapy and chemotherapy were given. The patient is still alive and doing well a few months after his surgery. The association of malignancy following radiation for acoustic neuroma, with or without neurofibromatosis 2, is well documented. Recent review of the literature reveals about 19 cases. *Conclusions:* Caution is recommended in the use of radiotherapy for benign vestibular schwannoma. There appears to be an increasing incidence of de novo malignant tumours and also malignant progression of the original vestibular lesion.

P-159

Gamma Knife radiosurgery for the treatment of pituitary tumours: an early Canadian experience

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Background: Pituitary tumours are relatively common neoplasms constituting 10-20% of primary brain tumours. While transsphenoidal surgical resection is considered the treatment of choice for tumours failing conservative therapy, Gamma Knife (GK) has been recently introduced as an adjuvant intervention. This study reports an early experience with GK for treating pituitary tumours. The short-term safety and efficacy of radiosurgery were evaluated. *Methods:* A cohort study of consecutive pituitary tumours treated with GK from 2003 till 2007. All cases were reviewed for short-term complications including cranial nerve deficits and visual field changes. Serial MRI studies were also reviewed to determine the progression of the treated tumours. *Results:* A total of 37 pituitary tumours was identified with an average follow-up period of 14 months (range 2 - 34). There were 19 functioning tumours which received an average dose of 22.2 Gy to the 50% isodose line; the remaining 18 tumours were nonfunctioning and received an average dose of 15 Gy. Although in the majority of cases GK was used to treat residual or recurrent disease which failed surgical resection, in eleven patients GK was the first-line of treatment. Neurological complications were experienced in three patients. One constituted transient visual field defect with subsequent resolution while the other two cases showed worsening or new visual field defect. There were a few minor complications secondary to frame placement which were mostly self-limiting. Serial MRI studies showed no progression in 36 tumours with some showing regression in size. In a single case, there was an increase in tumour size at the six-month follow-up. *Conclusions:* Although uncommon, injury to the optic nerves is the most serious potential complication. Careful treatment planning is needed to minimize this risk. In this study, tumour growth control was high over a short follow-up period. The results of this study should be interpreted with caution, and long-term studies are needed to further evaluate the efficacy of this intervention.

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P-160

Conventional and diffusion-weighted magnetic resonance imaging findings in a pediatric patient with a posterior fossa brain tumor and papilledema

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Background: Papilledema is a frequent finding in children with posterior fossa tumors and hydrocephalus. However, to date there are no studies identifying radiological features associated with papilledema in these patients. We present a case report to highlight magnetic resonance (MR) imaging findings associated with papilledema in a pediatric patient with an intracranial tumor. *Methods:* We present the case of a 21-month-old female patient, including the MR findings before and after resolution of clinically evident raised ICP and papilledema. *Results:* The MR findings observed included optic disc elevation, dilated perioptic subarachnoid spaces, optic nerve tortuosity, and restricted diffusion in the optic nerve heads. All of these radiological findings resolved in the post-operative period, after resolution of the clinical papilledema. *Conclusion:* The present case is unique because it demonstrates that both conventional and diffusion-weighted MR imaging findings can detect the presence, and follow post-treatment resolution, of increased ICP and papilledema in a pediatric tumor patient.

P-161

Invasion data from meningioma case series: linking histopathology to tumour characteristics

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Background: Tumour progression is dependent on the cells' ability to invade and grow into surrounding tissues. Development of an assay to assess both tumour invasion as a measure of aggressive behaviour and the inhibition of that invasion and growth through application of chemotherapeutics could provide clinically valuable data regarding an individual patient's response to treatment. *Methods:* Using an ex vivo invasion assay, tissue samples from 14 surgical patients radiographically diagnosed with meningioma were assessed. The migratory distance of tumour cells (μm) were monitored over 5 days and WHO grades confirmed. *Results:* Video-microscopic surveillance revealed that 13/14 samples demonstrated no cellular invasion; behaviour expected for benign tissue. Pathology confirmed the diagnosis of eleven WHO grade 1 meningiomas, one WHO grade 2 meningioma, and one hemangiopericytoma. The WHO grade 3 meningioma demonstrated significant tumour migration with inhibition under cisplatin. *Conclusions:* These laboratory observations suggest a correlation between the histopathology (WHO grade) of a meningioma and its invasiveness (a characteristic of malignant behaviour). This invasion protocol may potentially be used to assess tumour behaviour and response to chemotherapeutics as a prelude to individualized, adjuvant treatment regimens.

P-162

Pediatric posterior fossa ependymoma: is near total resection as effective as total resection?

A Singhal (Vancouver), J Hukin (Vancouver), T Ailon (Vancouver)*

Background: The current standard surgical therapy in posterior fossa ependymoma is aimed at achieving total resection. Because of the location and attachment of these challenging tumors, total resection can often be associated with permanent neurological morbidity. The current study aims to compare survival rates between patients with total resection (100%) and near-total resection (95-99%). *Methods:* We identified all pediatric patients treated in British Columbia with posterior fossa ependymoma over a 25 year period. We determined extent of resection, and examined survival rates and surgical morbidity. *Results:* A total of 50 patients with posterior fossa ependymoma were treated. 30% underwent total resections (15/50), 58% had near-total resections (29/50), and 6/50 had incomplete resections (<95% resection). Two patients with total resections and 1 patient with incomplete resection died of other causes, and were excluded from analysis. There was no difference in long-term survival between patients with total (6/13 survivors - 46.2%) and near-total resections (14/29 survivors - 48.3%). There were 5 long-term neurosurgical complications in the 29 near-total resections, and 2 long-term neurosurgical complications in the 15 total resections. In the group of patients with incomplete resections (<95%), 4/5 died of disease progression, and 1 has survived. *Conclusions:* There was no demonstrable difference in survival rates in patients who underwent total versus near-total resections. This suggests that the goal of surgical therapy should be maximal resection (>95%), but that it may be reasonable to forego total resection if a neurological deficit is expected.

P-163

Motor neuron syndrome in a woman with large cell lung cancer and anti Ma2 antibodies: a case report and review of the literature

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Background: Paraneoplastic motor neuron syndromes have been previously reported with lymphoproliferative disorders and in association with anti-Hu, anti-CV2, anti-CRMP5, anti-beta4spectrin, and anti-Ma2 antibodies. *Case Report:* We report the case of a 45-year-old homeless female with a history of large cell lung cancer presenting with a 13 month history of progressive, severe and atypically symmetric muscle weakness and wasting beginning in the upper extremities and progressing to involve the lower extremities. Electrodiagnositc studies showed deinervation of the bulbar, cervical, thoracic and lumbrosacral regions, with no conduction block. Imaging of the neuroaxis was normal. Serum and CSF studies were unremarkable. A paraneoplastic screen revealed positive anti-Ma2 antibodies. *Discussion:* Anti-Ma2 antibodies are most commonly seen in the setting of paraneoplastic limbic or brainstem encephalitis. Only 2 case reports exist of anti-Ma2 associated motor neuron syndrome, both of which have occurred in males. In these cases, either other neurological systems were involved or there were additional laboratory or diagnostic imaging findings. Our case is the first report of isolated motor neuron syndrome in a female with anti-Ma2 antibodies. *Conclusion:* In patients with atypical presentation of motor neuron disease a paraneoplastic screen should be considered.

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Late recurrences of childhood ependymoma

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Background: In contrast to the majority of pediatric CNS tumours for which remission at five years is considered a cure, late recurrences are not uncommon in ependymoma. *Methods:* We conducted a population based, retrospective study of all pediatric (<17 years at diagnosis) patients with ependymoma between 1970 and 2001 in British Columbia. We report on the incidence and clinical characteristics of relapses greater than five years after initial diagnosis. *Results:* 36/70 children with ependymoma relapsed, of these, three had a late relapse, they were 13.0, 11.3 and 1.9 yrs at diagnosis, the late relapses occurred at 314, 126 and 170 months respectively. Two had posterior fossa ependymoma; the third, a myxopapillary ependymoma of the lumbar spine. Near total resection (95-99%) was achieved in all three, followed by involved field radiotherapy at diagnosis; one also received craniospinal radiotherapy. Disease recurred locally in one and was disseminated at relapse in the other two. *Conclusions:* The majority of recurrences occurred within the first five years; the incidence of late recurrence was 4%. These late recurrences occurred despite initial aggressive resection and adjuvant radiotherapy, highlighting the need for long-term surveillance for both spinal and cranial childhood ependymoma.

SPINE

P-165

Safety and complications of revision lumbar surgery using minimally-invasive interbody fusion approaches

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Background: Minimally-invasive lumbar interbody fusion has rapidly evolved with the perception that revision surgery is more technically challenging. We sought to compare feasibility and safety of PLIF and TLIF performed in primary and revision surgery to assess differences in perioperative morbidity. *Methods:* Forty-three minimally-invasive TLIF and PLIF cases were analyzed. Seventeen revision cases were compared against 26 primary surgeries with regard to operative time, estimated blood loss (EBL), and intraoperative and early postoperative complications. *Results:* Age, operative levels, and surgical technique were similar between groups. Primary cases had EBL of 287 ml and two minor complications: one durotomy and one intraoperative pedicle fracture. Revision patients had EBL of 312 ml and six minor complications: five durotomies and one asymptomatic screw malposition. Postoperative CSF leak was more frequent with revision surgery (ANOVA, $p<0.05$) among both PLIF and TLIF patients (Dunn's, $\alpha=0.05$). There were no major complications, nerve injury, or conversion to open procedure. *Conclusions:* MIS approaches to revision lumbar surgery are technically feasible without major neurological complications. However, revision surgery has more minor perioperative complications, particularly incidental durotomy, with trends toward greater blood loss. While technically feasible, caution is required before attempting MIS lumbar spine revision surgery.

P-166

Giant cell ependymoma of the spine: case report of a thoracic spine lesion and review of the literature

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Introduction: Spinal ependymomas are slow-growing lesions that comprise the majority of primary spinal cord neoplasms. Extent of tumor resection is the most significant prognostic factor for long-term survival. Unusual histological subtypes can make intraoperative diagnosis spurious, altering surgical approach from gross-total resection for ependymoma to debulking for high-grade astrocytomas. *Methods:* We describe a 67 year-old female who presented with decreased lower extremity sensation leading to unsteadiness and a fall. Physical examination revealed lower extremity hyperreflexia, ankle clonus, but no clear sensory level. MRI demonstrated an intramedullary T1 and T2 hypointense, homogenously-enhancing lesion at T8 with extensive cephalad and caudal edema. *Results:* Laminectomy at T8-9 afforded gross total resection of the lesion with a clear plane of cleavage against spinal cord. Intraoperative pathology suggested high-grade glioblastoma; but final section showed sporadic giant cells with marked pleomorphism, uniform GFAP and CD99 immunostaining, and high MIB-1 index. Electron microscopy showed "zipper-like" junctions. There were no genomic abnormalities consistent with glioblastoma. *Conclusions:* We present the first reported case of thoracic giant cell ependymoma, complementing scant literature of one cervical spine case and two cases at the filum terminale. While those patients had benign courses, ours demonstrates high proliferation index makes the malignant potential uncertain.

P-167

A comparative analysis of the results of vertebroplasty and kyphoplasty in osteoporotic compression fractures; one-year follow-up

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Background: We evaluated the difference in pain improvement, time it takes to relieve pain, amount of cement per segment treated, complications of cement leakage, incidence of adjacent fractures, and improvement in disability and quality of life. *Methods:* A retrospective study of 50 patients in each group in the past two years. Outcomes were measured using Visual Analogue Scale (VAS), Oswestry Disability Index (ODI), Beck Depression Scale, and Euroquol-5D (EQ-5D) questionnaires. Follow-up x-rays were taken after the procedure to determine the incidence of cement leakage and of subsequent adjacent fractures. *Results:* VAS score improved faster in kyphoplasty. At one week the kyphoplasty group improved from a mean score of 7.7 to 3.6, whereas vertebroplasty group improved from 7.5 to 4.2. The kyphoplasty group showed greater improvement in ODI scores, from a mean of 53.2% to 36% versus vertebroplasty patients from 54% to 42%. Beck Depression score improved in kyphoplasty from 8.8 to 4.2; vertebroplasty patients from 8.4 to 7.0. EQ-5D score improved in kyphoplasty from 0.202 to 0.776; vertebroplasty from 0.107 to 0.510. Incidence of cement leakage was considerably higher in the vertebroplasty patients. The incidence of adjacent fractures showed no difference. *Conclusion:* Kyphoplasty gives superior results.

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Antagonism of TNF-alpha-induced inflammation and neurotoxicity in dorsal root ganglion explant cultures by an antagonist binding protein

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Background: Biochemical irritation of the dorsal root ganglion (DRG) after intervertebral disc herniation contributes to radiculopathy through TNFα-mediated inflammation. Soluble TNF receptor type II (sTNFRII) sequesters this cytokine providing clinical benefit, but the mechanistic effect on downstream mediators, interleukins (IL) and prostaglandins (PG), remains unclear. The study evaluated how sTNFRII attenuates inflammatory changes in DRG explant cultures. *Methods:* Rat lumbar DRGs (n=29) were divided into four groups: control, TNFα (25 ng/mL), and TNFα with low (0.2 γg/mL) or high (1 γg/mL) sTNFRII. Following 24 hours incubation, supernatant was evaluated for inflammatory cytokines (IL1, IL6, IL1), PGE2, and metabolites (glutamate, lactate, pyruvate). Single-factor ANOVA with post-hoc Tukey's analysis (α=0.05) assessed treatment differences. *Results:* Explant stimulation caused metabolic stress reflected by 1.8±0.5-fold higher lactate:pyruvate ratio and 80±8% increase in extracellular glutamate. Inflammatory activation was observed with heightened IL6 release (5.2±1.4-fold) and PGE2 production (14±3-fold). An autoregulatory response occurred with 11.8±0.6-fold greater shedding of sTNFRI. Treatment with high-dose sTNFRII reversed all changes. *Conclusion:* Stimulation of DRG explants by TNFα yields a phenotype of neurotoxic amino acid release and enhanced inflammatory mediator expression. Coincubation with sTNFRII antagonizes TNFα to abrogate these changes, suggesting potential for therapeutic intervention to treat peripheral nerve inflammatory disease.

