CANADIAN NEUROLOGICAL SCIENCES FEDERATION
FÉDÉRATION DES SCIENCES NEUROLOGIQUES DU CANADA

The journal

Canadian Journal of Neurological Sciences

Volume 39 Number 3 (Supplement 3) May 2012

# 47th Annual Congress of the Canadian Neurological Sciences Federation

*Ottawa, Ontario, Canada*

# 47e congrès annuel de la Fédération des sciences neurologiques du Canada

# ABSTRACTS / RÉSUMÉS

Ottawa 2012

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# 47th Annual Congress of the

## *Canadian Neurological Sciences Federation*

## OTTAWA • ONTARIO • JUNE 5-8, 2012



**Canadian Neurological Sciences Federation**
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# ABSTRACTS AND PROGRAM

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# The journal

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# 47th Annual Congress of the

## *Canadian Neurological Sciences Federation*

**OTTAWA, ON JUNE 5-8, 2012**

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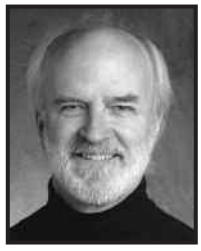

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# 2012 Society Prize Papers

## Andre Barbeau Memorial Prize

### Canadian Neurological Society

**Evaluating risky decisions: the Vancouver gambling test and patients with PD**

*ME Sharp (Vancouver)* J Viswanathan (Vancouver) LJ Lanyon (Vancouver) A Stoessl (Vancouver) S Appel Cresswell (Vancouver) MJ McKeown (Vancouver) JJ Barton (Vancouver)*

*Background:* Unmedicated Parkinson's patients tend to be risk-averse while those with impulse control disorders are risk-seeking. Prospect theory suggests that two important determinants of risk behaviour are how subjects perceive the magnitude and probability of outcomes. However clinical tests that explicitly reveal how subjects weight magnitude and probability are are lacking. *Goal:* In Part 1 we designed the Vancouver Gambling Test, which assesses how subjects integrate reward magnitude and probability to determine value in decision-making. In Part 2 we applied this test to Parkinson's patients off and on dopaminergic medication. *Methods:* In Part 1 twenty healthy subjects chose between two prospects of varying values, one with higher probability, the other with larger reward. In Part 2 we applied this and a version testing potential losses rather than gains to eighteen PD patients before and after levodopa, and eighteen controls. *Results:* In Part 1 healthy subjects were risk-averse for gains. Modeling with prospect theory confirmed this bias was predicted by non-linearities in subjective perception of reward and probability. In Part 2 Parkinson's patients were no different than controls when evaluating potential gain; however, unmedicated, they were slightly more likely to avoid large losses: our model suggested that this was likely due to subjective overestimation of loss magnitude. *Conclusions:* While unmedicated patients show risk-aversion for losses, medicated patients have normal perception of magnitude and probability.

## Francis McNaughton Memorial Prize

### Canadian Neurological Society

**Adult-onset spinocerebellar ataxia syndromes due to MTATP6 mutations**

*G Pfeffer (Vancouver)* EL Blakely (Newcastle) CL Alston (Newcastle) A Hassani (Newcastle) M Boggild (Liverpool) R Horvath (Newcastle) DC Samuels (Nashville) RW Taylor (Newcastle) PF Chinnery (Newcastle)*

*Background:* Spinocerebellar ataxia syndromes presenting in adulthood have a broad range of causes, and despite extensive investigation may remain undiagnosed in up to one half of cases. Mutations in the mitochondrially-encoded MTATP6 gene typically cause infantile-onset Leigh syndrome, but occasionally have onset later in childhood. We report two families with onset of ataxia in adulthood, who are clinically indistinguishable from spinocerebellar ataxia patients. *Methods:* Genetic screening study of 64 pedigrees with unexplained ataxia, and case series of two families who had MTATP6 mutations. *Results:* Three pedigrees had mutations in MTATP6, two of which have not been reported previously and are detailed in this report. These families respectively had the m.9185T>C and m.9035T>C mutations, which have not been previously reported to cause adult-onset cerebellar syndromes. Other investigations including muscle biopsy and respiratory chain enzyme activity were nonspecific or normal. *Conclusions:* This report expands the phenotypic spectrum of mutations of the MTATP6 gene. We suggest that MTATP6 sequencing be considered in the workup of undiagnosed ataxia even if other investigations do not suggest a mitochondrial DNA disorder.

## K.G. McKenzie Prize in Basic Neuroscience Research

### Canadian Neurosurgical Society

**SKP-SCs improve remylination within a model of adriamycin induced tibial nerve demyelination**

*J Grochmal (Calgary)* S Dhaliwal (Calgary) R Midha (Calgary)*

*Introduction:* Skin derived precursor cells (SKPs) can mimic the phenotypic appearance of Schwann cells when predifferentiated in vitro (SKP-SCs). Our hypothesis is that SKP-SCs can produce morphologically and electrophysiologically functional myelin as they ensheath axons. *Methods:* We unilaterally injected 500,000 DiI positive, GFP producing SKP-SCs into the tibial nerves of 10 adult Lewis rats, while the contralateral tibial nerve received media injection. This was done one week after a demyelinating bilateral tibial nerve lesion was created using a 30ul injection of 12.5ug/ml Adriamycin[1]. All animals were followed for compound motor action potentials (CMAPs) every three days. A parallel series of animals also included a cohort that received GFP labeled Schwann cells. These animals were analyzed for EPON morphometry, teased fibre immunohistochemistry (NaV1.6), as well as confocal axial imaging. *Results:* The cohort of animals that were followed until day 60 demonstrated no significant difference between their respective return to electrophysiological normalcy. At Day 33, however, SKP-SCs promoted a lower G-ratio when analyzed against either media or Schwann cell injection in this model. Confocal analysis revealed morphologically mature SKP-SC myelination. *Conclusions:* SKP-SCs graft can improve tibial nerve remyelination in this injury model. One plausible mechanism is the direct, compact myelination of axons by SKP-SCs.

**Reference**

1. England JD, Rhee EK, Said G, Sumner AJ: Schwann cell degeneration induced by doxorubicin (adriamycin). Brain. 111: 901-13, 1988.



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# K.G. McKenzie Prize in Clinical Neuroscience Research

## Canadian Neurosurgical Society

**A clinical prediction model for functional outcome after traumatic spinal cord injury**

*JR Wilson (Toronto)* A Kulkarni (Toronto) AM Davis (Toronto) A Kiss (Toronto) RG Grossman (Houston) MG Fehlings (Toronto)*

*Background:* To improve prognostication after spinal cord injury (SCI) and to help classify patients within clinical trials, we created a prediction model relating acute factors to long-term functional outcome. *Methods:* Data were obtained from two prospective datasets. The primary outcome was Functional Independence Measure (FIM) motor score at 1-year follow-up. Predictor variables were obtained within 3 days of injury and included: 1) ASIA grade; 2) neurological level; 3) age; 4) MRI intra-medullary signal characteristics. These predictors were chosen based on expert opinion and literature support. A linear regression model was created and validated using bootstrap re-sampling, with performance judged by R-squared values. FIM-motor score was then dichotomized and logistic modeling was used to classify patients achieving functional independence (score ≥6 for all FIM-motor items). Model discrimination was judged by the area under receiver operator curves (AUC). *Results:* Of 729 patients, 376 met the inclusion/exclusion criteria. The mean FIM-motor score at 1-year was 62.9 (±28.6). The linear model demonstrated an R-square of 0.54 in the original dataset and 0.53 across the 200 bootstraps, with mean parameter estimates for each covariate across the bootstraps closely approximating estimates from the original dataset. Functional independence was achieved by 148 patients (39.4%). For the logistic model, the AUC was 0.92, indicating excellent predictive discrimination. *Conclusion:* We anticipate that this model will have important impact to guide decision making and for counseling patients and families.

# The President's Prize

## Canadian Association of Child Neurology

**Does the absence of an abnormal imaging study define a specific cerebral palsy subtype?**

*R Benini (Montreal)* L Dagenais (Montreal) M Shevell (Montreal)*

Up to 32% of cerebral palsy children may have normal/non-specific neuroimaging findings. This study sought to identify clinical factors to differentiate between CP patients with normal/non-specific versus abnormal imaging. Using a population-based registry (REPACQ), various antenatal, perinatal and postnatal predictor variables were compared in CP patients with normal/non-specific versus abnormal findings on Magnetic Resonance Imaging. Out of 126 patients with MRI available, 90 patients (71%) had abnormal imaging whereas 36 patients (29%) had normal/nonspecific findings. Compared to other CP variants, normal/non-specific imaging was more prevalent ($p=0.001$) in dyskinetic CP (72.7%, 8/11 patients) and less likely ($p=0.002$) in spastic hemiplegic CP (10%, 4/40 patients). No significant differences ($p>0.05$) in the prevalence of perinatal or postnatal clinical features nor clinical outcomes were identified. 42% of CP children with normal/non-specific neuroimaging exhibited a high level of functional disability (GMFCS IV-V) versus 33% with abnormal imaging. Apart from confirming that normal/non-specific imaging is more prevalent in dyskinetic CP, no clinical features were identified to differentiate these patients from those with abnormal imaging. Perhaps more refined imaging techniques are needed to evaluate patients with normal/non-specific findings. Alternatively, genetic or functional, rather than gross structural lesions, may underlie the pathophysiology of CP in this cohort. Finally, the high proportion of functional disability underlines the importance of continuous follow-up even in the absence of abnormal imaging.

