P.081

Trends in entry to RCPSC neurosurgery residency training through the CaRMS match since loss of eligibility for ABNS certification

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Background: After July 16, 1997, Royal College of Physicians and Surgeons of Canada (RCPSC) trainees in neurosurgery were no longer eligible for American Board of Neurological Surgeons (ABNS) certification. It was anticipated that this would lead to an influx of neurosurgeons in Canada. *Methods:* We analyzed historical Canadian Residency Matching Service (CaRMS) data for 1997–2014 for trends in neurosurgery residency positions offered, vacancy rates, resident demographics and other pertinent data. *Results:* A mean of 0.94% of medical students applied to neurosurgery as their first choice (range: 0.54%-1.79%). Comparing 2 consecutive time periods (1997–2005 vs. 2006–2014), the mean number of neurosurgery entry positions per year increased from 14 to 19, while mean applicant numbers increased from 24 to 28, respectively. Ninety-five percent of those accepted into neurosurgery ranked it as their first choice discipline and few candidates who ranked neurosurgery highest were unmatched. Women applying to neurosurgery as their first choice discipline were equally likely to match as men (84% vs. 85%) and comprised 28% of neurosurgery residents selected since 2008 (vs. 14% in 1997–2007). *Conclusions:* The number of neurosurgery CaRMS positions and applicants have increased since 1997. This will have implications for neurosurgical workforce planning and physician employment in Canada.

P.082

Subjective anxiety ratings before and after stressful neurosurgical virtual reality tumor resection task

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Background: The availability of virtual reality (VR) surgical simulators affords the opportunity to assess the influence of stress on neurosurgical operative performance in a controlled laboratory environment. This study sought to examine the effect of a stressful VR neurosurgical task on the subjective anxiety ratings of participants with varying levels of surgical expertise. *Methods:* Twenty four participants comprised of six staff neurosurgeons, six senior neurosurgical residents (PGY4-6), six junior neurosurgical residents (PGY1-3), and six senior medical students took part in a bimanual VR tumor removal task with a component of sudden uncontrollable intra-operative bleeding. State Trait Anxiety Inventory (STAI) questionnaires were completed immediately pre and post the stress stimulus. The STAI questionnaire consisted of six items (calm, tense, upset, relaxed, content and worried) measured on a Likert scale. *Results:* Significant increases in subjective anxiety ratings were noted in junior residents ($p = 0.005$) and medical students ($p = 0.025$) while no significant changes were observed for staff and senior neurosurgical residents. *Conclusions:* Staff and senior residents more effectively mitigate stress compared to junior colleagues in a VR operative environment. Further physiological correlates are needed to determine whether this increased anxiety is paralleled by physiological arousal and altered surgical performance.

P.083

Acute stress decreases bimanual psychomotor performance during resection of simulated brain tumors

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Background: Objective methods to assess the influence of significant stress on neurosurgical bimanual psychomotor performance have not been developed. We utilized NeuroTouch, a virtual reality simulator, to answer two questions: 1) What is the impact of significant stress on bimanual psychomotor performance during the resection of a simulated tumor? 2) Does stress influence performance immediately following the stressful episode? *Methods:* Uncontrollable 'intraoperative' bleeding during one of the tumor resections resulting in simulated patient cardiac arrest served as the acute stressor. Six neurosurgeons, 6 senior and 6 junior neurosurgical residents and 6 senior medical students were studied. The evaluated advanced tier 2 metrics were efficiency index, ultrasonic aspirator path length index, suction coordination index and ultrasonic aspirator bimanual forces ratio. *Results:* The stress scenario significantly decreased the efficiency index of all groups and significantly decreased performance for many groups for suction coordination index and ultrasonic aspirator path length index. Performance in all advanced tier 2 metrics returned to pre-stress levels in post stress resection scenarios. *Conclusions:* Our results are consistent with the concept that acute stress initiated by severe intraoperative bleeding significantly decreases bimanual psychomotor performance during the acute episode but had no significant influence on immediate post stress operative performance.

P.085

A cadaveric study in endoscopic 3D visualization of posterior fossa neurovascular complexes

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Background: The use of 3D endoscopy for posterior fossa surgery gradually adopted. In this study we compare the 3D to classic 2D endoscopy in evaluating neurovascular complexes in posterior fossa. *Methods:* Twenty retrosigmoid craniotomies, with a maximal diameter of 2cm were performed under neuronavigation on 10 fresh cadaveric heads. The posterior fossa dura matter was opened with a C-shaped incision and the base of the dural flap was placed over the sigmoid sinus. We used 3D and 2D endoscopes, with 0 and 45 degree angulations, connected to high definition camera lenses for optimal

visualization of posterior fossa structures. *Results:* The superior, middle and inferior neurovascular complexes of the cerebellopontine angle were better visualized with 3D comparing to 2D endoscope. A detailed view of the porus trigeminous and structures associated with the tentorial incisura was also attained with 3D endoscopy. *Conclusion:* The high quality and resolution obtained by 3D endoscopy makes it a potentially valuable surgical and teaching tool in the armamentarium for endoscopic posterior fossa surgery. The stereoscopic view of the critical neurovascular structures of the posterior fossa, offered by 3D images, allows for a more detailed dissection in the difficult area of the cerebellopontine angle.