P-169

A rare case of intracranial hypotension secondary to spontaneous sacral dural fistulae in a pediatric patient

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Background: Intracranial hypotension due to spontaneous cerebrospinal fluid (CSF) fistulae is rare, especially in children. The authors present a case of a pediatric patient with chronic headache and back pain secondary to spontaneous sacral dural fistulae and intracranial hypotension. *Case Report:* A 9-year-old female presented with chronic daily headache, fulfilling the International Headache Society's clinical criteria for chronic migraine. An 'atypical' occipital location and associated back pain prompted investigation. MRI revealed intracranial hypotension. However, a lumbar puncture CSF opening pressure was 85 cm H_20. Several weeks later, a repeat lumbar CSF opening pressure was zero. A CSF radionuclide study revealed sacral nerve root dural fistulae. Following unsuccessful attempts at "blood patching", the patient underwent surgical repair. Although initially successful, symptom recurrence prompted a second operative procedure. The headaches gradually resolved, and two years later the patient remains asymptomatic. *Conclusion:* Intracranial hypotension secondary to spontaneous CSF fistula should be included in the differential diagnosis for children with headache. An isolated measurement of CSF pressure may be unhelpful. An MRI can demonstrate intracranial hypotension, while a radionuclide CSF study can localize the CSF fistula. "Blood patching" may not be successful. If surgery is initially unsuccessful, a repeat procedure should be considered.

P-170

Refinements to the simultaneous anterior-posterior approach to the thoracolumbar spine

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Introduction: The treatment of complex spinal disorders occasionally requires approaches both anteriorly and posteriorly. This case study illustrates a number of modifications to the previously described simultaneous anterior - posterior approach to the thoracolumbar spine. *Methods:* The details of this refined procedure, benefits it offers and the indications are illustrated by three cases. *Discussion:* By altering the incision slightly the risk of wound breakdown and infection has been reduced. The use of newly available positioning devices has allowed easier incorporation of fluoroscopy to guide the placement of spinal instrumentation. The authors have expanded the use of the approach beyond the original oncological indications.

P-171

Intraoperative spinal cord and nerve root monitoring: a survey of Canadian spine surgeons

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Introduction: Intraoperative spinal cord and nerve root monitoring is used in to identify an emerging insult to the neural elements in an attempt to prevent irreversible injury. There are three major types of monitoring: somatosensory evoked potentials (SSEP), motor evoked potentials (MEP) and electromyography (EMG). The availability of intraoperative spinal monitoring and the indications for use vary widely. This study addresses the current practice pattern of intraoperative spinal monitoring in Canada. *Method:* Members of the Canadian Spine Society were surveyed regarding the availability and indications for intraoperative spinal monitoring. *Results:* A total of 105 surveys were distributed, with 95 responses (90%). 61% of respondents perform spinal cord monitoring for selected cases. Surgeons in either full time or part time academic practice used monitoring more frequently than private practice surgeons ($p < 0.0008$). Years of practice and training background did not influence the usage of monitoring. The availability at the institution significantly correlated to use ($p < 0.0001$). A majority of respondents (78%) felt monitoring should be a "standard of care" for correction of major deformity (97%) and the resection of spinal cord tumours (65%). *Discussion:* There is much controversy regarding the indications for spinal monitoring. Availability is still limited in spine care practice in Canada. A majority of surgeons surveyed believe that spinal cord monitoring should be a "standard of care" for selected cases.

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P-172

Radiologic findings in a patient with cervical cord dysfunction

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Background: CT myelography was used to demonstrate cord lesions before the advent of MRI scanning. It is still utilized as a diagnostic modality in those who cannot undergo MRI. *Methods:* This case report demonstrates the limitation of CT myelography in a patient who initially could not receive an MRI. *Results:* A 57 year old male presented with lower cervical cord dysfunction after minor trauma, manifesting as severe neck pain, numbness of his lower arms, legs and abdomen and a sensory level in the mid-thoracic region. A pre-existing aneurysm clip was felt to be a contra-indication to MRI scanning. CT myelography demonstrated a focal cord expansion at C4 and a diagnosis of a spinal cord tumor was entertained. After consultation with the clip manufacturer, brain and cervical spine MRI revealed ischemia in the cerebellar hemisphere, occipital lobe, and spinal cord centrally at C4. These ischemic regions were likely related to dissection or emboli in the vertebrobasilar system. *Conclusion:* A patient who presented with lower cervical cord dysfunction had a CT myelogram as an alternate investigation showing an expansion of the cervical cord, compatible with a cord tumor. Subsequent MRI scan demonstrated an infarct of the cord, mimicking a tumor.

P-173

Anterior cervical spinal cord infarction presenting as limited dermatomal dissociative sensory loss following unilateral vertebral artery dissection

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Background: Infarction of the spinal cord is less common in cervical than thoracolumbar region. Vertebral artery dissection can cause cervical spinal cord infarction. However, unilateral vertebral artery dissection presenting as limited dermatomal dissociative sensory loss is extremely rare. *Methods:* We report a case of partial anterior cervical spinal cord infarct in a 77 year-old male, who presented with neck pain, and right-sided weakness affecting the upper extremity predominantly. Sensory examination revealed a patchy decrease in temperature and pain sensation from C5-T2 bilaterally. Despite intravenous heparin therapy, the patient later developed spinal shock and diaphragm paralysis due to extension of his infarct. *Results:* ECG, cardiac telemetry and cardiac enzymes were normal. Neuromyelitis optica IgG antibody assay was negative. Brain MRI was normal. An MRI of the cervical spinal cord showed hyperintensities in the anterior and lateral horns bilaterally most apparent at the C3-C4 levels with a thrombus in a dissected right vertebral artery. *Conclusions:* Our patient had a unique presentation with suspended dissociated sensory loss in the distribution of C3-T5 that can only occur with occlusion of a central sulcal artery secondary to vertebral artery dissection. The relative sparing of left-sided function may be attributable to anterior spinal artery duplication.

P-174

Spinal cord injuries at CHEO without radiological abnormalities

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Background: Spinal cord injury without radiological abnormality (SCIWORA) represents a traumatic myelopathy, either transient or permanent, that is not associated with a vertebral fracture or ligamentous instability on x-rays or CT. *Methods:* A retrospective medical chart review was conducted to identify children with spinal neurological deficits at CHEO between 1990-2005. *Results:* Of the 22 children with traumatic myelopathy, there were only two with SCIWORA; one had transient neurological deficits as a result of a sport related incident that resolved within 2-3 days, and the other has permanent paraplegia as a result of a motor vehicle accident. Spine MRI was positive in both cases; one showed a central C5-C6 disc herniation and the other a cord contusion at T1-T3. *Conclusions:* Spinal cord injuries in children are uncommon compared with adults. There is a subgroup of patients that present with myelopathy after trauma with normal spine x-rays and CT. This was determined to be 9% at CHEO over the last 15 years. This is extremely important in the emergency room setting of an unconscious patient as a result of trauma who has normal spine radiographs and CT. Spine MRI may be diagnostic and more predictive of outcome than the presenting neurological findings.

P-175

How symptom duration affects surgical outcome in spinal meningiomas in the modern MRI era

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Background: Meningioma is a common tumor that accounts for 25-46% of spinal neoplasms. It is generally benign, well circumscribed, and slow growing. It usually becomes clinically evident in the thoracic region and occurs most frequently in middle-aged women. Our objective is to analyze the effect of the duration of symptoms on the outcome following meningioma resection. *Methods:* We retrospectively reviewed a series of patients diagnosed with spinal meningiomas at our institution from 1999 to 2008. We focused on the duration of symptoms but also included the location and histological subtype in our analysis. *Results:* A total of 9 patients were locally reviewed. The duration of symptoms ranged from 9 months to 7 years with one patient presenting acutely. All patients presented with varying degrees of lower limb weakness and spastic gait, with 2 demonstrating sensory disturbance along with locomotor symptomatology. The lesions were most often in a thoracic location (8/9) although 1 was upper cervical. Prognosis appeared unrelated to metameric level. Histology was most often psammomatous (6/9) but had no predictive value. A trend toward better motor outcome resulted from a shorter presurgical duration of symptomatology. *Conclusion:* The duration of symptoms in spinal meningioma plays a minor role in outcome unless there is motor deficit, in which case a more expedited surgical intervention is advocated. The limited number of our cohort precluded any further conclusions.

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Common origin of artery of Adamkiewicz and a posterior spinal artery with a spinal dural arteriovenous fistula: A case report

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Background: Spinal dural arteriovenous fistula (SDAVF) is the most common of all spinal vascular diseases and its treatment remains a challenge for neurosurgeons and neuroradiologists. Characterization of the vasculature of the spinal cord and the spinal dural arteriovenous fistula is crucial for the appropriate treatment. A common origin of the blood supply to a dural arteriovenous fistula and the spinal cord from the same segmental artery is rare and is a contraindication to endovascular treatment. *Methods:* Case report *Results:* A 51 year-old male without past medical history presented with progressive sensory and motor deficits, as well as gait instability associated with urinary incontinence for a period of one year. MRI of the spine demonstrated a thoracic spinal dural arteriovenous fistula. A spinal angiography showed at T7 on the left: a common origin of the artery of adamkiewicz, a posterior spinal artery and the spinal dural arteriovenous fistula. That fistula was surgically treated and the patient made an almost complete recovery. To our knowledge, it is the first time that this common origin, of the three vessels, is described. *Conclusion:* It is imperative to assess the origin of the arterial supply of a spinal dural arteriovenous fistula and the spinal cord to determine the best treatment. A common origin of its blood supply with the spinal cord is a contraindication to endovascular treatment.

P-177

Tractography: a novel technique to image fiber tracts of the spinal cord

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Background: Tractography is a novel magnetic resonance imaging (MRI) technique that utilizes diffusion weighted images to delineate white matter tracts. While it has been utilized in the brain, its use within the spinal cord (SC) has been limited. We utilized tractography to determine whether tractography correlated with clinical status and whether it could lead to improved diagnosis compared to routine MRI. *Methods:* Healthy volunteers and patients with SC lesions underwent routine MRI with an added tractography sequence consisting of an axial diffusion-weighted single-shot echo planar imaging sequence using Grappa and 12 noncollinear gradient directions. MEDINRIA version 1.0.30 was used to generate the fiber tracking images. Tractography images were compared with routine MRI and clinical status to determine correlation. *Results:* SC tractography in healthy volunteers corresponded to normal anatomical tracts and allowed visualization of tracts as they entered and exited the SC. In patients with SC lesions, tractography enabled the visualization of fiber tracts disruption and displacement by the SC lesion. Tractography with routine MRI was able to determine etiology of neurological deficits and improve diagnosis compared to routine MRI alone. *Conclusions:* SC tractography holds promise in improving detection of fiber tract abnormalities to enable improved diagnosis, prognosis and operative management of SC lesions.

P-178

Tarlov's cyst of sacral region as a rare cause of retrograde ejaculation and infertility treated by microsurgical excision: case report and a technical note

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Background and Objective: Tarlov's cysts or spinal perineurial cysts are uncommon lesions. Mostly, it is an incidental finding on MRI scans or myelograms. Being asymptomatic in nature, most of them do not warrant any treatment. Due to low incidence of symptomatic cases it is difficult to formulate clear operative indications. *Case Report and Methods:* We report a case of large sacral perineurial cysts presented with back pain and retrograde ejaculations resulting in infertility. The case was treated by microsurgical excision of the cysts. Back pain was resolved completely after excision but the semen quality showed only marginal improvement. Later, the couple successfully conceived by intra-uterine insemination. We describe the possible mechanisms operating in the causation of these rare symptoms with a focus on different surgical indications and techniques. To the best of our knowledge this is the first ever reported case of Tarlov's cyst presenting with retrograde ejaculation and infertility. *Conclusion:* Despite being mostly asymptomatic and incidental finding, Tarlov's cyst is an important clinical entity due to its tendency to increase in size with time. It can be a rare underlying cause in otherwise unexplained retrograde ejaculations and infertility. Microsurgical excision may be a good option in select group of patients. NB: The paper is submitted to Journal of Spinal Cord Medicine and is currently under peer review.

P-179

Intrathecal pressure monitoring following acute spinal cord injury

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Background: Numerous factors contribute to secondary injury following spinal cord trauma; ischemia is thought to be among the most important. Spinal cord perfusion pressure (SCPP) is dependent on both mean arterial pressure and intrathecal cerebrospinal fluid pressure (ITP). To date, there have been no published series on ITP or SCPP monitoring following acute spinal cord injury (ASCI). We propose placement of a lumbar drain to monitor ITP, using protocols similar to intracranial pressure monitoring after severe head injury. The initial goals of this study are to document ITP in ASCI patients and determine the feasibility and safety of ITP monitoring in this patient population. *Methods:* Patients with ASCI between C0-T11 were eligible for inclusion. After obtaining informed consent, patients underwent placement of a lumbar catheter within 48 hours of the initial injury. Intrathecal pressures were documented hourly for up to seven days following the injury. *Results:* Our preliminary results show that mean ITP is elevated in patients with ASCI. There were no complications related to lumbar catheter placement. *Conclusions:* It is feasible to monitor ITP in patients with ASCI. Intrathecal pressures were abnormal suggesting that blood pressure augmentation and/or CSF drainage to optimize SCPP may be worthwhile in these patients.

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Vertebral osteomyelitis after treatment with intra-vesicular BCG for bladder carcinoma

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Background: M. bovis (the BCG vaccine) vertebral osteomyelitis following bladder instillations for the treatment of bladder cancer is rare. Only 8 cases were found in a literature review. *Method:* We present a case of a 67 year old male with L1-L2 vertebral osteomyelitis culture positive for M. bovis that developed following intra-vesicular BCG for bladder cancer within the previous year. *Results:* He had a 3 month history of progressive weakness and decreased ambulation. MRI revealed an enhancing lesion in the L1 and L2 vertebral bodies. He underwent an L1-L2 lamenectomy and discectomy for decompression and biopsy. Cultures were positive for M. bovis. In the year prior to his cancer treatment he underwent L3-S1 lamenectomies, with recurring symptoms 6 months later *Conclusion:* On reviewing the literature, presentation time of cases varied from weeks to years after BCG treatment. There was an association with trauma or surgery near the osteomyelitis site, not just in the urinary tract as previously reported. Diagnosis was often delayed. Although rare, neurosurgeons should consider the association between intra-vesicular BCG instillations and vertebral osteomyelitis in the differential diagnosis.