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# Platform Presentations

## CNS / CSCN Chair's Select Plenary Presentations

### A.01

**Discontinuation of antiepileptic drugs after successful epilepsy surgery: the Canadian perspective**

*JF Tellez-Zenteno (Saskatoon)* L Hernandez-Ronquillo (Saskatoon) N Jette (Calgary) J Burneo (London) D Nguyen (Montreal) E Donner (Toronto) M Sadler (Halifax) M Javidan (Vancouver) D Gross (Edmonton) S Wiebe (Calgary)*

*Purpose:* To identify the perceived practice among Canadian epileptologists regarding discontinuation of AEDs following successful resective surgery. *Methods:* We performed a survey of pediatric and adult epileptologists in Canada, using a 77-item questionnaire to explore attitudes, timing, rate of withdrawal, and factors contributing to the decision to withdraw AEDs after successful epilepsy surgery. Surveys were mailed with a postage-paid return envelope. Two subsequent surveys were mailed to non-respondents at 1-month intervals. *Results:* Surveys were sent to 82 epileptologists. Sixty six physicians answered the survey (80.5%). The minimum seizure free period required after epilepsy surgery before withdrawing AEDs, varied among responders: >6 months in 10%, 6-11 months in 21%, >1 year in 50%, >2 years in 12%, >2 years in 3% after. The most important factors influencing the decision to withdraw AEDs were the patients' preferences (78%) and the presence of unilateral mesial temporal sclerosis (70%). The most important factors against reduction were patients' wishes to resume driving (67%), focal (65%) (78%) epileptiform activity in the EEG after surgery, persistent auras (78%) and any seizures after discharge (81%) *Conclusion:* Canadian epileptologists indicated that AED levels, EEG and MRI are typically done before discontinuing AEDs. Generally, a good candidate for stopping AEDs has focal pathology, is completely seizure free, has anterior temporal lobe resection, and has no epileptiform discharges in the postoperative EEG.

### A.02

**Halting the progression of parkinsonian neurodegeneration by nano-micellar formulation of CoQ10 and PTS**

*S Pandey (Windsor)* K Facecchia (Windsor) K Muthukumaran (Windsor) A Lframboise (Windsor) JK Sandhu (Ottawa) M Sikorska (Ottawa) J Smith (Windsor) K Harrison (Windsor) D Lopatin (Windsor) J Cohen (Windsor) S Weinstock (Hasbrouck Heights,) C Keshen (Windsor) H Miller (Ottawa) M Beyers (Ottawa) P Lathier (Ottawa) H Desai (Windsor)*

Oxidative damage to cellular constituents is in the forefront of molecular changes underlying the progressive nature of neurodegeneration. Consequently, an exposure to environmental toxins, known to induce oxidative stress, has been correlated with an increased incidence of PD. Currently there are no effective drugs to treat the progression of neurodegeneration. We have developed a WS-CoQ10 formulation consisting of two components, CoQ10 and PTS (Polyoxyethanyl Tocopheryl Sebacete), and tested its ability to protect neurons. The results of in vitro studies confirmed a high degree of neuroprotection against different forms of neuronal injuries. Prophylactic application of WS-CoQ10 (provided in drinking water) in rodent models of PD revealed a near complete sparing of dopamine neurons from the effects of neurotoxins (MPTP in mice, including DJ1 transgenic, and paraquat in rats). Most importantly, a post-injury delivery of WS-CoQ10 stopped further progression of neurodegeneration in both rodent models of PD. The results of these pre-clinical studies are highly encouraging and suggest that our nano-micellar WS-CoQ10, which is both water and lipid soluble, has improved bioavailability and superior therapeutic efficacy could be used as an adjuvant therapy in the management of PD. It is effective at much lower doses than other forms of CoQ10 currently on the market. It is already FDA GRAS approved and can be produced for testing in human clinical trials.

### A.03

**West Nile virus neuroinvasive disease: the Saskatchewan experience**

*JF Tellez-Zenteno (Saskatoon) G Hunter (Saskatoon) L Hernandez-Ronquillo (Saskatoon) E Haghir (Saskatoon)**

*Background:* West Nile (WN) virus is a virus of the family Flaviviridae. The main route of human infection is through the bite of an infected mosquito. Approximately 90% of West Nile Virus infections in humans are asymptomatic. *Methods:* This study reviews the clinical profile of patients with neuroinvasive WN reported by the Surveillance program of the Saskatoon Health Region (SHR) in 2007. A total of 357 cases were reported. Neuroinvasive disease was defined by positive serology plus CNS symptoms. *Results:* 57 cases met criteria. Mean age was 55 + 15.7. Only 9 patients (16.5%) reported increased outdoor activity before symptoms. The most frequent symptoms were the following: 44 patients (77%) had fever, 35 (61%) shivers, 31 (54%) nausea and 25 (43%) headache. The most frequent neurological manifestations were as follows: meningitis in 23 (40%) patients, confusion 24 (42%), motor weakness 18 (31%), encephalopathy 14 (25%), meningoencephalitis in 11 (19%), post-polio syndrome 10 (18%), tremor in 10 (18%), sensory abnormalities 4 (7%) and opsoclonus, 3 (5%). Three patients died (5%). Findings from CSF, CT and MRI will be discussed. *Conclusion:* During a year of high incidence of disease in Saskatchewan, only 7% of cases developed neuroinvasive West Nile infection, but the consequences can be severe and persistent. Establishing risk factors for neuroinvasive disease will be helpful in developing preventative strategies.



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## A.04

**Evaluating risky decisions: the Vancouver gambling test and patients with PD**

*ME Sharp (Vancouver)* J Viswanathan (Vancouver) LJ Lanyon (Vancouver) A Stoessl (Vancouver) S Appel Cresswell (Vancouver) MJ McKeown (Vancouver) JJ Barton (Vancouver)*

*Background:* Unmedicated Parkinson's patients tend to be risk-averse while those with impulse control disorders are risk-seeking. Prospect theory suggests that two important determinants of risk behaviour are how subjects perceive the magnitude and probability of outcomes. However clinical tests that explicitly reveal how subjects weight magnitude and probability are are lacking. *Goal:* In Part 1 we designed the Vancouver Gambling Test, which assesses how subjects integrate reward magnitude and probability to determine value in decision-making. In Part 2 we applied this test to Parkinson's patients off and on dopaminergic medication. *Methods:* In Part 1 twenty healthy subjects chose between two prospects of varying values, one with higher probability, the other with larger reward. In Part 2 we applied this and a version testing potential losses rather than gains to eighteen PD patients before and after levodopa, and eighteen controls. *Results:* In Part 1 healthy subjects were risk-averse for gains. Modeling with prospect theory confirmed this bias was predicted by non-linearities in subjective perception of reward and probability. In Part 2 Parkinson's patients were no different than controls when evaluating potential gain; however, unmedicated, they were slightly more likely to avoid large losses: our model suggested that this was likely due to subjective overestimation of loss magnitude. *Conclusions:* While unmedicated patients show risk-aversion for losses, medicated patients have normal perception of magnitude and probability.

## A.05

**Evaluation of the accuracy of MR imaging in the clinical diagnosis of patients with amyotrophic lateral sclerosis**

*A Gupta (Ottawa)* P Bourque (Ottawa) S Chakraborty (Ottawa) T Nguyen (Ottawa)*

*Background:* Currently, there is no definite diagnostic test to detect ALS, which leads to considerable delay in the diagnosis. Such a delay precludes early initiation of neuroprotective treatments in clinical trials. Hyperintensity in the corticospinal tracts (CST) on T2-weighted MRI is described however, accuracy of this finding is quite variable. We investigated the presence of CST abnormalities in MR imaging in ALS patients. *Methods:* This a retrospective study performed on 64 ALS patients and 25 control subjects. Two neuroradiologists blinded to the patient's history independently evaluated the MRI. *Results:* The over all sensitivity and specificity of the MRI for the diagnosis was 48% and 76%. Highest specificities were found for abnormal signal in the CST in motor cortex (92%), subcortical white matter (92%) and centrum semiovale (88%) and pyramids (92%). Lowest specificities were found for cerebral peduncle (36%) and internal capsule (32%).There was no correlation found between the MRI positivity and speed of clinical progression. *Conclusion:* Conventional MRI was not found to be a good tool to predict the clinical diagnosis or clinical progression in patients with ALS. The regions that were found to have high specificity were motor cortex, subcortical white matter, and centrum semiovale and pyramids.

## A.06

**Reorganization of memory circuits in temporal lobe epilepsy**

*C Limotai (Toronto)* RS McLachlan (London) S Hayman-Abello (London) B Hayman-Abello (London) S Brown (London) F Bihari (London) SM Mirsattari (London)*

*Background:* Functional MRI (fMRI) was used to study the impact of temporal lobe epilepsy (TLE) and anterior temporal lobectomy (ATL) on the memory circuits in patients with medically refractory TLE. *Methods:* Nineteen patients with medically intractable TLE and 15 healthy control subjects were enrolled in this study. Ten patients underwent left ATL and 9 underwent right ATL. Group analyses of a novelty scene-encoding paradigm comparing areas of blood oxygen-level-dependent (BOLD) signal activation pre- and post-ATL were performed. *Results:* Fifteen, three, and one patient achieved Engel Class I, II, and III surgical outcome, respectively, at the last follow-up of 1 to 6 years after the surgery. Pathology revealed hippocampal sclerosis in 12, gliosis in 5, and benign tumors in 2 patients. Contralateral extra-temporal frontal or parietal lobe signal activation was observed preoperatively in both left TLE and right TLE. When comparing pre- and post-ATL fMRI study in each group, more widespread activation was seen in RTLE. Postoperatively, shifting areas of activation to the ipsilateral temporal lobe was observed in both left ATL and right ATL, but more robust on the right. *Conclusions:* Disturbance of normal memory circuits in TLE and the reorganization after ATL localized to the ipsilateral temporal area was observed.