P.086

Importance of ventricle-to-brain ratio (VBR) and volume of CSF drainage in the treatment of very low pressure hydrocephalus

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Introduction: Low pressure hydrocephalus is a known complication of prolonged hydrocephalus sometimes treatable with continued low-pressure drainage at subatmospheric pressures. Clarke et. al. and Filipidis et. al. have reported poor outcomes when treating very low pressure hydrocephalus (VLPH). We present 4 cases of very low pressure hydrocephalus (VLPH) following transnasal endoscopic resection of suprasellar lesions and hypothesize that poor prognostic cases can be identified thereby avoiding prolonged futile treatments. *Methods:* We performed a retrospective chart review of 4 cases of VLPH and tried to identify metrics contributing to successful treatment. We examined the Pearson correlations between Glasgow Coma Scale and ventricle-to-brain ratio (VBR); volume of CSF drained; net fluids; and serum sodium, urea, and creatinine. *Results:* Our investigation reveals that Glasgow Coma Score is positively correlated with increased CSF drainage and negatively correlated with increased ventricle-to-brain ratio. The most important determinant of good outcome is brain compliance as measured by the brain's ability to maintain a good GCS score in the face of wide ranges in ventricle-to-brain ratio (VBR). *Conclusion:* We propose that futile prolonged subatmospheric drainage be avoided by declining treatment in patients who have ventriculitis and patients who have a narrow range of ventricle-to-brain ratio (VBR) concurrent with a good neurological examination.

P.087

Tele-assistance during neurosurgical education: Remote Education, Augmented Communication, Training and Supervision (REACTS)

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Introduction: Tele-medicine has gained in popularity worldwide, particularly to help offer medical expertise, healthcare delivery and education to developing nations. There is little literature reporting the implementation or analysis of tele-assitance in the setting of surgical education. We have implemented a tele-assistance system, called Remote Education, Augmented Communication, Training and Supervision (REACTS), as a tool to augment mentor-student education in the operating room. This system allows the mentor to observe the student during surgery remotely through screen sharing technology with integrated visual and audio interaction. The goal of this study is to assess the safety and the benefit of REACTS as an educational tool. *Methods:* Prospective observational study to evaluate the safety and qualitative benefit of REACTS. *Results:* REACTS was used in 20 cases, including 5 placement of EVDs, 5 pterional craniotomies, 5 Sylvian fissures dissection, 5 lumbar discectomies, and 5 lumbar spine decompressions. No untoward or adverse events were observed. It was judged to be a positive influence on resident and fellow education by the mentors. The main pitfall in its use is to appropriately select the learner for a given procedure. *Conclusion:* REACTS surgical system is a safe, and a useful adjunct tool for neurosurgical operative education.

P.088

Management of inadvertent injury to superior sagittal sinus in parasagittal meningioma: technical note

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Background: Parasagittal meningioma is a common type of intracranial meningiomas. Surgical resection of such lesions can result in injury to superior sagittal sinus. In rare occasions, extended craniotomy might be required for uncontrollable hemorrhage from a lacerated venous wall. *Objective:* In order to avoid extended craniotomy, we attempted a surgical technique that would provide more sustained control over the lacerated venous sinus. *Method:* A 56 year old lady underwent surgical resection for parasagittal meningioma. The lateral wall of the superior sagittal sinus was preached while scraping the tumor capsule from the sinus wall. Owing to difficulty in controlling the bleeding site, a tack up falx-assisted tension suture was attempted with a mass of Gelfoam and Surgicel over the laceration. *Results:* Adequate control for the venous sinus laceration. *Conclusion:* The falx-assisted suturing technique is quick, easy to perform and efficient in maintaining a constant tamponade effect over the lacerated site. We highly recommend such technique prior to extending the craniotomy over an injured venous sinus.

Neurosurgery (Neuro Interventional)

P.089

Is Digital Subtraction Angiography (DSA) necessary for Computed Tomography Angiography (CTA) negative subarachnoid hemorrhage (SAH) patients' management?

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Purpose: CTA is becoming the frontline modality to reveal aneurysms in patients with SAH. However, in about 20% of SAH patients no aneurysm is found. In these cases, intra-arterial DSA is still performed. Our aim was to evaluate whether negative findings