P-181

A systematic review of clinical outcomes in the non-surgical treatment of thoraco-lumbar burst fractures with no neurological deficit

*RJ Diaz (Calgary)**

Background: Non-surgical treatment of burst fractures of the thoraco-lumbar spine has been proposed as a safe alternative to surgery; however there is controversy as to whether functional outcomes are the same in surgically versus non-surgically treated patients. *Methods:* A systematic review of the literature pertaining to non-surgical treatment of burst fractures of the thoraco-lumbar spine fractures without neurological deficit was performed. The objective of this study was to provide information on 1) functional outcome, defined by rate of neurological deficit and rate of return to work; 2) treatment failure, defined as clinically unsatisfactory pain, new neurological deficit related to the fracture, or surgery after trial of non-surgical management; and 3) major complications (death, sepsis, deep-vein thrombosis, thromboembolism, ulcers). A literature search was conducted on Pub Med and Ovid MEDLINE. References of key papers were reviewed. Full-text papers from 1970 to 2007 were included if the patients were adults; the study included patients with thoraco-lumbar burst fractures; patients received non-surgical treatment; information on functional outcome or treatment failure was provided; and the study was available in English. *Results:* A total of 15 papers, the majority being prospective or retrospective case-series, were included representing 447 patients. Only two prospective randomized trials compared non-surgical management to surgical management with findings of equivalence in functional outcome in one and significant lower functional disability score in non-operative treated patients in the other. With non-surgical treatment, the cumulative rate of reported neurological deficit was 2.2%. The rate of return to work was 80.5%. The rate of treatment failure was 9.9% and the rate of major complications was 2.4%. *Conclusion:* In general, non-surgical treatment of thoraco-lumbar burst fractures in patients with no initial neurological deficit is a safe and effective alternative to surgery. Lack of inclusion of patients with osteoporosis in the randomized studies limits generalization of good outcomes to this subgroup.

P-182

Severity-dependent expression of pro-inflammatory cytokines in traumatic spinal cord injury in the rat

L Yang (Gold Coast), P Blumbergs (Adelaide), N Jones (Adelaide)*

*Background:*The post-traumatic inflammatory response plays an important role in secondary injury mechanisms after spinal cord injury (SCI), and interleukin-1β (IL-1β), interleukin-6 (IL-6), and tumor necrosis factor-α (TNF-α) are key inflammatory mediators. The relationship between severity of SCI and expression levels of these pro-inflammatory cytokines has not been addressed. Thus, we hypothesized that the pro-inflammatory cytokines IL-1β, IL-6 and TNF-α may act as messengers to coordinate the inflammatory cascade in the secondary SCI and that the cytokine response should be greater in severe than in mild SCI. *Methods:* Mild and severe SCI was produced by dropping a 10 g weight from 3 and 12 cm at the T12 vertebral level. Histologic and immunocytochemical assessments were undertaken to evaluate the inflammatory cellular response and the immunoexpression of IL-1β, IL-6 and TNF-α in the injured rat spinal cord. Reverse transcription polymerase chain reaction (RT-PCR) and western blot were used to assess the expression of IL-1β, IL-6 and TNF-α mRNAs and their proteins post injury. *Results:* RT-PCR showed an early significant up-regulation of IL-1β, IL-6 and TNF-α mRNAs, maximal at 6 h post-injury with return to control levels by 24 h post-injury, the changes being less statistically significantly in mild SCI. Western blot showed early transient increases of IL-1β, IL-6 and TNF-α proteins in severe SCI but not mild SCI. *Conclusions:* Our study has suggested that endogenous cells (neurons and microglia) in the spinal cord, not blood-borne leucocytes, contribute to IL-1β, IL-6 and TNF-α production in the post-traumatic inflammatory response and that their up-regulation is greater in severe than mild SCI.

P-183

Early expression and cellular localization of pro-inflammatory cytokines interleukin-1beta, interleukin-6 and tumour necrosis factor-alpha in human traumatic spinal cord injury

L Yang (Gold Coast), P Blumbergs (Adelaide), N Jones (Adelaide)*

Background: The post-traumatic inflammatory response plays an important role in secondary injury mechanisms after spinal cord injury, and interleukin-1β, interleukin-6, and tumor necrosis factor-α are key inflammatory mediators. Almost all observations have been confined to animal models of spinal cord injury. The goal of this study was to characterize the post-traumatic inflammatory responses and localize cellular sources of interleukin-1β, interleukin-6, and tumor necrosis factor-α in human spinal cord injury. *Methods:* The study group comprised 11 patients with spinal cord contusion injury and 2 normal individuals. Histologic and immunocytochemical assessments were undertaken to evaluate the inflammatory cellular response and the immunoexpression of

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interleukin-1β, interleukin-6, and tumour necrosis factor-α in the injured human spinal cord. The cellular sources of interleukin-1β, interleukin-6, and tumour necrosis factor-α were elucidated by immunofluorescence double-labelled confocal imaging. *Results:* Increased immunoreactivity of interleukin-1β, interleukin-6, and tumour necrosis factor-α was detected in neurons 0.5 hour after injury, and in neurons and microglia 5 hours after injury, but the expression of these proinflammatory cytokines was short-lived and declined sharply to baseline by 2 days after injury. The other novel finding in this study was that, as early as 0.5 hour after spinal cord injury, activated microglia were detected, and axonal swellings and axons were surrounded by microglial processes. *Conclusions:* Endogenous cells (neurons and microglia) in the human spinal cord, not the blood-borne leukocytes, contribute to the early production of proinflammatory cytokines in the post-traumatic inflammatory response, and microglia are involved the early response to traumatic axonal injury.

P-184

A scoring system for elective triage of referrals: Spine Severity Score

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Background: The Spine Severity Score (SSS) is a 15-point scoring system devised for the purpose of triaging elective spine referrals. From the referral letter and the accompanying radiology report, a total score is calculated based on clinical, pathological, and radiological criteria - a maximum score of 5 within each category. A higher score represents a referral that should be seen more urgently. Verification of inter-observer and intra-observer reliability for the scoring system, and validation against the traditional gold standard for triage, the surgeon's clinical experience, are reported here. *Methods:* Four spine surgeons and three secretaries scored twenty-five standardized referrals. A second iteration of scoring was performed with a minimum time interval elapsed of six weeks. Scorers were instructed to choose the most significant (the one with the highest associated score) descriptor in each category. No further instructions were given on how to interpret the referral letter or the radiology report. The surgeons also scored the referrals using their own 4-point scoring systems. Descriptive statistics were computed as well as correlational analyses and appropriate paired t-tests. *Results:* Inter-observer reliability was assessed with intra-class coefficient (ICC = 0.96) (for iteration 2). Intra-observer reliability was assessed by computing Pearson product moment correlation coefficient ($r(174) = 0.96$, $p < 0.001$). Pearson correlation coefficient was also computed to compare the SSS to the gold standard ($r(24) = 0.69$, $p < 0.001$) (for iteration 2). *Conclusions:* The Spine Severity Score is a reliable scoring system for triage of elective spine referrals. We have been able to demonstrate strong inter-observer and intra-observer reliability, as well as moderately strong correlation with the traditional gold standard for triage, the surgeon's clinical experience.

P-185

A case series demonstrating atlantoaxial stabilisation using a pars screw and contoured rod construct

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Background: Instability at the atlantoaxial junction may arise due to trauma, inflammation, degeneration, neoplasia, or congenital abnormality. Rigid internal fixation techniques, including transarticular screws and C1-C2 screw and rod constructs, offer immediate stabilisation and high fusion rates, but may be technically challenging. An alternative construct is described and its application in a case series presented. *Methods:* Eleven patients underwent atlantoaxial stabilisation with a construct composed of C2 pars screws and a U-shaped rod contoured and secured with braided cable to the C1 posterior arch. The age of the patients ranged from 4 to 68 years, and pathology included trauma (n=3), rheumatoid arthritis (n=4), degenerative arthritis (n=1), and os odontoideum (n=3). The procedure was well-tolerated, as determined by multi-modality evoked potential monitoring in three patients and by unchanged clinical neurologic examination in all. Subsequent to the first case, no rigid external orthoses were used post-operatively. *Results:* A follow-up period of 6 to 15 months has consistently demonstrated bony fusion and operative segment stability on radiography. *Conclusions:* This case series demonstrates that the pars screw-contoured rod construct is a safe and simple method of atlantoaxial fixation that is effective across a range of patient demographics and indications.

P-186

A rare case of occipital cervical dissociation: preliminary 3 month follow-up

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Introduction: Atlanto-occipital dislocation (ADO) is a rare and often fatal injury. In cases of survival, residual deficits often include cranial nerve palsy, quadriplegia or respiratory issues. We present a rare case of AOD superimposed on a congenital atlanto-occipital assimilation with good recovery post-operatively. *Method:* This is a case of a 39 year old gentleman who experienced AOD following a motor vehicle accident. On examination, motor strength was 0 in the left leg and upper limbs, and rectal tone was absent. He was able to move his right leg at the ankle. CT demonstrated AOD, and MRI revealed ligament injury with C1-C2 instability. *Results:* Intervention included occipital cervical instrumentation fusion from the occiput to C3, with a left iliac crest bone graft. Three months post-operatively, imaging demonstrated fusion with satisfactory alignment. Strength in the legs was 3 in the left and 1 in the right. In the left arm, strength was 3+ for biceps and brachioradialis, 1+ for wrist extension, and 4 for finger movements. Strength in the right arm was 1. *Discussion:* A high velocity collision led to disruption of the atlanto-occipital ligaments in our patient. Internal fixation and fusion with bone graft led to good fusion post-operatively.

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"Who gets what" prior to surgical referral for radicular pain

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Introduction: There are no specific Canadian Guidelines regarding conservative management of patients with back and leg pain in the community, and management approaches vary greatly. *Methods:* A retrospective chart review included 100 patients with back and leg pain presenting to an academic spine clinic between 2005 and 2007. Clinic notes were reviewed to ascertain basic demographics, type of pain, diagnosis and conservative modalities employed, including medications used, prior to sub-specialist referral. *Results:* 48 females and 52 males (mean age 48.73 ± 13.32) were reviewed. All had radicular pain; 97% had concomitant back pain. No consistent pattern was found for treatment prior to referral. 16% received no therapies prior to referral, 33% had not tried exercise/physiotherapy. Patients were less likely to be on narcotics (33% vs 58%, p=0.05) and more likely to have been prescribed gabapentinoids (43% vs 9%, p=0.002), if they were referred by a specialist compared to a general practioner. No significant difference was noted in usage of anti-inflammatories, anti-spasmodics, tricyclic antidepressants, chiropractic care or physiotherapy. *Conclusion:* This study demonstrates a lack of consistency in conservative measures instituted prior to sub-specialist referral for low back and leg pain. These findings should aid future efforts to standardize conservative management of this patient population.

P-188

3-D intraoperative image guided spinal surgery

K Aal-Ali (Halifax), SD Christie (Halifax)

Introduction: Image guidance applications continue to be developed to enhance surgical accuracy, clinical outcomes and patient safety. The O-arm™ is a unique, mobile imager that has the capacity to generate both two- and three-dimensional, real-time, intraoperative images that can integrate directly with neuro-navigation platforms. The amalgamation of these technologies has proved to greatly enhance surgical visualization during complex and minimally-invasive spinal procedures. *Methods:* We report on our experience of over 25 cases of complex and minimally invasive spinal procedures, including discectomy, decompression of stenosis, pedicle instrumented arthrodesis and tumour resection. *Results:* The O-arm™ is easily integrated into an operating room setting familiar with a standard C-arm. High quality three-dimensional images are achieved in less than 30 seconds. The images are automatically transferred to the Treon StealthStation(r), where the Synergy™ software manages the intraoperative image guidance. No other registration is required following the scan. This technology allows for less radiation use during the case and avoids the need for the surgical team to wear lead aprons. Furthermore, post-operative scanning enables confirmation of implant placement prior to leaving the surgical suite *Conclusions:* Three-dimensional image guidance appears to be an advantageous adjunct during complex and minimally invasive spinal procedures.

P-189

Role of CT perfusion in spinal disease

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Background: Routine diagnostic techniques are inadequate to confidently differentiate diseases of the axial skeleton. The purpose of study was to determine whether CT perfusion can differentiate inflammatory diseases like tuberculosis from neoplastic diseases of spine. *Methods:* 51 patients with vertebral body lesions associated with paraspinal mass underwent CT guided bone biopsy and histopathological evaluation. CT perfusion was done in all patients before doing bone biopsy. Perfusion parameters like blood volume (BV), blood flow (BF) and time to peak (TTP) were calculated. Values are correlated with histopathological report of bone biopsy. Statistical analysis was done using Mann-Whitney test. p value<0.05 was considered significant. *Results:* Of 51 cases, 32 had infective osteomyelitis and 19 neoplastic disease(nine metastasis, five plasmacytoma, four lymphoma and one chordoma. Mean rBF was [inflammatory lesions, 1.459 and neoplastic lesions, 18.080 (p<0.000)]. Mean rBV was [inflammatory disease, 2.8589 and neoplastic lesions, 12.2133(p<0.000)]. Mean rTTP was [inflammatory pathology, 1.041 and neoplastic pathology, 0.703(p<0.079)]. *Conclusion:* This shows deconvolution-based CTP technique's potential for noninvasive diagnosis of at least all inflammatory lesions affecting spine that are associated with paraspinal mass. Confidence for specific diagnosis of neoplastic lesions is not possible because of small sample size of individual pathology. We acknowledge that the data correspond to small sample size. Nevertheless, validation of the use of deconvolution CTP parameters for the differentiation of inflammatory from neoplastic pathology may permit this technique to be used as an adjunct tool to biopsy when routine imaging findings are inconclusive.