# CNSS Chair's Select Plenary Presentations

## B.01

**A process benchmarking appraisal of surgical management of patients with acute traumatic cervical spinal cord injury SCI)**

*JC Furlan (Toronto)* MG Fehlings (Toronto)*

*Background:* This process benchmarking appraisal examines the potential barriers and ideal timelines for each step to early surgical decompression following SCI. *Methods:* We collected data from charts and STASCIS forms regarding time and reasons for delay of each step in the management of SCI patients. The reasons for delays were classified into: healthcare-related ("extrinsic") factors and patient-related ("intrinsic") factors. The cases were grouped into patients who underwent early (≤24hours) surgical decompression of spinal cord (Group-1) and later surgery (Group-2). *Results:* While both groups showed comparable time periods related to intrinsic factors, Group-1 had significantly shorter time associated with extrinsic factors than Group-2. Both groups were comparable regarding prehospital time, time in a second general hospital prior to transfer to spine center and time in the emergency department. Group-1 had significantly shorter waiting time, shorter waiting time for assessment by spine surgeon and shorter waiting time for surgical decision. *Conclusions:* Our results indicate that health-related factors are key determinants of the timing from SCI to surgical decompression. Time in the general hospital and time of waiting for surgical decision were the most important causes of



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delays for surgical spinal cord decompression. Early surgery is possible in the majority of the cases.

## B.02

### Randomized trial of clazosentan in patients with aneurysmal subarachnoid hemorrhage undergoing endovascular coiling

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CONSCIOUS-3 assessed the effect of clazosentan in patients with aneurysmal subarachnoid hemorrhage (aSAH) who underwent endovascular coiling. This double-blind, placebo-controlled, phase III trial randomized patients to intravenous clazosentan (5 or 15 mg/h) or placebo. The primary endpoint (all-cause mortality; vasospasm-related new cerebral infarcts; delayed ischemic neurological deficits; rescue therapy for vasospasm) was evaluated 6 weeks after aSAH. The main secondary endpoint was the extended Glasgow Outcome Scale (GOSE; week 12). CONSCIOUS-3 was halted prematurely following completion of CONSCIOUS-2; 571 patients were treated (placebo n=189, clazosentan 5mg/h n=194, clazosentan 15mg/h n=188). The primary endpoint occurred in 50/189 (27%) of placebo compared with 47/194 (24%) of clazosentan 5mg/h (odds ratio [OR]=0.786, 95% confidence interval [CI]=0.479-1.289; P=0.340), and 28/188 (15%) clazosentan 15mg/h (OR=0.474, 95% CI=0.275-0.818; P=0.007). Poor outcome (GOSE score ≤4) occurred in 24% (placebo), 25% (clazosentan 5mg/h; OR=0.918, 95% CI 0.546-1.544; P=0.748), and 28% (clazosentan 15mg/h; OR=1.337, 95% CI 0.802-2.227; P=0.266) of patients. Pulmonary complications, anemia, and hypotension were more common in patients receiving clazosentan. Clazosentan 15mg/h significantly reduced post-aSAH vasospasm-related morbidity/all-cause mortality; however, neither dose improved outcome (GOSE).

## B.03

### Clinical outcome prediction in aneurysmal subarachnoid hemorrhage using advanced biostatistical modelling

*BW Lo (Toronto)* M Levine (Hamilton) RM Pluta (Washington) D Ilodigwe (Toronto) E Pullenayegum (Hamilton) L Thabane (Hamilton) F Farrokhyar (Hamilton) R Macdonald (Toronto)*

*Background:* The goal of this study is to use advanced biostatistical methods to create individualized prognostic decision rules in aneurysmal SAH. *Methods:* The Tirilazad database (3552 patients) was used to create the aSAH prognostic model using Bayesian meta-analysis, linear and Bayesian regression, factor reduction and principal components analyses, artificial neural networks and fuzzy logic decision calculations. *Results:* Bayesian analysis made use of existing knowledge with prior likelihood distributions. Bayesian meta-analysis/hierarchical modelling of observational studies on aSAH prognostic factors (2000-2010) gave generalizable posterior distributions of population mean log odd ratios (ORs). Similar trends were noted in Bayesian and linear regression ORs. Significant outcome predictors ($p < 0.05$) were age, neurological grade, amount of SAH, prior SAH, aneurysmal size, myocardial infarction, fever, cerebral infarction, and neurological worsening after treatment. Factor reduction and principal component analyses showed interrelationships between variables, with cluster and path diagrams. Artificial neural networks found non-linear relationships with 10 hidden variables in 1 layer. Fuzzy logic decision rules (centroid defuzzification technique) denoted cut-off points for poor prognosis at greater than 2.5 clusters. Bayesian posterior likelihoods confirmed fuzzy logic rules. *Discussion:* This individualized aSAH prognostic system makes use of existing knowledge, recognizes unknown areas, incorporates one's clinical intuition and compensates for uncertainty in prognostication.

## B.04

### SKP-SCs improve remylination within a model of adriamycin induced tibial nerve demyelination

*J Grochmal (Calgary)* S Dhaliwal (Calgary) R Midha (Calgary)*

*Introduction:* Skin derived precursor cells (SKPs) can mimic the phenotypic appearance of Schwann cells when predifferentiated in vitro (SKP-SCs). Our hypothesis is that SKP-SCs can produce morphologically and electrophysiologically functional myelin as they ensheath axons. *Methods:* We unilaterally injected 500,000 DiI positive, GFP producing SKP-SCs into the tibial nerves of 10 adult Lewis rats, while the contralateral tibial nerve received media injection. This was done one week after a demyelinating bilateral tibial nerve lesion was created using a 30ul injection of 12.5ug/ml Adriamycin[1]. All animals were followed for compound motor action potentials (CMAPs) every three days. A parallel series of animals also included a cohort that received GFP labeled Schwann cells. These animals were analyzed for EPON morphometry, teased fibre immunohistochemistry (NaV1.6), as well as confocal axial imaging. *Results:* The cohort of animals that were followed until day 60 demonstrated no significant difference between their respective return to electrophysiological normalcy. At Day 33, however, SKP-SCs promoted a lower G-ratio when analyzed against either media or Schwann cell injection in this model. Confocal analysis revealed morphologically mature SKP-SC myelination. *Conclusions:* SKP-SCs graft can improve tibial nerve remyelination in this injury model. One plausible mechanism is the direct, compact myelination of axons by SKP-SCs.

**Reference**

1. England JD, Rhee EK, Said G, Sumner AJ: Schwann cell degeneration induced by doxorubicin (adriamycin). Brain. 111: 901-13, 1988.

## B.05

### Blunt cerebrovascular injury and the utililty of a screening protocol with computed tomographic angiography

*MK Tso (Calgary)* M Lee (Calgary) P Dolati (Calgary) C Tiruta (Calgary) C Ball (Calgary) W Morrish (Calgary) A Mitha (Calgary) A Kirkpatrick (Calgary) J Wong (Calgary)*

*Background:* Blunt cerebrovascular injury (BCVI) is characterized by dissection of the cerebrovascular vessels after blunt trauma. Early detection of BCVI may prevent stroke. This study investigates the utility of a consensus-based BCVI screening protocol with CTA at a single level-one trauma centre. *Methods:* Trauma patients from 2002 to 2008 were identified using a prospective registry containing trauma patients with an injury severity score (ISS) of at least 12, and



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screened for BCVI over two 3-year epochs (before and after the screening CTA protocol implementation in 2005. BCVI detection and stroke rates were compared before and after protocol implementation using the Fisher exact test. *Results:* Out of 5342 trauma patients, 47 (0.9%) had cerebrovascular dissections. The detection rate of BCVI before and after protocol implementation was 18% (23/129) and 10% (24/245) respectively (p=0.03). Prior to protocol implementation, 57% of BCVI patients (13/23) suffered an ischemic stroke. Eight of these 13 patients had clinical symptoms of ischemic stroke prior to the time of vascular imaging. After protocol implementation, the stroke rate was lower at 29% (7/24, p=0.08). All seven of these latter patients had met screening CTA criteria but three did not actually undergo CTA until later prompted by clinical symptoms. *Conclusions:* A CTA screening protocol for BCVI was effective in detecting early cerebrovascular dissections and was associated with reduction in ischemic stroke rates.

## B.06

### Quantitative MRI detects the impact of minocycline in acute spinal cord injury

*Zhang, Yunyan RJ Hurlbert (Calgary)* VW Yong (Calgary) S Casha (Calgary)*

*Introduction:* The impact of acute spinal cord injury (SCI) remains catastrophic. However, there is no treatment proven to significantly reduce disability following this devastating condition. Minocycline has been shown to reduce injury bulk and improve functional outcomes in mice subjected to SCI. The purpose here was to assess treatment impact of minocycline using quantitative MRI in a pilot, placebo-controlled and randomized trial of human SCI. *Methods:* Fifty-two patients were randomized within 12 hours of injury to either intraveneous minocycline or placebo, twice daily for 1 week. MRI was performed within 24 hours of injury (Day 1), and at Days 7, 28 and 365 after injury. Maximum canal compromise (MCC) and maximum spinal cord compression (MSCC) were quantified at injury epicenter, where the length and area of T2 hyperintensity were computed. Neurological outcomes were evaluated simultaneously. *Results:* Fifty patients were followed by MRI (25 were treated with minocycline); 31 had sequential MRI (20 with minocycline). The minocycline group tended to have less MSCC indicating less cord expansion, and smaller T2 lesion length and area than the placebo group (p>0.05). This is more evident in the motor complete and cervical only subgroups. *Discussions:* Favorable MRI outcomes were consistent with the clinical benefits of minocycline. It may indicate that quantitative MRI is useful to evaluate treatment impact in acute SCI.

# CACN Chair's Select Plenary Presentations

## C.01

### Beneficial functional outcomes of selective dorsal rhizotomy (SDR) are long lasting and alter the natural history of motor development in spastic cerebral palsy

*RW Dudley (Montreal)* M Parolin (Montreal) RS Saluja (Montreal) R Yap (Montreal) K Montpetit (Montreal) J Ruck (Montreal) C Poulin (Montreal) M Cantin (Montreal) TE Benaroch (Montreal) J Farmer (Montreal)*

Natural history studies of gross motor development in spastic cerebral palsy (CP) indicate that many children decline through adolescence. Randomized control trials have revealed the early functional benefits of selective dorsal rhizotomy (SPR) for spastic CP, but no study has reported long-term outcomes on large numbers of patients. Thus, the impact of SDR on the natural history of CP remains unresolved. We analyzed long-term follow-up data to assess the durability of functional outcomes after SDR. Children were evaluated by a multidisciplinary team preoperatively and at 1, 5, 10, and 15 years postoperatively using standardized assessments of spasticity, gross motor function, and activities of daily living (ADLs). Of 102 patients that had formal preoperative evaluations more than ten years earlier, 97, 62, 57, and 14 patients completed formal postoperative assessments at 1, 5, 10, and 15 years, respectively. We found statistically significant durable improvements in spasticity, Gross Motor Function Measure (GMFM), and ADLs by the Pediatric Evaluation of Disability Inventory (PEDI). When children were stratified according to severity by the Gross Motor Function Classification System (GMFCS) we found long-lasting improvements through adolescence for GMFCS Groups I, II, and III, which differs from previously reported natural history curves for untreated patients. We conclude that the benefits of SDR are long-lasting and positively alter the natural history of spastic CP.

## C.02

### 900 consults later: a 1-year audit of neurology consults at an academic paediatric hospital

*C Boelman (Toronto)* S Weiss (Toronto)*

*Objective:* To determine both the basis of neurology consultations and their impact in an academic paediatric hospital setting. *Methods:* Neurology consultation reports were collected prospectively over 12 months (January-December, 2010). Data collected and analyzed included: date, unit & reason for consultation, basic patient demographics, prior neurologic investigations and subsequent initial neurology recommendations for acute investigations & treatment. *Results:* A total of 918 consultations were completed, with a median of 3 new consultations daily (range: 0-8). Infants accounted for 25% of consults. The most common reasons for consultation were seizures (possible new seizures 41%, breakthrough seizures 17%, status epilepticus 4%), headache (7%), altered level of consciousness (7%), and focal weakness (4%). The emergency department accounted for 45% of consults, followed by the intensive care units (paediatric 13%, neonatal 6.3%, cardiac 3.4%),



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neurosurgery (5.8%) and oncology (3.5%). 44% of cases had acute neuroimaging prior to consultation, of which 54% showed a new abnormality. Overall, initial neurology recommendations included an acute EEG (37%), neuroimaging (21%) or treatment change (58%). *Conclusion:* There was a steady demand for neurology consultation that was dominated by requests for evaluation of seizures in children, particularly in infants. The results highlight the importance of education throughout the hospital on seizure management and on the appropriate use of investigations. Further study of the large number of consultations to the emergency department is warranted.

## C.03

### Short stature prolonged ambulation in boys with Duchenne muscular dystrophy

*JK Mah (Calgary)* F Hu (Washington) CM McDonald (Sacramento) C Research Group (Washington)*

*Objectives:* We aimed to describe the prevalence of short stature, the impact of corticosteroids (CS) on growth, and the effect of height on motor function among boys with Duchenne muscular dystrophy (DMD). *Methods:* Data was collected prospectively from the Cooperative International Neuromuscular Research Group (CINRG) DMD natural history study. Standing and calculated height were obtained using calibrated stadiometers and ulna length respectively. Descriptive statistics were used to define the baseline characteristics and changes over time. *Results:* 340 boys (mean age 12.0 ± 5.8 years) were enrolled at baseline; 194 (57%) were ambulatory, and 210 (62%) received CS. The proportion of participants with short stature increased steadily with age. Although CS-naïve participants were taller, a mixed-effect model showed that the rate of change in height was not significantly different between CS-naïve and CS-treated groups. 48 (14%) participants became non-ambulatory after one year. Boys with short stature (n=12, 25%) maintained ambulation longer (until mean age of 15.9 ± 3.2 years) than those with normal height (11.1 ± 1.3 years, p<;0.001). *Conclusion:* Short stature is a common feature of DMD, and it is associated with prolonged independent ambulation. The potential benefit of early diagnosis, timely CS treatment, and genetic polymorphism warrants further consideration.

## C.04

### SUDEP: is there an optimal way to inform parents?

*R Ramachandrannair (Hamilton)* SM Jack (Hamilton) BF Meaney (Hamilton) GM Ronen (Hamilton)*

*Objectives:* To understand the range of parental views on whether and how to approach the issue of SUDEP with families, to clarify the optimal timing and formulation of the information, and to learn from the true experts (parents) the optimal counselling strategies to minimize the inherent emotional burden. *Methods:* The principles of fundamental qualitative description were used to guide this study of parent experiences and perceptions. Stratified purposeful sampling included parents (i) Who lost children to SUDEP, (ii) Of children with moderate to severe/mild/new onset epilepsy. Data were collected through 1:1 interviews and focus groups. The principles of content analysis were used to code and categorize data. Line by line coding of the transcripts was followed by second level coding to collapse the codes into categories and themes. *Results:* 42 caregivers participated. Among parents with children who are alive, there was little consistency in their understanding of SUDEP .Consensus was that parents should be informed about SUDEP (majority:at the time epilepsy is confirmed). All parents agreed that they need to be told, by a pediatric neurologist familiar with SUDEP/epilepsy. Information should be shared face-to-face and not over the phone. Parents want to reserve their right to inform older children. To our knowledge, this is the first study that has tried to seek clarification on 'counselling parents on SUDEP' from the true experts (parents).

## C.05

### Does the absence of an abnormal imaging study define a specific cerebral palsy subtype?

*R Benini (Montreal)* L Dagenais (Montreal) M Shevell (Montreal)*

Up to 32% of cerebral palsy children may have normal/non-specific neuroimaging findings. This study sought to identify clinical factors to differentiate between CP patients with normal/non-specific versus abnormal imaging. Using a population-based registry (REPACQ), various antenatal, perinatal and postnatal predictor variables were compared in CP patients with normal/non-specific versus abnormal findings on Magnetic Resonance Imaging. Out of 126 patients with MRI available, 90 patients (71%) had abnormal imaging whereas 36 patients (29%) had normal/nonspecific findings. Compared to other CP variants, normal/non-specific imaging was more prevalent (p=0.001) in dyskinetic CP (72.7%, 8/11 patients) and less likely (p=0.002) in spastic hemiplegic CP (10%, 4/40 patients). No significant differences (p>0.05) in the prevalence of perinatal or postnatal clinical features nor clinical outcomes were identified. 42% of CP children with normal/non-specific neuroimaging exhibited a high level of functional disability (GMFCS IV-V) versus 33% with abnormal imaging. Apart from confirming that normal/non-specific imaging is more prevalent in dyskinetic CP, no clinical features were identified to differentiate these patients from those with abnormal imaging. Perhaps more refined imaging techniques are needed to evaluate patients with normal/non-specific findings. Alternatively, genetic or functional, rather than gross structural lesions, may underlie the pathophysiology of CP in this cohort. Finally, the high proportion of functional disability underlines the importance of continuous follow-up even in the absence of abnormal imaging.

## C.06

### Pediatric epilepsy surgery using intra-operative 3-tesla MRI and neuronavigation: the montreal children's hospital experience

*RW Dudley (Montreal)* M Jabiri (Paris) T Primiani (Montreal) JL Montes (Montreal) JD Atkinson (Montreal) J Farmer (Montreal)*

Modern epilepsy surgery, involving tailored resections of specific epileptogenic foci and functional disconnection procedures, requires highly detailed imaging as completeness of resection, or disconnection, correlates with better seizure outcomes. For the past two years at the Montreal Children's Hospital we have been using a 3-Tesla intraoperative MRI (iMRI)-based neuronavigation for pediatric epilepsy surgery. We conducted a chart and imaging review of all epilepsy cases performed in this setting from September 2009 to August 2011. The iMRI neuronavigation suite was used in a total



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of 25 epilepsy surgeries, and an iMRI was performed in 22 of these 25 (88.0%) cases. In 20 cases where an epileptogenic lesion was well delineated on pre-operative imaging, a complete resection was achieved in 85.0% of these operations. In seven cases (35.0%) further surgery was required because of residual lesion found on iMRI, and in five of these cases complete resection of the lesion was then achieved. Of 16 patients that have had at least one-year follow-up, 81.3% are seizure free after surgery. This review suggests that 3-Tesla iMRI has been beneficial in tailored epilepsy surgeries in our patient population. Further follow-up studies will be needed to assess if this translates into durable, long-term seizure freedom for these patients.