P-190

Minimally invasive surgery for lumbar spondylolisthesis

*R Sahjpaul (North Vancouver)**

Background: Minimally invasive (MIS) techniques are becoming increasingly popular in the treatment of disc disease, spinal stenosis and spondylolisthesis. Reported benefits include reduced operative time, blood loss, hospital stay, and patient morbidity. *Methods:* Thirty one patients undergoing MIS transforaminal lumbar interbody fusion (TLIF) and percutaneous pedicle screw fixation over the past 24 months were reviewed. *Results:* Mean age was 52 years. Sixteen patients had Grade 1 and 12 patients had Grade 2 spondylolisthesis. Two patients were converted to open decompression and fusion due to technical difficulties. The remainder underwent MIS TLIF using either R90 spacer or Capstone cages and Sextant percutaneous pedicle screw fixation (Medtronic). Mean operative time was 3.4 hrs (2.5-5.5), blood loss 141 cc (50-300), hospital stay 2.8 days (1-4). There were no infections or screw malpositions. This data compares favourably to the literature. All outcome measures were significantly better than in a control group of 10 patients who underwent an open decompression and fusion procedure. *Conclusions:* Minimally invasive surgery is an attractive alternative to open decompression and fusion for spinal stenosis due to spondylolisthesis

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Juvenile spinal cord AVM: case presentation and literature review

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Purpose: Juvenile intramedullary AVMs are rare lesions carrying a very high incidence of hemorrhage.
This is an 11 year-old girl presenting with rapidly progressive paraparesis evolving to paraplegia caused by a large intramedullary spinal cord AVM. The lesion was treated with endovascular technique. The treatment and clinical evolution are reviewed. *Case presentation:* This is an 11 year-old girl who presented with rapidly progressive weakness and pain in both legs and back pain. These symptoms had evolved over a week and they were preceded by a minor fall. At the time of admission the patient was unable to walk, no movement was present below the knee's level. She had painful disesthesia in both legs but more pronounced on the right, and she was in urinary retention. The MRI revealed a intramedullary vascular lesion at the T11 level. An urgent spinal angiogram confirmed the presence of an intramedullary AVM fed by the anterior spinal artery and some contribution from a right postero-spinal artery. The patient was initially observed. A second spinal angiogram was performed three weeks after the initial one in view of endovascular treatment of the lesion. The second angiographic study demonstrated a large (approximately 13 mm in diameter) intranidal aneurysm. Retrospectively the aneurysm was present on the initial MRI but it was totally thrombosed and during the 3 weeks interval the lesion had spontaneously recanalized. Embolization using glues was performed. The clinical outcome was excellent in fact already 10 days following the procedure the patient was able to walk with assistance and the bladder function had totally recovered. *Conclusion:* Juvenile spinal cords AVM are very rare lesions. The treatment is particularly complicated due to their primary intramedullary location and the supply often from the anterior spinal artery. The presence of intranidal aneurysm requires treatment since this is often the source of the hemorrhage. The clinical presentation and the evolution of these lesions are reviewed with special emphasis on the angiographic pattern and endovascular procedure.

Stroke (Vascular Neurology, Imaging, Basic Science and Neurovascular/Endovascular Surgery)

P-192

Subarachnoid hemorrhage in Down syndrome: a case report

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Introduction: Craniocervical instability and Moyamoya syndrome are recognized neurosurgical issues in Down syndrome (Trisomy 21). Proteins encoded on chromosome 21 include SOD-1, cystathionine α-synthase and α-chains of collagen type VI. Abnormalities are associated with vascular disease and inherent ligamentous laxity. *Case Report:* We present a case of subarachnoid hemorrhage (SAH) in Down syndrome. A minor traumatic episode may have precipitated the SAH. Diagnostic imaging revealed vertebral artery dissection and pseudoaneurysm. Serial angiography showed pseudoaneurysm progression and an endovascular stent was placed across the vertebrobasilar junction. The pseudoaneurysm disappeared on follow-up imaging. The patient has had a good recovery. *Literature Review:* There are two previous SAH reports in Down syndrome, one associated with Moyamoya syndrome and the second with mycotic aneurysm rupture. There are two reports of anomalous vertebral arteries. There are no previous reports of vertebral artery dissection and SAH. *Conclusions:* The vertebral artery dissection, with subsequent pseudoaneurysm formation and SAH may relate to abnormalities of collagen and/or the inherent craniocervical instability associated with Down syndrome.

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The state of emergency stroke resources and care in rural Arizona

ML Miley (Chicago), BJ Bobrow (Phoenix), BM Demaerschalk (Phoenix)*

Background: 1/3 of Arizonian patients reside outside a metropolitan community and do not have access to emergency stroke expertise. Our purpose was to evaluate the emergency stroke resources and care at remote Arizona hospitals. *Methods:* After excluding 70 hospitals in Phoenix and Tucson, consenting managers or directors of emergency and quality departments at 35 rural hospitals were mailed a formal survey on behalf of the Arizona Department of Health Services. *Results:* 24/35 (69%) hospitals completed the survey. 24% hospitals reported >100 annual acute strokes, 19% reported 50-100, and 57% reported fewer than 50. Of the 24 hospitals, 90% had CT/MRI. Radiological interpretation was available on-site 24/7 at 33% of hospitals, occasionally on site at 43%, 24/7 teleradiology was used at 24%. 1 hospital had neurologists on call 24/7. 90% of the hospitals were interested in participating in a state-wide stroke telemedicine initiative. Cumulatively, hospitals administered tPA to 2-4% of all stroke patients. *Conclusion:* Remote communities of Arizona are under serviced with regard to the availability of neurologists and the delivery of emergency stroke care. The majority of the remote Arizona EDs are both interested in and capable of participating as spoke sites in a state-wide stroke telemedicine initiative.

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Stroke telemedicine for Arizona ruralresidents (STARR)

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Background: A deficit of emergency stroke care in Arizona's remote communities calls for a state-wide acute stroke care plan centered on stroke telemedicine. Our purpose was to formulate a 5-year stroke telemedicine plan for Arizona rural residents. *Methods:* We derived data from our previously designed telemedicine trial to estimate the resources (neurologists, equipment, management personnel, information technology, and administration). We determined that Phoenix would serve the northern and Tucson the southern portions of the state. To determine the boundary between portions, we used a combination of county borders, highways, and proximity to

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metropolitan areas. We devised a prioritization scheme for staged spoke site participation in the opening year. *Results:* The STARR plan divides Arizona into North and South regions. 8 Phoenix primary stroke centers (PSC) would service 26 remote EDs and 3 Tucson PSCs would service 9 EDs. Each hub will have 2-4 stroke neurologists sharing call duties, 1 director at 0.20 full-time equivalent (FTE) and 1 coordinator (0.20 FTE). The 5-year budget is US $25,137,015. *Conclusion:* The 5-year plan for STARR has been formulated and initiated. Telemedicine may be an effective method to provide expert care to stroke patients located in rural areas.

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Angiographic and clinical evaluation of the effect of intra-arterial milrinone infusion in patients with vasospasm from aneurysmal subarachnoid hemorrhage

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Objective: The use of intra-arterial Milrinone for the treatment of vasospasm resulting from aneurysmal subarachnoid hemorrhage remains controversial. This study aims to examine the angiographic results of intra-arterial Milrinone infusion in this population of patients. *Methods and Material:* A retrospective review of all patients treated intra-arterial Milrinone infusion from June 2005 to June 2007 was performed. On DSA the caliber vessel was graded as normal, mild vasospasm (<50% caliber reduction), moderate vasospasm (50 - 70% caliber reduction), severe vasospasm (>70% caliber reduction), and complete occlusion. Milrinone was delivered with intra-arterial catheter at rate 0.25 mg/min; total dose delivered ranged between 2-15 mg. The cerebral angiograms pre and post Milrinone treatment were assessed. *Results:* A total of 13 patients (11 females) underwent 14 procedures with intra-arterial Milrinone infusion; 3 of these patients had combined treatment using percutaneous angioplasty (PTA) and Milrinone infusion. Eleven patients had cerebral angiogram prior to vasospasm. Pre treatment cerebral angiogram revealed 1 patient (7.2%) with complete occlusion of vessel, 7 patients (50%) had severe vasospasm, and 6 patients (42.8%) had moderate vasospasm. The post treatment cerebral angiogram showed return to normal caliber in 4 patients; improvement to mild vasospasm in 8, and 1 patient had no improvement of moderate vasospasm despite two sessions of treatment. No complications related to the use of Milrinone were identified. *Conclusion:* Intra-arterial Milrinone infusion for the treatment of cerebral vasospasm was safe and resulted in satisfactory and sustainable improvement in the caliber of the vessels.

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Carotid stenting in high risk patients: a Canadian single centre experience

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Background: Carotid artery stenting (CAS) is emerging as an acceptable treatment alternative to carotid endarterectomy in high-risk patients with carotid stenosis. However, recently published clinical trials (EVA-S and SPACE) suggest that CAS is associated with increased procedural morbidity. *Purpose:* The aim of this study was to assess the outcome of carotid artery stenting in our population of symptomatic and asymptomatic high-risk patients treated with carotid stenting, and to determine the impact of individual risk factors and lesion characteristics on treatment complications. *Methods:* Clinical variables and treatment outcomes of 110 consecutive carotid artery stenting procedures were analyzed from a retrospective case series (2002-2006). Primary outcomes examined were major peri-procedural complications reflected by 30 day mortality/stroke/ morbidity. *Results:* There were a total of 110 cases (mean age 71+0.9 yrs, n=79 males, n=31 females). More then 80% of the study group had a history of hypertension and elevated cholesterol, and 40-60% had a history of coronary artery disease, diabetes and smoking. The predominant qualifying events for carotid stenting were transient ischemia attack (n=48), stroke (n=24), ocular ischemia (n=18) and symptomatic endarterectomy restenosis (n=10). Four patients who underwent carotid stenting were asymptomatic. The grading of the stenoses was done on angiography using the NASCET criteria and showed that 29% of the patients had 70-79% stenosis, 39% had 80-89% stenosis and 32% had >90% stenosis. Distal filter protection was used in 89 of 99 cases from 2003 onwards. Major complications over the 5 year period were 1 death (0.9%), 4 strokes (3.6%), and 3 non-cardiac/non-neuro complications (2.7%). *Conclusion:* Complication rates at our institution compared favourably with published clinical trial data and support the hypothesis that carotid artery stenting can provide excellent treatment outcomes in high risk symptomatic patients.

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Cerbrovascular reactivity (CVR) in neurofibromatosis I (NF1) with moyamoya

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Background: Vasculopathy occurs in NF1 and one of the manifestations of this in the brain is Moyamoya syndrome (MMS). We have been using CVR to determine whether MMS results in impaired perfusion in patients and have evaluated five NF1 MMS patients with this technique. *Methods:* The CVR of five NF1 patients (5 - 11 years) was evaluated with blood oxygen level dependent (BOLD) MRI signal change induced by CO_2 increases produced by CO_2 rebreathing in awake patients and by apnea in anesthetized, ventilated patients. *Results:* Four patients also had optic gliomas. One had episodic weakness associated with crying. Another had episodes of speech arrest. Three did not have symptoms referable to the vascular abnormalities. In these three asymptomatic patients with a left ICA abnormality there was decreased CVR in the left hemisphere. The patient with speech arrest had narrowing of the left proximal MCA and decreased reactivity in the left hemisphere. The other patient had bilateral disease and a symmetrical but low amplitude increase in signal in both hemispheres during apnea. *Conclusion:* Of the five NF1 patients with MMS, four had optic gliomas. The CVR evaluation confirmed impaired vascular re-activity in the expected hemisphere even in the asymptomatic patients.

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Cardioembolic stroke in a patient with left atrial myxoma

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Background: Cardiac myxoma (CM) is the most common primary cardiac tumor and classically presents as a triad of constitutional, cardiac, and embolic symptoms. Up to three quarters of embolic phenomena occur within the CNS and present as a variety of neurologic manifestations. We report a patient with TIA and calf thrombosis whose underlying atrial myxoma was initially overlooked until followed by microembolic strokes. The clinical presentation, diagnosis, and management considerations of this rare but potentially curable etiology for stroke are highlighted. *Methods:* Case report and literature review *Results:* A 67 year old woman presented with six months of fatigue, decreased exercise tolerance, and pre-syncope followed by TIA and left peroneal vein thrombosis. Two months later, she experienced sudden onset nausea, polyopsia, disequilibrium, and transient quadraparesis. While her neurologic exam was essentially normal, neuroimaging showed multiple hypodensities consistent with embolic ischemic infarctions. Transthoracic echocardiogram revealed a left atrial tumor, which was surgically resected, and confirmed to be a myxoma. *Conclusions:* CM often presents with nonspecific protean manifestations that make the diagnosis elusive. Devastating neurologic consequences, most commonly stroke, can occur if the diagnosis is missed. Echocardiography is highly sensitive for CM and should be performed in young patients with cryptogenic stroke, even in the absence of cardiac signs or symptoms. Surgical resection is curative, although does not prevent the potential latent sequelae of intracranial myxomatous emboli, including aneurysms and tumor metastases.

P-200

Arterionenous malformations in the pregnant population: clinical presentations and management strategies

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Background: The management of patients who present with AVM rupture during pregnancy is challenging and guidelines are lacking. *Methods:* Five cases of pregnant patients with ruptured AVMs were treated from 1992-2007. A chart review was conducted. Outcomes were categorized as excellent (modified Rankin Grade 0-1), good (Grade 2), poor (Grade 3-5), and dead. *Results:* All patients presented with intraparenchymal hemorrhage. Two patients had excellent, 2 had good, and 1 had poor clinical grade. Four patients were pregnant at the time of the initial bleed (12, 17, 19, and 26 weeks) and the 5th became pregnant subsequently. Two patients had deliberately staged treatment, with partial embolization at 27 and 28 weeks. Surgery was then carried out after delivery. In the remaining 3 patients, surgical excision was undertaken at gestational ages of 12 (uncal herniation was present), 15, and 33 weeks. Three patients had excellent, and 2 had good outcomes. All patients delivered healthy babies. *Conclusion:* Embolization of ruptured AVMs after the first trimester is safe and should be used when indicated. Targeted embolization of a ruptured intranidal aneurysm is a useful strategy to delay surgery until after delivery. Surgical excision if necessary is advocated in the 2nd trimester.

P-201

Pathogenesis of stroke caused by osteophytic compression of a vertebral artery

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Background: Compression of a vertebral artery (VA) by osteophytic spurs is a rare cause of ischemic stroke (IS), attributed to hemodynamic compromise due to insufficient contralateral supply. We aim to reassess this hypothesis. *Methods:* Case report. *Results:* A 53 year-old man with controlled hypertension and dyslipidemia, had several transient ischemic attacks (TIA) lasting <1 minute and four IS between 2002-09 and 2006-12 despite antiplatelet, antihypertensive, and statin therapy. His TIA/IS consisted of vertigo, left-sided sensory-motor deficit and unstable gait. He also had isolated transient binocular blindness (ITBB) in 2006-11. He never had cardiac symptoms or craniocervical trauma or pain. He quited smoking in 2005-02. Physical exam showed normal vital signs and cardiovascular exam, dysathria, left-sided sensory-motor and cerebellar deficit, and unstable gait. Serial brain MRI between 2002-11 and 2007-04 revealed infarcts of different chronology in the inferior part of both cerebellar hemispheres. Contrast angiography revealed two 40-60% excentric stenoses in the second segment of the right VA, occluded left posterior inferior cerebellar artery (PICA), small but patent left VA, patent carotid, basilar and intracranial arteries, and no atherosclerosis. CT angiography (CTA) showed right VA compression by osteophytes at C5-C6 and C6-C7 spinal levels, causing stenoses. Results of three 24-hour Holter monitorings, transthoracic and transesophageal echocardiography, blood glucose, lipid levels on statin treatment, and prothrombotic and vasculitic work-up were normal. He had right VA surgical decompression on 2007-06-07 and no additional TIA/IS as of 2008-01-11. *Discussion:* CTA advantageously images relationship between VA and adjacent cervical spine. Although ITBB in the case we report suggests right VA dissection with top of basilar embolism, absence of neck pain, occurrence of multiple stereotyped TIA/IS over several years, absence of infarcts in territories distal to the right VA, and left PICA occlusion are more consistent with hemodynamic compromise. Surgical VA decompression resolves the cause in both mechanisms.

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Arterial injuries after anterior cervical surgical approach

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Background: Injuries to arteries during anterior Cervical surgical approach for treatment of degenerative disc disease (DDD) are very uncommon. If it happens, may lead to unpleasant results for the patient and treating surgeon, and possible subsequent medico-legal implications. *Method:* Three cases of cervical arterial injuries where identified among over 1200 surgical cases who underwent this method of treatment for DDD. *Results:* One case of serious post-operative bleeding from thyroidal artery; a second case of vertebral artery dissection, diagnosed post-op; and a 3rd case of vertebral artery laceration, with profuse per-operative bleeding. Management of these cases is discussed and pertinent literature reviewed. *Conclusion:* Arterial injuries are very uncommon, but potentially dangerous complication of anterior cervical surgical approach in treating patients with DDD. Avoidance is the best treatment, which could be achieved through: 1) a thorough knowledge of surgical

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anatomy and awareness of probable anatomic variations. 2) a very meticulous dissection and careful handling of surgical instruments. Instruments being used routinely, could turn into dangerous tools, in a moment of in-attention and may cause damage even in the best surgical hands. If an arterial injury is identified, appropriate therapeutic measures must be instituted for each specific case.

P-203

Analysis of functional outcomes and risk factors following pediatric central nervous system thrombosi

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Background: Stroke in childhood is an uncommon event, affecting 4 children per 1000,000 per year. The life long burden of resultant morbidity is significant. It is important to characterize the functional outcome following stroke to encourage treatment advances and offer prognostic insight to patients and their families. *Methods:* The study examined the functional outcome following arterial ischemic stroke (AIS) and sinovenous thrombosis (SVT) in children under 18 years. Features of the initial stroke were characterized by retrospective chart review and these were related to functional outcome after follow-up interviews. *Results:* Follow-up interviews were conducted on 16 patients (13 with AIS, 3 with SVT and 2 with hemorrhagic stroke) a mean of 6.7 years after the event. 8 patients had no disability (modified Rankin Score (mRS)0-1) and 8 had mild to moderate disability (mRS 2-4). The mRS correlated with the child's school success; patients with mRS of 0-1 were more likely to be functioning at grade level than patients with mRS of 2-4(p=0.009, chi square). Prognosis could not be predicted by features of the stroke. *Conclusions:* In the current small patient sample prognostic indicators of the functional outcome of stroke were not found. The even distribution observed between good and poor outcomes makes it difficult to offer confident advice to families and observation of larger cohorts should be conducted. It is not satisfactory to suggest that the outcome of stroke in children is less severe than stroke in adulthood

P-204

Successful use of intra-arterial thrombolysis for the treatment of basilar artery thrombosis in a child: a case report

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Introduction: 75-90% of patients presenting with acute brainstem stroke die or are locked in long-term survivors. *Case:* A previously healthy 6 y.o. boy developed sudden onset left hemiparesis, vertigo and dysarthria. CT-head in a community hospital showed no hemorrhage or acute infarction. He arrived hours post-ictus to BC Children's hospital with mutism, ophthalmoplegia, drooling, weak gag, no tongue protrusion and quadraparesis with pyramidal signs. MRI brain: acute pontine infarct and an older left thalamic infarct. MR and CT angiography confirmed basilar artery occlusion, secondary to a left vertebral artery dissection. He continued to worsen, and at 12 hours post-ictus, underwent mechanical and intra-arterial thrombolysis with 12 mg (0.5 mg/kg) of recombinant tissue plasminogen activator. The procedure successfully opened the basilar artery with no complications. At two weeks, the child had normal speech, minimal word finding difficulties, full extraocular movements, emotional lability, NG feeds and mild limb weakness. At six weeks only mild emotional lability persisted. *Conclusion:* This case highlights the need for rapid evaluation of children presenting with stroke symptoms, the potential benefit of thrombolysis and the need for a large prospective study to further evaluate the safety and efficacy of thrombolytic therapy in children.

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Stent Assistance on Endovascular Aneurysm Treatment in Acute SAH Period

*Y Kim (Cheonan)**

Despite rapid advances in endovascular technology and development of coil engineering, complex aneurysms have been remained as difficult ones because of their unfavorable geometry, which reduces the possibility of complete elimination of aneurysm from the parent artery and intimidates early rebleeding. The author reports the experience of the Neuroform stent-assisted treatment for the ruptured complex intracranial aneurysms in acute period. Between October 2003 and December 2007, 87 patients with ruptured intracranial aneurysms have been selected for this study. Patient selection for treatment with intracranial stenting with or wothout coiling was based on only on the angioarchitectural characteristics of each aneurysm. Patients could not be pretreated with antiplatelet drugs of Clopidogrel and Aspirin because of the patients in this study were all ruptured and the procedures were performed in the emergency bases. In four cases stent in stent technique was conducted for the treatment of internal carotid artery dissecting aneurysms. Y-configured reconstructions were performed for the treatment of two basilar tip aneurysms and one MCA bifurcation aneurysm. In four patients, deployment of the stents were difficult due to anatomical arterial tortuosity and the stents were positioned in suboptimal place. One of the incomplete occlusion patient delayed coil escape was noted on post-treatment 10 months follow up angiography without any neurological events, and two patients with large aneurysms had occurred coil compaction. Delayed transient dysarthria was presented by the focal infarction in ipsilateral cerebral hemisphere. The embarrassment of antiplatelet drugs premedication for several days might limit the stent-assisted treatment on early period. But it was not seemed necessary for prevent thromboembolic events. The author suggests that stent application on ruptured complex aneurysm without antiplatelets premedication would rather be safe and effective in the early period.

P-206

Multiple cranial dissections after childbirth

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Background: Spontaneous carotid and vertebral dissections are rare causes of stroke. While the association between puerperium and vascular dissection has been reported in the cardiac literature, to our knowledge, this is the first case described of spontaneous peripartum bilateral carotid dissections with left vertebral dissection. We report clinical and radiographic findings in a case of post-partum bilateral carotid and unilateral vertebral dissections and review the literature on causes, pathophysiology, diagnostic considerations and treatment options. *Methods:* Case report and literature review. *Results:* Nineteen days after uneventful caesarian section for breech

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presentation of healthy twins, a 41 year old female gravida 2, para 2 presented to the emergency department with a one week history of headache and acute dysarthria and right sided arm weakness lasting several hours. MRAngiogram revealed bilateral carotid artery and left vertebral artery dissections. The patient received anticoagulant therapy and recovered without deficit. Cardiac literature suggests multifactorial etiology of peripartum dissections, including increased age, hemodynamic factors and multiparity. *Conclusions:* The puerperium may be a period of increased risk for dissection. The differential diagnosis of transient focal neurological deficits and headache should include arterial dissection in post-partum patients. Early diagnosis and treatment may reduce the likelihood of chronic neurologic deficits.

P-207

Cause or coincidence? Paraclinoid aneurysm concealed by sphenoid wing meningioma: case report

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The coexistence of brain tumors and aneurysms is rare. In all previously reported cases the aneurysm was detectable by angiography. We report here a case in which a paraclinoid internal carotid artery aneurysm was coexistent and concealed from angiographic detection by an adjacent parasellar meningioma. This is the first report of an aneurysm concealed from angiographic detection secondary to adjacent tumor compression. This case highlights the importance of considering associated vascular abnormalities when resecting skull base tumors, even if they are not detected on preoperative angiography.

P-208

Trans-arterial Onyx embolisation of intracranial dural arteriovenous fistulas with direct cortical venous drainage.

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Purpose: To present our experience with the endovascular management of intracranial dural arteriovenous fistulas with direct cortical venous drainage by trans-arterial embolisation using Onyx. *Materials and Methods:* Between January 2004 to December 2007, eleven consecutive high grade intracranial dural arteriovenous fistulas (Cognard type III (8 patients) or IV (3 patients)) were treated by trans-arterial embolisation with Onyx. There were 6 males and 5 females. Average age was 53.6 years (range 31 - 82 years). Patients presented with subarachnoid haemorrhage (2), pulsatile tinnitus (1), convulsion (1), scleral injection and exophthalmos (1), dizziness (1), hydrocephalus (1), sensation of pressure in the head with exercise (1), residual fistula following previous embolisation attempt at a different institution (1) or as an incidental finding on cranial CT (2). The locations of fistulas included tentorial or falcine (4), superior sagittal sinus (3), sphenoparietal sinus (2), sigmoid and transverse sinus (1) and middle cranial fossa (1). The majority of cases were treated by Onyx embolisation alone. One case had additional embolisation with n-butyl-2-cyanoacrylate (nBCA) at the same session. Imaging follow-up was obtained in all but one patient (mean 3.6 months). *Results:* Eight patients had a technical success at the end of the embolisation procedure with complete angiographic exclusion of the fistula, confirmed at follow-up imaging in 7 patients. Two patients had a small residual fistula at the end of embolisation, one of which had residual mild cortical venous drainage. Both were stable at follow-up angiography. One patient had a residual fistula supplied by the ophthalmic artery, which was thought to be unsafe to embolise and was sent for surgery, which was curative. In one patient the microcatheter ruptured, with a fragment of the distal microcatheter left in the occipital artery extending down into the common carotid to the C6 vertebral level. No clinical complications were observed in this series at clinical follow-up (mean 3.3 months). *Conclusion:* Endovascular management of intracranial dural arteriovenous fistulas with direct cortical venous drainage by trans-arterial Onyx embolisation is a safe and effective treatment according to our experience. Compared to historical data of fistulas embolised with nBCA at our institution, the rate of success of Onyx embolisation appears to be considerably superior.

P-209

Is postpartum cerebral angiopathy so benign?

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Introduction: Primary Postpartum cerebral angiopathy (PCA) is a rare condition occurring within days to weeks after a usually uncomplicated pregnancy and delivery. PCA may present clinically with neurological deficits or seizures and radiologically by reversible cerebral vasoconstriction. Most often patients fully recover with few if any sequelae. We describe the clinical and angiographic features of three cases of PCA that had severe intracranial hemorrhages and review the current literature. *Methods:* Case series and review of the literature. *Results:* We present three cases of PCA. Two patients presented with an intracerebral hematoma and one patient with a subarachnoid hemorrhage. Vasoconstriction was treated medically. Although one patient required surgical drainage of the intraparenchymal hematoma, all patients had a favorable outcome. *Conclusion:* PCA should be suspected in postpartum females presenting with headaches and neurologic symptoms associated with ischemic or hemorrhagic stroke or SAH. Although reversible and usually benign, severe vasoconstriction can lead to severe intracranial hemorrhages.

P-210

Otorhinorrhea as a complication of cerebral arteriovenous malformation

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Background: Non ruptured arteriovenous malformation (AVM) can rarely present with elevated intracranial pressure. Isolated elevated intracranial pressure can rarely present with otorrhea. We present a case of otorrhea due to cerebral AVM. *Method:* Case report and review of the literature *Results:* A 23 year old male with a history of cystic fibrosis and hepatic transplantation was treated medically for a pseudotumor cerebri believed to be secondary to receiving immunosuppressive treatment. At that time the work-up revealed a small temporal AVM without any venous outflow obstruction. He presented a few years later an otorhinorrhea secondary to right tegmen mastoidi erosion. The AVM was resected and the fistula and mastoid tegmental dehiscence was repaired. The angiogram revealed

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complete resection of the AVM and all symptoms of pseudotumor cerebri resolved after surgery. Review of the literature showed no other case of a spontaneous CSF otorhinorrhea associated with an AVM. *Conclusion:* Non ruptured AVM can rarely present with a spontaneous otorhinorrhea. In addition to the repair of the fistula, resection of the AVM is mandatory for resolution of the pseudotumor cerebri and prevention of CSF fistula's recurrence.

P-211

Superficial siderosis associated with a large cavernous malformation

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Background: The natural history of cavernous malformations (CM) involves intermittent episodes of asymptomatic microhemorrhages and thrombosis. However, few cases have been associated with superficial siderosis (SS), a syndrome caused by repeated hemorrhage into the subarachnoid spaces. *Methods:* Case report and review of the literature *Results:* A 67-year-old woman, known for epilepsy, gait disturbance and sensorineural deafness, complained of a progressing headache for the last week. Cerebral MRI revealed a heterogeneous temporoparietal lesion suggestive of a large CM with an adjacent chronic intraparenchymal hematoma. A superficial hypodense rim along the pial surface of cortical gyri, cerebellum and brainstem was noted. Resection of the cavernoma was performed. Only eight other cases of CMs associated with SS have been reported in the literature and their radiological characteristics and management strategies have been reviewed. *Conclusion:* CM are rarely associated with SS. SS has almost always been described with multiple small CM but a single cavernomas may also be found. For large CM, adjacent chronic hematoma might contribute to the chronic bleeding in subarachnoid spaces. Resection of the CM may improve patient's symptomatology.

P-212

Surgical approach for blood blister-like aneurysms

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Background: Small hemispheric bulge from the anterior wall of the internal carotid artery (ICA), also called blood blister-like aneurysm (BBA), are known to be a surgical challenge. This type of aneurysm requires special technical considerations. *Method:* Case series and description of surgical strategies for BBA. *Result:* Four patients with a BBA discovered in the setting of a subarachnoid hemorrhage were treated surgically. The technique took into account the special characteristics of the aneurysms and their high intra-operative risk of rupture. A step-by-step description of the surgical technique is demonstrated. *Conclusion:* Recognition of the BBA entity pre-operatively is essential to address these aneurysm which require particular surgical strategies.