# EPILEPSY

## D.01

### A comparison between pharmacological treatment of epileptic patients with and without intellectual disability

*Fridhandler, Jonathan N Jette (Calgary) FM Coelho (Toronto) P Tai (Toronto) DM Andrade (Toronto)**

In this study we compare anti-epileptic drug (AED) treatment of intellectually disabled (ID) patients and those with normal intellect (NI). We reviewed the medical records of 100 epilepsy patients (50 ID and 50 NI and comparatively severe epilepsy), and recorded all current and past AEDs prescribed for epilepsy. Patients with ID were currently taking a greater number of AEDs (p=0.0001) and had been exposed to more AEDs in the past (p=0.005). There were no significant differences between the two groups in terms of past or present exposure to the newer AEDs as a group (lamotrigine, topiramate, levetiracetam, gabapentin, felbamate and tiagabine). Patients with ID were more likely to be currently taking an old AED (phenobarbital, primidone, phenytoin, carbamazepine or valproic acid) (p=0.01). More ID patients were currently taking (p=0.002) and had previously taken (p=0.004) a benzodiazepine (BZD) AED such as clonazepam, nitrazepam and clobazam. Despite the fact that both groups of patients are equally exposed to the old and newer AEDs, their overall pharmacological treatment is different. Patients with ID are more likely to be currently taking at least one old AED and are more commonly treated with BZD. Further investigation should help clarify the reasons for this finding.

## D.02

### Curative temporal lobectomy for post-ictal aggression resulting in murder

*NS Pandya (Saskatoon)* JF Tellez-Zenteno (Saskatoon)*

Although aggression associated with epilepsy is well documented, criminal behavior associated with seizures is uncommon. Moreover, behavioral symptoms may persist despite adequate medical management of seizures. Here we report the case of a previously healthy patient who presented with new onset complex partial seizures and rapidly became refractory to medical treatment despite the use of multiple anti-epileptic drugs. Simultaneously, the patient became increasingly emotionally labile with outbursts of anger and escalating violent behavior which coincided with seizure onset and was especially worse post-ictally. These explosive episodes led to multiple arrests for violent behavior, culminating in the stabbing death of her friend. Neurological assessment demonstrated normal physical examination and neuroimaging; however, video electroencephalographic telemetry showed clear onset of epileptic events in the right temporal region, making her an appropriate candidate for temporal lobe resection. Six months post-operatively, the patient was seizure-free, weaned off medications, and her emotional outbursts had subsided. Targeted violence associated with epilepsy is rare, but has been associated with specific structural lesions. Our case is significant because it illustrates the extreme violence resulting from temporal lobe epilepsy in the absence of a structural lesion and the potential for dramatic improvement with surgical resection. This rare case of epilepsy-induced aggression resulted in second degree murder, was successfully used as a criminal defense, and was cured with surgery.

## D.03

### Patient barriers to epilepsy surgery evaluation in a large health region

*C Hrazdil (Calgary)* J Roberts (Calgary) S Wiebe (Calgary) K Busche (Calgary) P Federico (Calgary) A Hanson (Calgary) W Murphy (Calgary) N Pillay (Calgary) N Jette (Calgary)*

*Background:* Despite class I evidence that carefully selected patients with refractory focal epilepsy benefit from epilepsy surgery, the majority of patients average 10-20 years before appropriate surgical management. We aimed to determine patient barriers to accessing epilepsy surgical evaluations in a large group of Canadian patients. *Methods:* A 5 minute questionnaire was administered to 100 consecutive clinic patients in Calgary with focal epilepsy. Survey items included: 1) lack of knowledge about surgical options, 2) misconceptions about the risks of surgery vs. ongoing seizures, 3) disability, 4) treatment goals, and 5) potential demographic and socioeconomic contributors to a delay in optimal care. Content validity was completed through a literature review and serial individual and team face-to-face revisions achieving agreement about each questionnaire component. The survey's face validity was next tested by administering it to ten consecutive eligible subjects. Both written and verbal feedback confirmed that, in their judgment, our test seems to accurately measure patient barriers to surgical evaluation. *Results:* Final results will be presented at the congress. *Conclusions:* Patient barriers to receiving an epilepsy surgery evaluation in Canada have not previously been formally evaluated. Our results could help guide future education endeavors and potentially influence public policy making.

## D.04

### Seizures and long-term evolution of a men with MECP2 duplication syndrome

*Nascimento, Fabio A. H Faghfoury (Toronto) M Care (Toronto) T Krings (Toronto) DM Andrade (Toronto)**

Mutations in MECP2 gene can lead to Rett syndrome in girls. Duplication of this same gene in boys has been increasingly recognized with over 100 cases reported. MECP2 duplication (MECP2-dup) leads to cognitive delay and macrocephaly. Here we describe an adult with severe seizures of several types, including reflex seizures, and their management challenges. Nine months after



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an uneventful birth, developmental delay was recognized in this patient. At 14 years-of-age he began experiencing complex partial, atonic, tonic, secondarily generalized tonic-clonic, and finally eating reflex seizures (atypical absences or tonic). All antiepileptic drugs available, and several combinations of them, failed to control his seizures. At the age of 23 years his monthly seizure frequency was of 125. The patient was then submitted to deep brain stimulation and the monthly seizure frequency decreased by 65%. Despite a significant seizure improvement, his cognitive nmotor skills continue to deteriorate. He is no longer able to walk, he is non-verbal and he is tube-fed. Frequent respiratory infections are the most severe and life-threatening events at the age of 36. In conclusion, this report describes the long-term evolution of MECP2-dup syndrome and the, so far not well described epilepsy features associated with this syndrome.

## D.05

### In neurological practices, how many patients are appropriate for an epilepsy surgery evaluation?

*C Hrazdil (Calgary)* J Roberts (Calgary) S Wiebe (Calgary) K Busche (Calgary) P Federico (Calgary) A Hanson (Calgary) W Murphy (Calgary) N Pillay (Calgary) N Jette (Calgary)*

*Background:* Practice guidelines stipulate that epilepsy surgery should be considered in patients with medication resistant focal epilepsy, yet referral patterns have not changed and epilepsy surgery continues to be underutilized. Surprisingly, one recent study has shown that non referral by neurologists is even higher than that by family physicians. To facilitate the referral of patients for an epilepsy surgery evaluation, we recently developed a tool (www.epilepsycases.com) that can be used to determine the appropriateness of a referral. Our objective was to prospectively validate the instrument and determine the proportion of patients followed in general neurology practices that were appropriate for an epilepsy surgery evaluation compared to patients followed in the regional epilepsy clinic. *Methods:* We prospectively applied the tool in 100 consecutive cases of focal epilepsy seen in Calgary general neurology and epilepsy clinics. An appropriateness rating score was calculated using a patient questionnaire and chart review. Variables collected included: seizure type, epilepsy duration, seizure frequency, number of AEDs tried, AED-related side effects, EEG, and MRI results. *Results:* Final results will be presented at the congress. *Conclusions:* With prospective validation, this tool can provide a more widely applied comprehensive guide for determining candidacy for epilepsy surgery evaluations, thus optimizing the care of patients with epilepsy.

## D.06

### Severe hypersensitivity reactions to aromatic AEDs: lymphocyte toxicity assay

*PA Hwang (Toronto)**

*Aim:* To examine the predictive roles of LTA and HLA factors in subjects at risk for severe HSRs. *Methods:* An ongoing prospective study, a case controlled analysis of 20 subjects at risk for severe hypersensitivity reactions eg. Stevens-Johnson syndrome or Toxic Epidermal Necrolysis to aromatic ant-epileptic drugs include: phenytoin, phenobarb, carbamazepine, oxcarbazepine and lamotrigine was compared to aged-matched controls, of Han and non-Han Chinese subjects. *Results:* The Han Chinese had a much higher risk for SJS/TEN when the HLA-B*1502 was positive compared to non-Han controls (P<;0.05). The lymphocyte toxicity assay (LTA) was predictive of SHSRs in over 90%, using the subjects' lypmphocytes, without posing a risk to the patients on aromatic AEDs. *Conclusion:* The value of in-vitro testing using a combination of LTA for subjects at risk, and HLA_B*1502 in Han Chinese is highly predictive of severe HSRs to aromatic AEDs. These tests should be used in advance of starting the AEDs in subjects at risk for severe HSRs.

## D.07

### A prospective study of a cohort of patients with newly-diagnosed epilepsy: their response to medication, and the role of EEG and MRI

*Jg Burneo (London)* E Sandison (London)*

A cohort of patients with newly-diagnosed epilepsy seen at UWO-Epilepsy Program were prospectively included and their response to first, second and third adequate trials of antiepileptic drugs (AEDs) was assessed, as well as the role of EEG and MRI in the development of intractability. 174 patients were included. The mean age was 37 years (range: 10-84). Information was available for 139 patients. Of these 83 (59.7%) became seizure free and 56 continued to have seizures. The median age of onset was 36.8 years in those who became seizure free, and 31.2 years for those who did not. Of the ones who did not become seizure free with the first AED trial, response to a second trial of AED was seen in 14.3% of total. Of those who became seizure free after the first trial of AED, 15 had normal EEG, and 28 normal MRI of the brain. Of the ones who did not become seizure free after 3 trials of AEDs, the EEG was normal in 5 patients, and the MRI was normal in 13. Patients with early seizure onset and those with symptomatic epilepsy are likely not to become seizure-free after treatment with first AED. In general, response to first AED trial was seen in close to 60% of patients. EEG and MRI findings did not influence prognosis

## D.08

### Steal phenomena of sturge-weber syndrome mimicking contralateral ictal EEG onset

*C Limotai (Toronto)* C Go (Toronto) A Ochi (Toronto) I Noyman (Toronto) J Rutka (Toronto) H Otsubo (Toronto)*

*Background:* Contralateral high amplitude delta activity at the ictal onset in two patients with Sturge-Weber syndrome (SWS) was observed. We hypothesized steal phenomena on ictal scalp EEG in patients with SWS. *Methods:* We retrospectively reviewed interictal, ictal EEG findings, and the surgical outcome after hemispherectomy in two cases with intractable epilepsy secondary to extensive left hemispheric angioma. *Results:* Two patients (one girl, one boy) had early-onset epilepsy at 2 and 3 months, respectively. Both experienced similar clinical partial motor seizures, interictal, and ictal EEG findings. Ictal EEG changes were characterized by build-up of repetitive sharply-contoured theta activity noted at the left posterior temporo-parietal-occipital regions. There was also simultaneously abrupt higher amplitude delta activity, without clear evolution, seen on the contralateral normal hemisphere. Both



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underwent hemispherectomy on the affected hemisphere. One patient achieved seizure freedom at 1 year during his last follow-up and the other recently had the surgery performed. *Conclusions:* We hypothesize that steal phenomena as draining of the blood from the normal hemisphere to the area of the ictal onset zone on the affected hemisphere, produces unique scalp EEG pattern. Recognition of this EEG pattern can prevent misinterpretation of contralateral ictal onset.

## D.09

### Outcome of temporal lobe epilepsy surgery in patients with normal MR imaging

*MM Ali (Calgary)**

*Background:* Reports of surgery for temporal lobe epilepsy suggest a better seizure outcome for patients with MRI identified lesions compared with those with normal MR imaging (nMRI). The purpose of this study was to review our results of surgical treatment of temporal lobe epilepsy with nMRI at the Calgary Epilepsy Program. *Methods:* We retrospectively evaluated the surgical outcome of all patients who underwent temporal lobe surgery with nMRI between 2000 and 2010. All patients underwent comprehensive presurgical evaluation. *Results:* A total of 40 patients underwent TLE surgery with nMRI. They were 20 women and 20 men. The mean age at surgery was 29.0 years (with 7 patients younger than 18 years). 29 patients underwent anteromesial temporal lobe resection and 11 trans cortical selective amygdalo-hippocampectomy. Of the 40 patients, 15 underwent intracranial electrodes implantation prior to the resection. At the final follow-up (average 51 months), 22 out of the 40 patients (55 %) were seizure free. Histopathological examination showed no structural pathology in 17 patients (41 %), mesial temporal sclerosis in 7 (18 %), gliosis in 9 (23 %), and cortical dysplasia in 7 (18%). *Conclusion:* Temporal lobe resection in well-selected patients with nMRI can provide favorable rates of seizure freedom. The majority of patients exhibit non-specific pathological abnormalities from surgical specimens.

## D.10

### Coprolalia as a manifestation of epileptic seizures

*CJ Dove (Hamilton)* SM Mirsattari (London)*

*Background:* Coprolalia is a well-known symptom of Tourette Syndrome, but it has only been reported as a manifestation of epileptic seizures in a few cases. *Methods:* We conducted a retrospective chart review of five patients with ictal coprolalia. Age at onset, seizure semiology, video-electroencephalogram (EEG) findings, neuroimaging, epilepsy etiology, and response to treatment were documented. *Results:* Age at seizure onset ranged from 14 to 24 years (mean = 19 years). Ictal coprolalia was always associated with complex partial seizures, but was never the first manifestation of a seizure. Continuous scalp video-EEGs were available for all patients, while subdural recordings were available for two. Seizure onset zones were in the temporal or orbitofrontal lobes but without consistent lateralization. Three patients had an underlying ganglioglioma, while two patients had normal MRI brain imaging. All five patients met criteria for medically refractory epilepsy. Two patients underwent lesionectomy with improvement in seizure frequency and intensity. *Conclusions:* Coprolalia can be a rare manifestation of complex partial seizures. We hypothesize that ictal coprolalia is indicative of seizure propagation to the limbic system. An alternative hypothesis is localization to the language network, which has also been implicated in Tourette Syndrome.

## D.11

### Neocortical temporal lobe epilepsy

*E Bercovici (Toronto)* BS Kumar (London) SM Mirsattari (London)**

Complex partial seizures (CPS) can present with various semiologies. While mesial temporal lobe epilepsy (mTLE) is a well recognized cause of CPS, neocortical temporal lobe epilepsy (nTLE) albeit being less common is increasingly recognized as separate disease entity. Differentiating the two remains a challenge for epileptologists as many symptoms overlap due to reciprocal connections between the neocortical and the mesial temporal regions. Various studies have attempted to correctly localize the seizure focus in nTLE as patients with this disorder may benefit from surgery. While earlier work predicted poor outcomes in this population recent work challenges those ideas yielding good outcomes in part due to better localization using improved anatomical and functional techniques. This paper provides a comprehensive review of the diagnostic work up, particularly the application of recent advances in electroencephalography and functional brain imaging, in neocortical temporal lobe epilepsy.

# Movement Disorders

## E.01

### Time to H&Y stage & motor complications in early-onset versus late-onset Parkinson Disease

*LW Ferguson (Saskatoon)* A Rajput (Saskatoon) AH Rajput (Saskatoon)*

*Background:* We compared time to Hoehn and Yahr (H&Y) Stages and dyskinesias and motor wearing-off between autopsy-confirmed early-onset (EOPD) and late-onset (LOPD) Parkinson disease (PD). EOPD have a more favorable prognosis, but higher incidence and shorter time to dyskinesias and wearing-off. There is little data on pathologically confirmed EOPD. *Methods:* EOPD patients (onset age 21-50; n=22) were compared with randomly identified LOPD (onset after age 64; n=44). Patients in both groups had clinical and autopsy confirmed diagnosis of PD. Progression through H&Y stages was recorded when there was an irreversible worsening. *Results:* Median H&Y stage at first visit was similar in both groups. Mean years from disease onset and from levodopa initiation to H&Y stages III, IV, and V were significantly longer in EOPD compared to LOPD (p<;0.04). Levodopa use was similar between both groups. Time from levodopa initiation to dyskinesia threshold was similar in both groups, but much longer to wearing-off threshold in EOPD (p=0.003). A greater proportion of EOPD ever had any one or more of dyskinesias, motor wearing-off, and on-off (p<;0.008). On-off was not observed in LOPD. *Conclusions:* Most of our findings agree with previous studies. However, we found that onset of wearing-off occurred much longer after levodopa initiation in EOPD.



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## E.02

### Home IVIG for maintenance therapy in CIDP

*HD Katzberg (Toronto)* V Rasutis (Toronto) V Bril (Toronto)*

*Background:* Home IVIG for treatment of neuromuscular diseases is available in the US and Europe but not in Canada, where treatment is hospital based, costly and cumbersome. This study aims to evaluate the safety and tolerability of home IVIG for treatment of CIDP. *Methods:* Patients with CIDP on a stable regimen with IVIG 10% were enrolled in the study. Following baseline clinical evaluation, patients received 6 months of IVIG in the home at their usual dose and frequency by a study nurse. Neurological and quality of life assessments were performed at 3 and 6 months to ensure stability and tolerability. *Results:* Ten subjects aged 26-86y were enrolled from September to December 2011 and 24 total infusions have been administered to date. All subjects received 1 gram / kilogram of IVIG 10% every 3-5 weeks. Six subjects have been neurologically stable on their 3 month visit compared to baseline. No significant change in quality of life was observed. No major adverse reactions have occurred. All patients have stated that they prefer non-hospital maintenance treatment. *Conclusion:* This preliminary review shows that patients with CIDP treated with maintenance home IVIG have demonstrated clinical stability and safety. If these results are confirmed in the full cohort, data supports a shift of IVIG treatment out of hospital in selected patients with chronic neuromuscular diseases in Canada.

## E.03

### Modulation of beta frequency oscillations in the human STN

*AO Hebb (Seattle)* F Darvas (Seattle) KJ Miller (Stanford)*

*Background:* In Parkinson's Disease (PD), β (13-30Hz) oscillations in local field potentials (LFP) are prominent in the subthalamic nucleus (STN). We present short and long time base modulation of β power within the human STN with behavior. *Methods:* STN-LFPs were recording intraoperatively during Deep Brain Stimulation (DBS) lead placement for PD. Subjects participated in speech and motor-based behavioural tasks. Task-synchronized time-frequency analysis was performed to highlight modulation of frequency bands coincident with onset of behavior. β-power over longer time periods were analyzed for trends related to the type of repetitive task. *Results:* There was robust β-desynchronization with speech and motor tasks in bilateral STN relative to pre-task baseline. When long term shifts of β power were evaluated, different tasks were associated with distinct levels of STN β-power. Specifically, magnitude of β-power pre-task baseline depended on the type of task the subject was performing. Repetitive motor tasks were associated with the highest level of baseline β power, whereas speech tasks were associated with low β power state. *Conclusions:* STN β-power is modulated bilaterally with motor and speech tasks over short and long time epochs. With the development of new DBS technology with the capability to record LFP, this baseline β-power may serve as an important control variable to modulate DBS pulse generation to reduce stimulation induced side effects.