P-213

Primary central nervous system vasculitis: the real world

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Background: Primary central nervous system vasculitis (PCNSV) is usually fatal if untreated. An incidence rate has been reported as 2.4/1,000,000 in a Mayo Clinic review. Diagnostic criteria include any acquired neurological deficit, exclusion of confounding disorders, and CNS vasculitis demonstrated on angiography or brain biopsy. Medical therapy is empiric. Recent descriptions of reversible cerebral vasoconstriction syndrome (RCVS) variants apparently have benign prognoses warranting different treatment. *Methods:* We searched a tertiary hospital database for "cerebral vasculitis" and similar terms from 1998-2005. A rheumatologist and neuroradiologist applied PCNSV criteria to diagnose patients. *Results:* We found 5 patients with PCNSV. The incidence rate was 0.07/1,000,000. One biopsy was performed. Angiograms demonstrated vasculitis. Dexamethasone induced remission in 2 and methylprednisolone in 3 patients. Prednisone maintained remission in 3 and cyclophosphamide in 1 patient. The sole death occurred in a RCVS patient. *Conclusions:* This study sheds new insight on incidence and prognosis. Our incidence rate represents real world health care settings. In terms of prognosis, we found a patient matching the "benign" RCVS profile with a fatal outcome. Treatment of all PCNSV cases should remain empirically aggressive. The number of patients diagnosed with PCNSV was very low. Further understanding of this rare condition should involve a multi-centre study.

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High frequency of magnetic resonance perfusion-weighted imaging abnormalities in lacunar infarcts and relationship to clinical outcome

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Background: Lacunes can be associated with early clinical deterioration and perfusion-weighted imaging (PWI) may help predict such deterioration. We sought to determine the frequency MRI PWI abnormalities in lacunes and whether such findings predicted early clinical deterioration, final infarct volume and outcome at 90 days. *Methods:* Patients with ischemic stroke/TIA had an MRI within 24 hours of the event and again at 30 or 90 days. Imaging was reviewed to identify lesions meeting lacunar criteria (solitary, subcortical lesions, ≤20mm greatest diameter). Multiple perfusion parameters (MTT, Tmax, TTP, CBF, CBV) were qualitatively assessed and infarct volumes measured. Early clinical deterioration (NIHSS worsening of ≥2 points within 3 days) and 90-day modified Rankin Scale score (mRS) were recorded. *Results:* Of 517 enrolled patients, 36 met radiological lacunar criteria (7%). Fourteen patients were excluded due to inadequate perfusion studies. Of the remaining 22 patients, 15 (68.2%) had abnormal PWI (≥1 abnormal perfusion parameter). Five patients (22.7%) experienced early clinical deterioration: 4 patients (26.7%) with abnormal PWI and 1 patient (14.3%) with normal PWI (p = NS). PWI abnormalities were not associated with a worse 90-day mRS score, nor did they

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predict infarct volume growth. *Conclusions:* MRI PWI abnormalities are present in two-thirds of lacunar infarcts but abnormal perfusion does not appear to be predictive of clinical deterioration, infarct growth or 90-day outcome.

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Comparison of coil types in aneurysm recurrence

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Background: Endovascularly coiled saccular aneurysms may recur, requiring retreatments. The extent of recanalization may depend upon coil type and design. Design variabilities include coating with a: polymer that induces tissue response across the aneurysm neck (Matrix); hydrophyllic gel that expands upon blood exposure, reducing dead-space (HydroCoil). Both approaches are proposed as improvements over bare platinum coils (GDC). We evaluated aneurysm recurrence, dependent upon coil type. *Methods:* Retrospective analysis of senior author's (AJR) prospective database. A 100 consecutive patients who underwent endovascular coiling for ruptured aneurysms ranging in size from 5-15 mm were identified during a period from 04/16/2002 through 12/31/2006. The types of coils used were: HydroCoils® (MicroVention), GDC® and Matrix® (Boston Scientific). *Results:* Mean aneurysm size (mm) was 7.4 (GDC), 8.1 (HydroCoil), 7.0 (Matrix). The treatment distribution was: GDC 31 (1 with Neuroform stent); Hydrocoil 26; and Matrix 43 (2 with Neuroform stents). Follow-up of ≥1 year was available in 67.7% (n=21) GDC, 76.9% (n=20) HydroCoil and, 72% (n=31) Matrix. Retreatments performed were: GDC 6.4% (n=2); Hydrocoil 11.5% (n=3); and Matrix 20.9% (n=9). *Conclusions:* GDC needed least number of re-treatments, although HydroCoils required a similar number of retreatments. Matrix coils were more likely as GDC and slightly more likely as hydroCoils to need re-treatment. The data indicates that factors other than coil surface coating attenuates aneurysm recurrence. Blinded evaluation of associated angiography is ongoing.

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Management of anterior cranial fossa dural arteriovenous fistulae

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Introduction and Purpose: Dural arteriovenous fistulae (DAVF) of the anterior cranial fossa are rare lesions that may cause intracranial hemorrhage. Previous reports mostly describe treatment by open surgery. The purpose of this study was to describe our experience with this specific type of fistulae including endovascular treatment. *Methods:* We retrospectively identified all patients with anterior cranial fossa DAVF diagnosed and treated in three separate institutions during the last 22 years. Clinical charts, imaging studies and procedural notes were evaluated. *Results:* We found 22 patients with 22 DAVF in the anterior cranial fossa; 20 males and 2 females aged 3 to 77 years. Eleven patients were primarily treated by surgical disconnection and 2 by radiosurgery. Nine patients were treated endovascularly. Six (66%) of these were cured. In the cases 3 cases of failed embolization final disconnection was achieved by surgery. All endovascular procedures were transarterial injections of diluted glue (NBCA). There were no complications from the endovascular treatment. One surgically treated patient developed brain edema around the venous pouch and confusion post venous disconnection. No patient suffered from a hemorrhage during the follow up period. *Conclusion:* Disconnection of anterior cranial fossa DAVF by transarterial catheterisation through the ophthalmic artery and subsequent injection of NBCA is possible with a rather high success rate and a low risk for complications. In patients with good vascular access this could be the treatment of choice, to be followed by open surgery in case of failure.

P-217

Traumatic dural arteriovenous fistula

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Background: Traumatic dural arteriovenous fistulas (AVF) are uncommon, and extremely rare in children. Injury of a meningeal artery in close proximity to a vein may induce the formation of an arteriovenous shunt. *Methods:* A 12 year-old boy fell off his bicycle and sustained a right temporo-parietal skull fracture associated with an underlying epidural hematoma, which did not require surgery. A right temporal bruit was identified on regular follow-up six weeks later. Brain MRI/MRA and cerebral angiography showed a large high-flow dural-based fistula between the right middle meningeal artery and the sigmoid sinus. *Results:* Endovascular coiling and embolization were unsuccessful. A right temporo-parietal craniectomy was performed and the dural-based fistula excised. The patient remains neurologically intact with no headaches or bruit five years later. *Conclusions:* Head trauma can induce the formation of a dural AVF. Thrombosis may promote the growth of dural arteries, which progressively hypertrophy. The aggressive nature of an AVF depends on the presence of cortical venous drainage. Surgery, endovascular techniques, as well as Gamma Knife radiosurgery have been utilized to treat these fistulas. AVF are considered benign when there is no cortical venous drainage; these lesions uncommonly progress, and management may be conservative unless there are intolerable symptoms.

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A post traumatic cerebral infarct from carotid and vertebral artery dissection: case report

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Introduction: Simultaneous dissection of carotid and vertebral arteries due to trauma is extremely rare. We present a case with such an occurrence. *Methods:* A 33 year old female was involved in a head on collision approximately 24 hours prior to admission. Her Glasgow coma scale was 15 and her initial CT scan was normal. She had several long bone fractures and laceration of the intestine. Over a period of 18 hours she became obtunded and developed cerebellar signs. Subsequent investigations revealed a defect of the right internal carotid and left vertebral artery highly suggestive of dissection. Multiple bilateral areas of infarct in the cerebellum and cerebrum were evident. In spite of adequate treatment she died. *Results:* Simultaneous post traumatic dissection of both carotid and vertebral arteries is extremely rare. Bilateral spontaneous dissection can occur in about 10%. It is suggested that following blunt injury occurrence of the dissection is maximum within the first 24 hours.

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Focal cerebral ischemia together with headache, are the most common clinical features. *Conclusion:* With an initial normal radiological investigation and deteriorating level of consciousness, ischemic changes due to vertebral or carotid artery dissection, has to be kept in mind.

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Restricted diffusion on MR diffusion weighted imaging is suggestive of poor outcome in cerebral fat embolism syndrome

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Introduction: The cerebral fat embolism syndrome (CFES) carries a generally favourable prognosis, although some patients develop severe neurological deficits and brain atrophy. MRI is the standard test for this condition and may have value in predicting prognosis. *Methods:* We reviewed the charts and radiology of two cases of CFES with MRI imaging and poor neurological outcome. *Results:* Neurological outcome was a Modified Rankin Scale of 4 in both cases. Diffusion-weighted imaging demonstrated restricted diffusion suggestive of cytotoxic oedema. Diffuse cerebral volume loss and persistent T2 signal abnormality was observed in follow-up imaging. *Discussion:* In this series the presence of restricted diffusion on DWI predicted severe phenotype, with poor prognosis, irreversible T2 lesions and cerebral volume loss on follow-up MRI. We conclude that DWI and ADC may have prognostic value in differentiating outcome in CFES and should be studied further.

P-220

Management of complex intracranial dural sinus thrombosis including novel use of an endovascular device

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Background: Multiple cranial sinus thrombosis (CST) is associated with a high morbidity, mortality and complex management. Treatment of the primary problem (thrombosis) and associated adverse events is essential. We describe successful management of a case including, novel use of a device. *Case Report:* A 35 years old obese female on oral contraceptives presented with severe headache and declining level of consciousness. She was intubated and admitted to NSICU. Neuroimaging showed right frontal venous infarction and multiple CST. Mechanical thrombolysis with a Merci device failed. A microcatheter was positioned in the superior sagittal sinus (SSS) and TPA infiltrated at 4 units/hr. The patient improved to GCS 9+T (from 7+T) and her ICPs became normal. However, a few hours later, she deteriorated again. CT showed an expanded right frontal hematoma. TPA and heparin were stopped. Angiography demonstrated considerable recanalization of the SSS, left vein of Labbé and transverse sinus. After failure with angiojet, a Pronto thrombectomy catheter (a peripheral endovascular device) was used successfully to recanalize both transverse sinuses. Then, a decompressive craniectomy was performed. NSICU stay included management of complications related to femoral pseudoaneurysm and recurrent PE. She was transferred to a rehabilitation facility on post-operative day 10, when she was alert, oriented and with a moderate left hemiperesis. *Conclusion:* Successful management of multiple CST requires a combination of medical and surgical interventions; vigilance for associated complications and readiness to adopt novel device usage and techniques.

P-221

Challenges in the treatment of Brainstem Arteriovenous Malformations

L Thines (Toronto), AR Dehdashti (Toronto), L Da Costa (Toronto), M Tymianski (Toronto), KG TerBrugge (Toronto), M Schwartz (Toronto), RA Willinsky (Toronto), C Wallace (Toronto)*

Background: The eloquent location of brain stem arteriovenous malformations (BS-AVMs) makes their management challenging. Our objective was to determine the value of the therapeutic modalities by examining the outcome of treated and untreated patients. *Methods:* We reviewed a prospective series of 31 patients managed for a BS-AVM between 1989 and 2007. We analyzed the early and final outcomes(modified Rankin Scale: mRS), the complication and cure rates of the various treatments. *Results:* BS-AVMs were symptomatic in 93% of patients and presented with bleeding in 61% of cases. Locations were: isolated BS in 17, cerebellar peduncles or cerebellum involvement in 11, cisternal or ventricular in 3. The initial examination was abnormal in 71% of patients but the mRS values were between 0 and 2 in 86% of cases. The average follow-up was 6.2 years. Among the 8 patients who rebled (26%, annual risk of 6 %/year), only 2 worsened. The management was conservative in 4 cases: 3 patients stabilized or improved and 1 patient died because of his poor initial condition. Treatment included 18 radiosurgical procedures, 20 embolizations (intent to cure 6, palliative 11, pre-radiosurgery or surgery 3) and 5 surgeries (intent to cure 4, associated aneurysm 1) with a multimodality management in 7. Permanent neurological complications rates were: radiosurgery 17%, embolization 10% and surgery 60% (1 death). The overall obliteration rate was 60% including radiosurgery 39%, embolization 40% and surgery 75% with respective complication-free cure rates of 71%, 50% and 0%. The final mRS values were between 0 to 2 in 77% of cases. In the 11/31 (35%) aggravations, 8 (73%) were related to the treatment. *Conclusions:* Radiosurgery might be the first line treatment regarding its non-invasiveness and low complication rate. Embolization could be dedicated to small and accessible malformations. Surgery should be considered very cautiously. Despite an annual rebleeding rate of 6%, the outcome was still favorable and thus the conservative management remains a realistic option in BS-AVMs.

P-222

Blindness due to venous occlusion related to cardiac surgery

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Introduction: Visual loss noted on wakening from open heart surgery occurs between 0.6 and 4.5 % of cases and is often permanent. Although previously attributed to ischemia, we present 3 such patients with venous obstruction. *Methods:* Review of charts, radiological, neuro-ophthalmological and laboratory data. *Results:* Two men and one woman aged 43-53 years of age, noted binocular blindness on wakening from open heart surgery. Superior vena cava obstruction/thrombosis in 2 cases was associated with marked edema of head, neck and arms. In each the pupillary light reflex was absent bilaterally. CT angiography showed a dilated superior ophthalmic vein in one patient. The following were unremarkable:

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funduscopy, remainder of the neurological examination, vital signs, CT of the brain. The third case had occlusion of the central retinal veins bilaterally with numerous retinal hemorrhages. This patient had suffered hypotension from cardiac tamponade and hemorrhage after a Bental procedure and aortic valve replacement. *Conclusion:* Superior vena cava obstruction was associated damage to the retrobulbar portion of the optic nerve; we propose involvement of the posterior ciliary circulation. Another cause of blindness was bilateral central retinal vein occlusion; the mechanism is uncertain.

P-223

Perinatal stroke secondary to chorioamnionitis: a histopathological case presentation

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Background: Arterial ischemic stroke is a well-documented cause of perinatal morbidity, particularly in those infants with defined risk factors. *Methods:* Here we report a case of stroke occurring in a neonate with no significant risk factors, other than the histopathologically-documented findings of severe chorioamnionitis with probable umbilical vein thrombosis. *Results:* A term infant, after uneventful labour, presented on the third day of life with right focal seizures. Neuroimaging disclosed acute cortical ischemic infarction involving the territory of the left middle cerebral artery. The sole potential agent identified was vacuum extraction; investigations for hypercoagulability, and for electrolyte, glucose, metabolic, or cerebrospinal fluid derangements revealed no abnormalities. Placental histopathology confirmed chorio-amnionitis, while the umbilical vessels revealed funisitis with endovasculitis. Layered deposition of fibrin and inflammatory material (lines of Zahn) within the umbilical vein were strongly suggestive of thrombosis. *Conclusion:* Chorioamnionitis has been epidemiologically correlated with perinatal neurologic deficits. This case suggests that, in addition to the recognized inflammatory cascade of *in utero* infection, umbilical vein thrombosis with subsequent "paradoxical" embolization may represent one mechanism responsible for this association.

P-224

Successful endovascular management of acutely ruptured vertebral artery pseudoaneurysm in isolated vertebrobasilar circulation complicated by symptomatic vasospasm

SH Khan (Cincinnati), TA Abruzzo (Cincinnati), O Choutka (Cincinnati), A Losinieki (Cincinnati), AJ Ringer (Cincinnati)*

Introduction: Stent reconstruction of ruptured intracranial vertebral artery (VA) pseudoaneurysms is gaining acceptance as an alternative to therapeutic occlusion. Significant vasospasm impedes stent delivery while vasospasm treatment and antiplatelet thrombo-prophylaxis may promote bleeding. Further complicating is an isolated vertebrobasilar system, lacking communication with anterior circulation. We report successful management of such a case. *Methods:* A 49 year old man with WFNS grade 3 subarachnoid hemorrhage, angiographically demonstrated a left VA, fusiform pseudoaneurysm (5.1 mm). The right VA terminated in PICA. Posterior communicating arteries were absent. Treatment plan included acute medical therapy followed by subacute stent reconstruction, to avoid antiplatelet use while at greatest risk for rehemorrhage and coil occlusion of residual aneurysm at delayed follow-up. *Results:* On day 7 post-hemorrhage the patient became more somnolent. Angiography showed severe flow-limiting spasm, proximal and distal to the pseudoaneurysm. Verapamil infusion attenuated vasospasm, enabling Neuroform® stent placement across the pseudoanauerysm. In-stent balloon angioplasty effected a widely patent VA with mild residual aneurysmal dilatation. One week later, he was transferred for rehabilitation with a modified Rankin Score of 0. Angiography after a month, demonstrated near-complete resolution of the pseudoaneurysm. A subtle recurrence was noted 6-months post-operatively, which was not treated. Repeat angiography at 9-months, confirmed VA stabilization in post-reconstruction shape. *Conclusions:* Acutely ruptured VA pseudoaneurysm complicated by symptomatic vasospasm can be successfully managed by a combination of intraarterial vasolytics, stent reconstruction and balloon angioplasty, when parent vessel sacrifice is prohibitive.

P-225

Microsurgical management of non-infectious distal intracranial aneurysms

N Gelinas-Phaneuf (Montréal), DJ Sirhan (Montréal)*

Background: Non-infectious distal intracranial aneurysms are a rare entity with a paucity of data on their surgical management. Theoretical advantages of microsurgery include vessel preservation, instant hemorrhage control and adjacent hematoma evacuation. *Methods:* We performed a retrospective chart review of 4 patients over the last 9 years (1998 -2007). Clinical presentation, imaging, surgical approach and outcome were analyzed. Pathologic specimens were obtained in all cases. All patients underwent post-operative angiography. A comparative literature review is presented. *Results:* All patients had suffered from either a remote or recent bleed. Sex predilection was equal (2M:2F) and ages ranged from 28 to 56 years (Mean 40.8). Hunt and Hess grades ranged from I to III. Aneurysms were located on the middle cerebral artery (2), pericallosal artery (1) and posterior inferior cerebellar artery (1). All cases were judged to be either inaccessible or inadequately treatable endovascularly. Hemorrhagic patterns included 3 SAH, one ICH and one pure IVH. Aneurysms were resected in 2 cases and clipped in 2. Pathology revealed classical absence or thinning of the internal elastic lamina with no infectious stigmata. Postoperative modified Rankin scores were good in all(Mean 0.75). Follow-up angiogram showed cure in all. *Conclusion:* Microsurgical approach can yield excellent outcomes with radiological cure whilst sparing normal vasculature. Such treatment must be weighed against the risks and benefits conferred by a tailored endovascular approach on a case by case analysis.

P-226

Effectiveness of intra-arterial Verapamil and Papaverine in causing sustained spasmolysis on cerebral vasculature after aneurysmal subarachnoid hemorrhage

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Introduction: Local intra-arterial administration of papaverine commonly manifests immediate but transient vasodilation during cerebral arterial infusion. The vasodilatory effects of verapamil are

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angiographically delayed. However, an improved clinical outcome has been reported with the latter drug. We propose the difference in outcome is due to a delayed but sustained vasodilatory action. *Methods:* A retrospective analysis of the senior author's (AJR) data base. All patients with cerebral vasospasm who underwent angiography and chemical intra-arterial spasmolytic therapy from January 2002 through December 2006 were identified. *Results:* Twenty-nine patients received papaverine while 22 received verapamil. Nineteen (76%) in the Papaverine group received single and 6 (24%) received multiple treatments. In the verapamil group, 15 (68%) received single and 7 (31.8%) received repeat treatments. The mean interval to treatment (MIT) with Papaverine was 2.33 days vs 3 days in verapamil-treated patients. Among patients treated more than once, those who did not receive angioplasty with the first treatment comprised 2/6 patients (33.33%) in papaverine-treated group and 4/7 patients (57.1%) in verapamil-treated group. The MIT was 2.5 days in the papaverine group vs 3.75 days in the verapamil group, when only chemical spasmolysis was employed. *Conclusions:* Angioplasty was required less frequently after verapamil treatment and the MIT was increased when compared to the papaverine treated group. We conclude, therefore, that spasmolytic effects of verapamil persist longer than those of papaverine. This may reduce the complexity or risk of interventional management of vasospasm.

P-227

Successful endovascular management of trapped lateral sinus DAVM via direct extra-dural trans-cranial route: strategies and techniques

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Background: Endovascular treatment of lateral sinus dural arteriovenous malformations (LS-DAVM) trapped by transverse sinus and jugular bulb occlusion is challenging because trans-arterial embolization is unlikely to be curative and percutaneous access unfeasible. We describe successful trans-cranial endovascular management of DAVM using novel technical modifications. *Methods:* We reviewed all cases of LS-DAVM treated between January 1996 and July 2006 via trans-cranial route at two neurovascular tertiary referral centers. Clinical records and imaging studies were analyzed. Outcomes were assessed by modified Rankin Scale (mRS). *Results:* Three trapped LS-DAVM (Borden type 2 or 3) were treated via trans-cranial route under general anesthesia. 2 presented with venous hypertensive encephalopathy and 1 with cerebral hemorrhage (ICH). All had previous trans-arterial embolization with N-butyl cyanocrylate (NBCA) or Onyx(r). Positioning was modified supine in 2 and prone in 1. Intra-op angiography was via trans-femoral arterial sheath in all. Burr holes were localized using roadmap angiography. Direct trans-dural puncture of the trapped sinus was performed through burr holes with a 14 or 20 gauge angiocath in 2, and a 23 gauge butterfly needle in 1. In 1 case intra-operative Doppler localization was performed. All punctures were confirmed by direct contrast injection under fluoroscopy. The 3 cases of trapped LS were occluded by embolization with: NBCA + liquid coils; NBCA; and Hydrocoil® + Onyx® with dual microcatheters, respecively. In every case post-op angiography demonstrated DAVM cure. There was no procedure related morbidity. The mRS at discharge was 0 (n=2) and 3 (n=1; patient with ICH). *Conclusions:* Endovascular management of trapped LS-DAVM is feasable via direct extra-dural trans-cranial route with excellent angiographic and clinical results. Coils + liquid embolics can be effective. Prone positioning and dual microcatheters are technically advantageous.

P-228

Predictive outcome factors in posterior fossa arteriovenous malformations - review of a single center experience

LB da Costa (Toronto), L Thines (Toronto), A Dehdashti (Toronto), MC Wallace (Toronto), RA Willinsky (Toronto), M Schwartz (Toronto), M Tymianski (Toronto), KG ter Brugge (Toronto)*

Objectives: Posterior fossa arteriovenous malformations (PFbAVMs) are uncommon lesions. Eloquence of adjacent structures increases risk of neurological deficit from hemorrhage and/or treatment. We reviewed a series of PFbAVMs managed by the same group during 15 years to identify predictive factors of poor outcome. *Methods:* 64 consecutive, prospectively collected PFbAVMs with initial and final mRS were included. Average FU was 3.3 years. Location, angioarchitecture, treatment type, presentation and final modified Rankin Score (mRS) were obtained. mRS=3 to 6 defined poor outcome. The impact of each factor in the final mRS was analyzed. *Results:* Embolization was used in 58% of AVMs, surgery in 23.5% and radiosurgery in 18.5%. 10 patients (15.6%) received multimodality treatment. Obliteration rate was 49%. 97% of patients had symptoms, hemorrhage in 62.3%, 50% with neurological deficit at presentation. Risk of FU hemorrhage (excluding presentation) was 4.1%/year. Initial mRS (p=0.0001) and presence of AA (p=0.0078) was correlated to a poor final mRS. *Conclusion:* PFbAVMs are complex pathologies often diagnosed after intracranial hemorrhage with neurological deficits. This high hemorrhage rate at presentation does not reflect in a higher risk of future hemorrhage. The presence of associated aneurysms and a poor initial mRS are strongly associated with a poor clinical outcome.

P-229

Inflammatory adverse events associated with the endovascular treatment of medium and large intracranial aneurysms

LB da Costa (Toronto), TR Marotta (Toronto), W Montanera (Toronto), J Spears (Toronto)*

Background: Medium and large intracranial aneurysms carry a poor natural history and their treatment remains challenging. With more frequent use of coiling, many clinical and radiographic complications have been reported. Less common, but of great concern, are the inflammatory events such as peri-aneurysmal edema, communicating hydrocephalus and aseptic meningitis recently reported after coiling. Identification of the factors related to these events is critical. We report our experience with these relatively uncommon adverse events in the treatment of aneurysms ≥ 1cm in size over a 2.5-year period. *Method:* We reviewed the retrospective data entered into the Multicenter, Medium and Large Intracranial Aneurysm Study that was started in July 2007. The 31 cases reviewed included all intracranial aneurysms ≥ 1cm in size

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treated by endovascular means over a 2.5 year period from a single institution (St. Michael's Hospital) at the University of Toronto. Clinical and radiographic follow-up was included. *Results:* Two cases of delayed communicating hydrocephalus requiring shunting and 4 cases of symptomatic peri-aneurysmal edema with delayed focal neurological deficits and headaches requiring steroid were recorded. Long-term neurological outcomes were excellent (Rankin 1-2) in all patients, but these poorly understood inflammatory events raise significant concern. *Conclusions:* While these inflammatory reactions are considered to be uncommon, the incidence of these events seems to be much higher in aneurysms ≥ 1cm in size. The sample size of the current review is inadequate to make statistical associations between coil types and adverse events, however, these findings further support the importance of multicenter data collection in the determination of the nature and sequelae of these events to optimize the endovascular treatment of medium and large intracranial aneurysms.

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Aneurysmal subarachnoid hemorrhage in perivascular spaces mimicking brainstem hematoma

LB da Costa (Toronto), MQ Ribeiro (Braga), PR Howard (Toronto), RA Willinsky (Toronto), KG ter Brugge (Toronto)*

Background: Aneurysmal subarachnoid hemorrhage (SAH) is often a devastating event and associated intraparenchymal hematoma increases the likelihood of neurological deficit. We report a case of aneurysmal rupture with acute clot in the brainstem and subarachnoid space with minimal clinical consequences. We believe this clinico-radiological dissociation is due to extension of subarachnoid blood in dilated Virchow-Robin spaces. This is the first report of subarachnoid hemorrhage into Virchow-Robin spaces. *Methods:* We present a case of a patient presenting with SAH and minimal peri-oral sensory deficits despite the presence of significant amount of blood inside the brainstem. The hypothesis for this clinico-radiological dissociation based on extension of the subarachnoid hemorrhage into pre-existing enlarged Virchow-Robin spaces is discussed. *Results:* A basilar tip and a posterior communicating artery aneurysm were treated with coiling, and the patient recovered without neurological sequelae. A smaller paraclinoid aneurysm was managed conservatively. Magnetic Resonance Imaging (MRI) three weeks after coiling showed residual blood in the brainstem with mild edema and confirmed the presence of enlarged Virchow-Robin spaces in brainstem, midbrain, basal ganglia, insula and deep white matter over the convexities. *Conclusion:* The presence of intraparenchymal hematoma after SAH is associated with poorer prognosis. A brainstem hematoma after SAH is rare and has never been described in a good clinical grade patient. Our hypothesis is that the blood extended into existing enlarged perivascular spaces (Virchow-Robin), eventually dissecting cranio-caudally along fibre tracts. This is the first case of such occurrence and emphasizes the importance of aggressive resuscitation and a proper clinical examination in face of alarming imaging finding in SAH management.

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Brain aneurysm treatment (1): an international survey of methods, usage and availability

NS Alshafai (Toronto), M Cusimano (Toronto), S Ho (Toronto)*

Background: The publication of the International Subarachnoid Aneurysm Trial (ISAT) rapidly changed the management of patients with subarachnoid hemorrhage in many countries. The present and perceived future trends of aneurysm management will have significant implications for patients and how we educate future cerebrovascular specialists. *Methods:* The present study aims at analyzing actual trends in the treatment of intracranial aneurysms based on an international survey among neurosurgeons and neuroradiologists. Previous surveys in this field have almost entirely focused on postoperative outcomes. In contrast, this study focused on opinions and insights on the different treatment methods, their usage, and availability. *Results:* An electronic anonymous 52-question survey using a web-based survey service was conducted. 235 (21%) respondents representing 26 countries indicated that at the present time 50% of aneurysms were treated by coiling and 50% treated with clipping, In 10 years respondents indicated that coiling would account for 80% of aneurysm treatments. The complete results of the survey will be presented and discussed at the meeting. *Conclusions:* The results demonstrate that there is a definite trend towards endovascular management of aneurysms but it is clear that cerebrovascular specialists will require excellent training with both techniques.