## E.04

### Challenges of diagnosis of young onset Parkinson's Disease

*A Rana (Toronto)* M Rana (Toronto) AN Rana (Toronto) S Khondkar (Toronto)*

*Objective:* We wanted to study the average time to reach final diagnosis of Parkinson's disease and number of investigations in relatively younger age patients after they first saw a neurologist. *Introduction:* The typical age of onset of adult onset idiopathic Parkinson's disease is 55 to 60 years. Approximately 10 per cent of Parkinson's disease patients have young-onset Parkinson's disease. Due to much earlier age of onset and different presenting symptoms, the time to make a final diagnosis may be longer than classic adult onset idiopathic Parkinson's disease. In addition these patients may undergo multiple investigations before the final diagnosis is made. *Methods:* We did chart review of fourteen of our YOPD patients between the ages of 37 to 45 years and compared them with fourteen classic adult onset Parkinson's disease patients. *Results:* The time to conclude diagnosis in YOPD patients was much longer than the adult onset PD. YOPD patients saw much larger number of neurologists and underwent through significantly increases number of investigations as compared to adult onset PD. *Conclusion:* Young onset Parkinson's disease may be subject to delay in diagnosis of PD. Furthermore, they may have to undergo increased number of investigations and see more number of neurologists before diagnosis of PD is concluded, which can be improved by further awareness and education of physicians.

## E.05

### Attitdues of Parkinson's patients in reporting compulsive gambling with dopamine agonist

*A Rana (Toronto)* M Rana (Toronto) AN Rana (Toronto) S Khondkar (Toronto)*

*Objective:* To discuss the Parkinson's disease patient's attitude in reporting dopamine agonists induced compulsive gambling. *Introduction:* Dopamine agonists are known to cause compulsive behavoural side effects such as gambling.Although PD patients have been reported to have trouble telling lies but they may have quite different attitude when it comes to reporting compulsive gambling to their physicians. We present three of our patients who experienced compulsive gambling behavior on dopamine agonists and had totally different attitudes in reporting this problem. *Methods:* A 49-year old man with history of PD developed compulsive gambling within six month of being on Dopamine Agonist (Pergolid). Patient reported this to his neurologist after he realized that he was suffering from a strange behvaroural problem. Discontinuation of Dopamine Agonist eliminated the condition of compulsive gambling.
Second patient was a 37 year old male with PD who developed compulsive gambling on pramipexole and declined history of gambling until was confronted by his sister. Fourth patient was 69 year old male who devoloped gambling being on pramipexole as well, however he attributed this to his defense mechanism of coping with young son's death. *Results:* These three patients had different attitude stowards reporting this problem was different. *Conclusion:* PD patients with dopamine agonist induced pathological gambling should be screened thorougly with paralel history since their reporting attitude are diverse.



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## E.06

### Adult-onset spinocerebellar ataxia syndromes due to MTATP6 mutations

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*Background:* Spinocerebellar ataxia syndromes presenting in adulthood have a broad range of causes, and despite extensive investigation may remain undiagnosed in up to one half of cases. Mutations in the mitochondrially-encoded MTATP6 gene typically cause infantile-onset Leigh syndrome, but occasionally have onset later in childhood. We report two families with onset of ataxia in adulthood, who are clinically indistinguishable from spinocerebellar ataxia patients. *Methods:* Genetic screening study of 64 pedigrees with unexplained ataxia, and case series of two families who had MTATP6 mutations. *Results:* Three pedigrees had mutations in MTATP6, two of which have not been reported previously and are detailed in this report. These families respectively had the m.9185T>C and m.9035T>C mutations, which have not been previously reported to cause adult-onset cerebellar syndromes. Other investigations including muscle biopsy and respiratory chain enzyme activity were nonspecific or normal. *Conclusions:* This report expands the phenotypic spectrum of mutations of the MTATP6 gene. We suggest that MTATP6 sequencing be considered in the workup of undiagnosed ataxia even if other investigations do not suggest a mitochondrial DNA disorder.

## E.07

### Cocaine addiction relieved by a striatal lesion: cues to a future treatment approach?

*H Boudjani (Montreal)* S Charbonneau (Montreal) S Potvin (Montreal) C Chayer (Montreal) V Dubuc (Montreal) LC Gioia (Montreal) AY Poppe (Montreal) C Odier (Montreal) Y Deschaintre (Montreal) S Lanthier (Montreal)*

*Background:* Cocaine procures satisfying sensations by inhibiting the presynaptic dopamine reuptake. Cocaine withdrawal favors seeking behaviors. Animal and functional studies support the central role of the dorsolateral striatum (DLS) in cocaine addiction. In rats, DLS lesions attenuate cocaine seeking behavior. *Case Report:* 45-year-old, right-handed man with antisocial personality traits consulted for acute hemiparesis. He was repeatedly incarcerated and had regular contacts with prostitutes. He started smoking cigarettes and using illicit drugs at age 9, with up to 7 g/d of cocaine from age 24. He reported continuous intense urges to seek cocaine since he started a behavioral drug abstinence therapy a month before presentation. Physical exam revealed skin tattoos, poor mouth hygiene, no signs of endocarditis, and hemiparesis. MRI showed acute left DLS infarct. Investigation found a left internal carotid artery dissection and mitral vegetations with negative blood cultures. Remarkably, he reported no further craving for cocaine following stroke onset. He scored 9/10 on the Drug Abuse Screening Test-10 for the year preceding stroke, indicating a severe level of problems related to drug use and 0/10 after stroke. He has abstained from major stimulant use for the last year. *Conclusion:* This case report supports the central role of the DLS in cocaine-seeking behavior among humans. Deep brain stimulation in this region may be a future therapeutic strategy for cocaine addiction.

## E.08

### Cardiac screening investigations in adult-onset progressive external ophthalmoplegia

*G Pfeffer (Vancouver)* MM Mezei (Vancouver)*

*Introduction:* Patients with mitochondrial myopathies may develop cardiac complications such as cardiomyopathy and/or cardiac conduction defects. To identify these potentially life-threatening and treatable conditions, it is common practice to screen patients intermittently with ECG and echocardiography. The optimal time interval for such screening investigations is unknown. We developed this study to review our screening results in adult-onset patients with progressive external ophthalmoplegia (PEO). *Methods:* Retrospective review of PEO patients with 5 years or more of cardiac screening investigations, who do not have any cardiac symptoms. *Results:* 15 patients were included, and one patient developed mitochondrial cardiomyopathy identified on screening echocardiogram. Four patients had other abnormalities identified which were unrelated to their mitochondrial myopathy. *Discussion:* Only one patient in 15 developed cardiac complications relating to mitochondrial disease after 5 years or more of follow-up. We suggest that a screening interval of 3-5 years is probably appropriate for adult-onset PEO patients who do not have cardiac symptoms.

## E.09

### A common movement abnormality in patients with LGI1 limbic encephalitis is a manifestation of tonic seizures

*Tai, Peter RA Wennberg (Toronto) J Dalmau (Philadelphia) DM Andrade (Toronto)**

Temporal lobe seizures and memory loss are common features of anti-LGI1 limbic encephalitis (LGI1-LE), previously attributed to voltage-gated potassium channel-antibodies. Abnormal, involuntary movements have been described in up to 40% of patients with LGI1-LE. The motor movements are not absolutely typical of dyskinesias or myoclonus. However, in the literature they were described as “twitches”, “myoclonus” or “stereotyped brief monomorphic movements”. Here we describe 3 patients with such typical movements happening 10 to 100 times per day. Serology tests were positive for anti-LGI1-antibodies in all. Continuous video-EEG recordings demonstrated that these events were associated with an ictal EDE pattern seen on scalp EEG, typical for tonic motor seizures, consistent with remote onset and propagation of ictal activity. The unusual nature of these tonic seizures, when seen in the setting of an acute encephalopathy, and especially in patients with other, unrelated, temporal maximum ictal EEG abnormalities, should serve as a diagnostic clue to the possibility that the acute encephalopathy may be LGI1-LE. It should be noted that these tonic seizures may present with abnormal movements similar to those described above, even without a definitive ictal EEG recording, as the latter may only be seen in association with the more prolonged seizures.



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## E.10

### Episodic ataxia type 2 and pregnancy

*SD Spacey (Vancouver)**

Episodic Ataxia type 2 (EA2) is an autosomal dominant condition resulting from mutations in the CACNA1A gene. EA2 is characterized by attacks of ataxia lasting minutes to hours in duration. Attacks are typically triggered by exertion. Currently there is no documentation in the literature on the effects of EA2 in pregnancy and management of EA2 in pregnancy and labour. We present a 29 yr old pregnant women with EA2 and report the effects of EA2 on pregancy, the effects of pregnancy on EA2 and the management of her labour and delivery. The patient has a deletion in the CACNA1A gene. DNA from chorionic villus sampling from her current pregancy is negative for this deletion. Prior to pregnancy she would experience EA2 attacks 1/month triggered by exertion and migraine without aura 1/month. She was on acetazolomide 250 mg 5X/day. Once she became pregnant she reduced her acetazolamide to 250 mg BID and her EA2 attack frequency diminished to 1/ trimester. Her migraine frequency increased to 2-3/week and this stopped in the second trimester. Her due date is 02/19/2012. Pregnancy appeared to reduce the need for acetazolomide and reduce EA2 attack frequency in this patient. She will have a trial of labour with minimal exertion with a plan to c-section if EA2 triggered.