P-232

Single centre expereince of stent assisted aneurysm coil embolization with the Neuroform Stent (Boston Scientific) versus Enterprise Stent (Cordis)

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Background: We have treated complex wide necked aneurysms with stent assisted coil embolization since 2004 with the neuroform stent. In 2007 the enterprise stent became available. It is our preliminary subjective experience that the enterprise stent is easier to use. The purpose of this is to provide some objectivity towards the comparison of the two devices. *Methods:* A retrospective analysis of all wide necked aneurysm patients treated with the neuroform and enterprise stent was performed. Prospectivley we continue to collect cases and data. Parameters assessed include; (1) length of time of procedure (2) number of stents used in each case (3) number of patients requiring multiple or staged procedures (4) subjective degree of aneurysm coil embolization and (5) follow up angiography results. *Findings:* In the neuroform stent group, 21 patients (mean age 59) underwent 25 procedures treating 21 aneurysms. The mean procedure time was 4.8 hours. Three patients required multiple staged procedures. Thus far, 8 patients underwent treatment with the enterprise stent with a mean procedure time of 3 hours. We continue to accrue patients prospectivley in this group. No patients in this group required multiple or staged procedures. *Conclusions:* Preliminary data suggests that use of the enterprise stent results in a shorter procedure time and fewer staged procedures.

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P-233

The challenge of timely carotid endarterectomy for women with symptomatic carotid stenosis

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Background: Re-analysis of trials of endarterectomy for symptomatic carotid stenosis (CEA) demonstrated sex differences in the benefit from surgery based on timing. We implemented a rapid-access neurovascular clinic (NVC) to expedite evaluation of patients with TIA/minor stroke. We report the impact of the NVC on treatment timing. *Methods:* Patients' medical records who underwent CEA in our hospital in 2004 (post-implementation of the NVC) were reviewed and compared event-to-consultation (EC), consultation-to-surgery (CS), and event-to-surgery (ES) to 2003 intervals. *Results:* The minority of CEAs were performed in women: 39% (25/64) in 2003 and 37% (29/79) in 2004. Comparing 2003 to 2004: the median EC interval for men was 57 (interquartile range 18-75) versus 30 (12-85) days (p=0.5), and 42 (24-114) versus 29 (11-88) days (p=0.4) for women; the median CS interval for men was 12 (6-21) versus 14 (4-46) days (p=0.9), and 17 (10-53) versus 7 (4-18) days (p=0.03) for women; and the median ES interval for men was 60 (24-110) versus 58 (23-129) days (p=0.9), and 85 (42-145) versus 48 (24-114) days for women (p=0.2). *Conclusion:* Organized approach to evaluation and treatment of patients with TIA/minor stroke was associated with reduction in CS interval for women. Meeting current recommendations for timing of CEA remains challenging.

P-234

Neuroimaging features of cerebellar venous infarct: a case report and review of literature

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Background: Cerebellar venous infarction is relatively uncommon. Neuroimaging features of a presumed venous distribution infarct in the cerebellum are presented and a brief overview of the literature is discussed. *Case Report:* A 34 year-old right handed female approximately 9 weeks post-partum presented with a two day history of severe bilateral occipital headache. At the time of initial presentation she was found to be drowsy and a detailed neurological examination revealed left-sided dysmetria and disdiadochokinesis. Initial CT head disclosed displacement of the fourth ventricle towards the right but no overt lesion(s). Due to rapid deterioration, the patient underwent a suboccipital craniectomy and duroplasty for decompression of the cerebellum. Post-operative MRI showed large area of T1 and T2 prolongation in the left cerebellar hemisphere extending into the vermis with accompanying mass effect. There was involvement of the grey as well as white matter. The lesion showed increased diffusion suggesting vasogenic edema. Foci of petechial hemorrhage were present within the abnormality though there was no hematoma formation. No abnormal enhancement was noted. No arterial or dural sinus occlusion was seen on MR. CT head performed 2 months later showed complete resolution of the cerebellar abnormality. *Discussion:* We propose venous occlusion as the likely cause of this transient left cerebellar lesion.

Trauma, Critical Care

P-235

Visual evoked potentials (VEP) changes in cases with head trauma

*M Movassat (Tehran)**

Background (purpose): To evaluate the worth of VEP (visual evoked potentials) test in cerebral lesions due to head trauma. *Methods:* A case series study in 16 patients with head trauma by VEP test (pattern or flash) from May 2007 to Sep. 2007. *Results:* In all patients but one amplitude and/or implicit time of P100 wave (in pattern VEP) or P2 wave(in flash VEP)were abnormal. In most cases (80%) amplitude changes were more significant than changes of implicit time. In one case both amplitude and implicit time were totally normal. Abnormalities of VEP test were more severe in cases with vision loss but not shoulder by shoulder. *Conclusion:* VEP test is helpful for diagnosis of visual pathways lesions due head trauma. It also can help to differentiate true lesions from simulation in legal medicine.

P-236

Conversion to symptomatic Chiari I malformation after minor head or neck trauma

CH Tator (Toronto), M Wan (London), H Nomura (Fukuoka)*

Background: Many individuals with Chiari I malformation do not become symptomatic until adulthood, and factors contributing to the onset of symptoms are not well characterized. The purpose of this systematic chart review was to determine the incidence and validity of minor head or neck trauma as precipitating factors for the onset of symptomatic Chiari I malformation. *Methods:* The charts of all patients seen by the senior author from 1990-2006 were reviewed to identify patients presenting with symptomatic Chiari I malformation following minor head or neck trauma. Specific inclusion criteria were used to determine if the onset of symptoms could be reliably attributed to the minor trauma. *Results:* Of 85 patients with symptomatic Chiari I malformation seen by the senior author during this time, 11 (12.9%) had a history of minor head or neck trauma preceding the onset of symptoms, and three (3.5%) had onset of symptoms attributable to the trauma based on strict inclusion criteria. *Conclusions:* Minor head or neck trauma can precipitate the onset of symptoms in a small number of previously asymptomatic patients with Chiari I malformation. Neurological symptoms that persist or worsen following minor head or neck trauma could indicate an underlying Chiari I malformation.

P-237

Child restraint devices in Canadian taxicab vehicles

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Background: Traumatic brain injury (TBI) is the major cause of pediatric morbidity and mortality from motor vehicle collisions. Childhood TBI can be reduced by the proper use of child restraint

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devices (CRD) in cars. Little information exists on the availability of CRD in taxicabs. Taxicabs, being regulated as public transportation, are not required to have CRD. The objectives of this project were to determine if Canadian taxicab companies provide appropriate and timely access to CRD in their vehicles. *Method:* The study was a cross-sectional survey of 38 taxicab companies proportionally sampled from large Canadian cites. Two parallel surveys, a telephone questionnaire and a mail-out survey, examined issues related to CRD availability. *Results:* From the mail survey 16 responses were obtained. Of these companies 13 do not provide CRD under any circumstances. The most common reason being that the government does not require CRD in taxicabs. The telephone survey reflected similar results with 34/38 companies not providing CRD and in 66% of the cases the reason was lack of government regulation. Other responses included inconvenience, cost, lack of demand and storage. In both surveys every company said that they would accommodate caregiver provided CRD. *Conclusions:* Canadian taxicab companies rarely provide CRD in their vehicles. This project has led to the development of a regional program to enhance the availability of CRD in taxicabs, in an effort to prevent TBI in Canadian children.

P-239

Traumatic head injury

M Mrazik (Edmonton), D Louw (Edmonton)*

Background: Each year in the workplace, head trauma constitutes a significant proportion of total injuries. Last year in Alberta, more than 3000 head injuries were reported. Epidemiological data capturing the mechanism of injury and outcomes are not well known. *Methods:* During a 1 year period, 106 traumatic cases of traumatic head injury were reviewed at an outpatient rehabilitation center. Epidemiological data was collected considering the mechanism of injury, severity of injury, duration of PTA, and whether a helmet was being used by the injured subject. *Results:* Being struck by a falling object constituted 39% of injuries, falls (34.9%), and involvement in a motor-vehicle accident (18.9) represented other common mechanisms of injuries. While most injuries were mild, (17%) were classified as severe head trauma and led to more catastrophic outcomes. In a majority of cases (74.5%) helmets were not worn by workers. *Conclusions:* Traumatic head injuries occur relatively frequently in the workplace leading to disruption in the occupational functioning of survivors. Many injuries appear preventable. Use of safety helmets in the workplace is surprisingly low. Advocating for increased helmet use with improved design of helmets could potentially have a significant effect on reducing head injury in the workplace.

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Development of an outcome prediction tool for severe pediatric head injury

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Background: Traumatic brain injury (TBI) is the most common cause of serious morbidity and mortality in children. The ability to provide an accurate prognosis for these children would be useful to the family and clinician. An appropriate mathematical model based on clinical and radiological data can predict an outcome of interest. Proposed predictors are age, Glasgow Coma Scale score (GCS), Abbreviated Injury Scale score (AIS), Injury Severity Score (ISS) and systolic blood pressure (SBP). *Methods:* The CHEO TBI database was analyzed. Binary outcomes of interest were: "good", Glasgow Outcome Scale (GOS) 3-5 and "poor", 1-2. A series of univariate logistic regressions were performed to ascertain significance of the individual predictors. A series of leave-one-out multinomial logistic regressions were then performed to assess overall prediction accuracy. *Results:* 183 cases were identified in the database. GOS scores were available for 119 (65%) patients. Known "good" outcomes were 68 (57%) and known "poor" outcomes were 50 (42%). Significant individual predictors were GCS scores ($p<0.0001$), SBP ($p<0.01$), AIS ($p<0.0001$) and ISS ($p<0.01$). Leave-one-out logistic regression based classifier was able to predict "good" outcomes with sensitivity - specificity of 85 - 80 percent. *Conclusions:* A mathematical model can be developed capable of outcome prediction in pediatric TBI.

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43rd Annual Congress of the Canadian Neurological Sciences Federation PROGRAM *(subject to change)*

Monday, June 16, 2008

11:00-12:00 CNSF Audit Committee Meeting
11:00-12:00 CNSF Committee Meeting - Governance
12:30-15:30 CNSF Committee Meeting - Planning & Reporting
15:30-16:30 NSFC Board Meeting
16:30-17:30 CNSF Board Meeting
17:30-18:30 CACN Council Meeting
17:30-19:00 CAN/CNSF 2010 Meeting

Tuesday, June 17, 2008

07:00-07:45 Resident's Breakfast
08:30-17:00 **Neurobiology Review Course**
08:30-17:00 **ALS**
08:30-17:00 **Child Neurology Day**
09:00-11:00 CNSF Professional Development Committee Meeting
10:00-12:00 CNSF Scientific Program Committee Meeting
12:00-13:00 Lunch
12:00-13:00 CSCN EMG Section Committee Meeting
12:00-13:30 Neurology Residents Meeting
12:30-16:30 CNS Education & Manpower, Royal College Specialty Committee (not confirmed)
13:00-14:00 CSCN EEG Section Committee Meeting
13:00-14:00 Journal Editorial Board Meeting
14:00-15:00 Journal Publications Committee Meeting
16:30-18:00 CSCN Council Meeting
16:30-18:00 CNSS Council Meeting
16:30-17:30 Neurosurgery Residents Business Meeting
17:00-18:00 CACN AGM
18:00-20:00 Neuromuscular SIG Meeting
18:00-20:00 **Epilepsy Video Session**
18:00-20:00 **Movement Disorders Course**

Wednesday, June 18, 2008

07:30-08:30 Canadian League Against Epilepsy - AGM
07:30-08:30 AETC Meeting
08:30-10:30 **Grand Opening Plenary - Scientific and Technical Advances in the Clinical Neurosciences**
10:30-10:45 Break
10:45-12:15 **Chair's Select Plenary Presentations**
12:30-14:00 **Stroke Satellite (Boehringer Ingelheim)** ***Co-developed***
12:30-14:00 **Neuropathic Pain Satellite (Pfizer Canada)** ***Co-developed***
14:00-17:30 **Cerebrovascular Surgery Course**
14:00-17:30 **Spine Course**
14:00-17:30 **Neuroradiology Course**
14:00-17:30 **Stroke Course**
14:00-17:30 **Epilepsy Course**
14:00-17:30 **Neurocritical Care Course**
17:30+++ Exhibitors Reception

Thursday, June 19, 2008

07:00-08:30 Canadian Board of Registration of EEG Technologists Meeting
07:30-08:30 CNSF Affiliate Societies Meeting
07:30-08:30 CNS Council Meeting
08:30-10:00 **Plenary-CNS, CACN & CSCN Neurology**
08:30-10:00 **Plenary-CNSS Neurosurgery**
10:00-10:15 Break
10:15-12:30 **Platform Sessions (7 simultaneous)**
12:00-13:00 Canadian Neuromuscular Group Meeting
12:30-13:30 Canadian Neurocritical Care Group
12:30-13:30 Canadian Neurological Society Foundation Board Meeting
12:30-14:00 Lunch / Exhibit Viewing / Digital Poster Tours
13:00-14:00 Canadian Paediatric Neurosurgical Study Group
14:00-16:30 **Platform Sessions (7 simultaneous)**
16:30-17:30 Exhibit and Digital Poster Viewing
17:00-18:00 Canadian Neurological Society AGM
17:30-19:00 Presidents' Reception

Friday, June 20, 2008

07:30-08:30 CSCN AGM
07:30-08:30 CNSS AGM
08:30-09:30 **Distinguished Guest Lecture**
09:30-10:30 Canadian Brain & Nerve Health Coalition
10:00-11:30 Canadian Pediatric Neuromuscular Research Group
09:50-10:15 Break/Exhibit and Digital Poster Viewing
10:15-12:00 **Grand Rounds**
12:00-13:30 Lunch / Exhibit Viewing / Digital Poster Tours
12:00-13:00 Canadian Neuromuscular Group Meeting
12:00-13:15 Canadian Headache Society AGM
12:00-13:30 Royal College Committee Neurosurgery (not confirmed)
13:30-17:00 **Headache Course**
13:30-17:00 **What's New in Neurosurgery? Course**
13:30-17:00 **EEG Course**
13:30-17:00 **Medical Legal Symposium**
13:30-17:00 **Dementia Course**
13:30-17:00 **What's New in Neurology? Course**
13:30-17:00 **Neuromuscular Course**
17:00-18:00 CNSF Board Meeting
17:00-22:00 Canadian Headache Society Guidelines Meeting

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