## E.11

### Subthalamic nucleus deep brain stimulation: defining an invaluable role for microelectrode recording

*FA Zeiler (Winnipeg)* M Wilkinson (Winnipeg) JP Krcek (Winnipeg)*

*Introduction:* The benefit of intra-operative microelectrode recording (MER) for the purpose of neurophysiological localization and mapping of the STN is debated. Hypothesis: MER will alter final STN DBS lead placement by demonstrating a discrepancy between the proposed anatomical and neurophysiological STN dimensions and border. *Methods:* A retrospective review of the charts of patients receiving STN DBS implantation for Parkinson's disease at our institution from January 2004 to March 2011. Data on STN predicted and MER measured dorsal and ventral boundaries was recorded. *Results:* Data from 43 of 44 patients were reviewed. The average number of tracts on the left was 2.4, versus 2.3 on the right. Dorsal and ventral anatomical boundaries of the STN based on Schaltenbrand's Stereotactic Atlas were estimated to be at -5.0mm above and +1.4 mm below target respectively. The average dorsal and ventral boundaries of the STN using MER were -2.6 mm above and +2.0 mm below target respectively. In 29 of 43 patients, MER indicated necessary alterations in trajectory predicted by conventional atlas/MRI. In 19 of 43 patients the trajectory of implantation was moved 2mm anterior as per MER. *Conclusions:* MER in STN DBS surgery demonstrated measurable difference between stereotactic atlas/MRI STN target and neurophysiologic STN localization. Furthermore, a large proportion of contralateral trajectories were moved anterior as a result of Stereotactic Atlas and MRI inaccuracies.

# NEUROSURGERY I

## F.01

### Characterization of cerebral astrocytoma zonal proliferation and intrazonal clustering using geminin, HIF-1 alpha and VEGF

*BW Lo (Toronto)* T Johnson (Hamilton) CX Ma (Hamilton) J Provias (Hamilton)*

*Background:* We previously characterized zonal proliferation of diffuse cerebral astrocytomas using angiogenic markers, hypoxia inducible factor-1 alpha (HIF-1A) and vascular endothelial growth factor (VEGF), demonstrating core tumoural zones and surrounding peripheral zones. This study looks more closely at the level of cell cycle activity using Geminin, a cell cycle replication inhibitor. *Methods:* Immunohistochemical staining of 15 cases of astrocytomas (5 cases of each low, intermediate and high grade astrocytomas) was done using Geminin 1/100, HIF-1A 1/100 and VEGF 1/300. *Results:* As astrocytoma grades increased, staining intensity of HIF-1A, VEGF and Geminin increased. Nuclear positivity was noted for HIF-1A and Geminin. At a particular grade, staining of HIF-1A is stronger than that of VEGF in the peripheral zones. Heterogeneous clusters of Geminin staining were noted within each grade, both in tumour and periphery. *Discussion:* Hypoxia induces angiogenesis - HIF-1A predicts temporal and spatial profiles of zonal proliferation, and is expressed early in peripheral zones of low/intermediate grade astrocytomas. Geminin leads to dysregulation of DNA replication by altering interaction of Mcm 2-7 and Cdt-1. Its upregulation signals increased synthetic and mitotic activity of proliferative tumour cells, with increased expression in tumour cells in high grade gliomas. Clusters of Geminin staining in tumour and periphery zones reflect their heterogeneous nature. We aim to further characterize Geminin as a prognostic marker, and how clusters migrate from core to periphery.

## F.02

### Diffusion tensor imaging of spinal cord tumours

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*Background:* Spinal cord tumors can alter the spinal cord integrity and we wanted to see if magnetic resonance (MR) diffusion tensor imaging (DTI) would be affected by these changes. We assessed DTI measures of mean diffusivity (MD) and fractional anisotropy (FA) of the spinal cord to determine if these measures are affected by tumour. *Methods:* Thirteen patients with intramedullary spinal cord tumours and eight healthy volunteers were obtained from the tractography database. T2-weighted fast-spin-echo and DTI were obtained with a 1.5-T MR-scanner. MD and FA maps were computed at the level of the tumor and 1.5 cm cranial and caudal to the tumor. *Results:* For the controls, averaged MD values and FA values ranged from 0.981-1.205 x10-3mm2/s and 0.721-0.781, respectively. Compared to healthy controls, there was a significant decrease in the FA values (p=0.05) at all levels. The range of FA values at the level of the tumour, caudal to the tumour and cranial to the tumour was 0.232-0.352, 0.541-0.612, and 0.647-0.711, respectively. There were no significant MD value changes. *Conclusion:* FA measurements correlate with spinal cord



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abnormalities due to tumours while MD measurements do not. Further work is ongoing to determine other DTI measures that are relevant clinically.

## F.03

### Traumatic subdural hematomas: conservative treatment outcome and risk factors

*P Bajsarowicz (Montréal)* I Prakash (Montreal) J Lamoureux (Montréal) RS Saluja (Montreal) M Feyz (Montreal) M Maleki (Montreal) J Marcoux (Montreal)*

*Background:* The Brain Trauma Foundation has published guidelines for the surgical management of traumatic subdural hematomas (SDH). There is, however, a paucity of studies that looked at the outcome with non-operative management, and all were done on extremely small numbers of patients. *Method:* We reviewed all cases (677) of traumatic SDH initially treated conservatively at our institution over a five-year period. Outcome measures were the need for eventual operative treatment and the Glasgow outcome scale (GOS) score. Many factors were compared between the group who required surgery and the conservative group. *Results:* 8.27% eventually required a surgical evacuation of their SDH. These patients had a GOS significantly lower than the non-surgical group. They also had a significant difference ($p < 0.05$) with respect to the following factors: older age, alcohol abuse, history of falls, pre-trauma intake of blood-thinners, thicker SDH, larger midline shift, and more than one SDH. There was no statistical difference for gender, Glasgow coma scale score on arrival, Injury Severity score, post-trauma blood-thinner intake, abnormal coagulation profile, or brain atrophy. *Conclusion:* A large proportion of traumatic SDH can be successfully treated conservatively. Patients at risk for deterioration could be identified and should be followed more closely.

## F.04

### Comparison of traumatic brain injury (TBI) between aboriginal communities of Northern Quebec and the general Quebec population

*RW Dudley (Montreal)* M Faez (Montreal) M Maleki (Montreal) J Marcoux (Montreal)*

Health indicators suggest that Aboriginal People of Canada are in worse health than the overall Canadian population. The main cause of potential years of life lost is injuries. Our objective was to compare the general Quebec population and Aboriginal communities of Northern Quebec in terms of traumatic brain injury (TBI). We used the Montreal General Hospital (MGH) TBI database to find all patients admitted with moderate & severe TBIs from 2005 to 2010. We divided these patients into two groups, those from the aboriginal Nord-du-Quebec region versus the other regions serviced by the MGH. We performed a retrospective review of the demographics, injury severity, and outcomes in these two groups. The rate of TBI in the Northern Quebec Aboriginal communities was four-times greater than in the general population (0.098% vs 0.024%, p<;0.001), and these patients were on average 20 years younger than their general population counterparts (33.7 vs 54.2, p<;0.001). There was no difference in injury severity score between the two groups, but Aboriginal victims of trauma presented with a lower initial Glasgow Coma Score (iGCS) (6.4 vs 8.5, p=0.007). Despite a lower iGCS, these patients had the same length of hospital stay, and as good Glasgow Outcome Scores as the general population. This data suggests that young aboriginal people of northern Quebec are at increased risk of significant TBI.

## F.05

### Head injury protection in short track speed skating

*M Vassilyadi (Ottawa)* B Hoshizaki (Ottawa) K Nishizaki (Ottawa) C Karton (Ottawa) P Rousseau (Ottawa)*

*Background:* The protective headgear worn by short track speed skating athletes was originally designed to decrease the risk of catastrophic head injuries based on safety standards employing peak linear acceleration. While peak linear acceleration has been shown to be closely linked to severe brain injuries, it is the combination of peak linear and more importantly peak angular acceleration which is more closely associated with concussion. *Methods:* Two short track speed skating helmets were tested by dropping a Hybrid III headform at a velocity of 4m/s on a monorail at three different locations, and compared with two types of hockey helmets and a bicycle helmet. *Results:* Peak linear accelerations ranging from 59.0g to 97.8g were below an estimated 106g, representing an 80% risk of sustaining a concussion. Peak angular accelerations ranged from 7619rad/s2 to 9884rad/s2, exceeding the 80% estimated risk of 7900rad/s2 for the speed skating helmets and one of the hockey helmets. *Conclusions:* While speed skating helmets were effective at maintaining peak linear acceleration below an 80% concussion risk, they were less successful at managing peak angular acceleration. Thus, these helmets may be more effective at managing the risk of severe brain injury rather than decreasing the risk of concussion. The bicycle helmet and the vinyl nitrile foam hockey helmet were best at maintaining peak angular acceleration low.

## F.06

### A survey of seizures in patients undergoing cardiac surgery

*TE Gofton (London)**

*Background:* Using continuous EEG monitoring (cEEG), seizures have been reported in at least 8% of patients in general ICUs. We have observed clinical seizures in fewer than 1% of patients in our cardiac surgery recovery unit (CSRU) and sought to determine whether such patients were having a higher incidence of nonconvulsive seizures (NCS) using continuous cEEG. *Methods:* Informed consent was obtained preoperatively in patients visiting cardiac surgeons. Using an abbreviated system of electrode placement, post-operative cEEG was performed for 12-24 hours. CEEGs were classified for the principal abnormality and for epileptiform activity or seizures. *Results:* Of 100 patients (73 M, 27 F, average age 65 +/- 11 years; range 30-84 years) 3 had seizures. Two patient had a focal onset seizure (both clinical and electrographic) with secondary generalization and one had an electrographic seizure only. Two other patients had only generalized spikes within 6h of surgery. No EEGs showed focal abnormalities or NCS. *Conclusions:* CEEG captured seizures in only 3/100 (3%) patients in the immediate post-operative period after cardiac surgery. There is likely a low yield in performing CEEG routinely in cardiac surgery patients, in contrast to general or neuro-ICUs, where seizures are more common and nonconvulsive in nature.



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## F.07

### Endoscopic third ventriculostomy in the presence of large or giant basilar artery aneurysms

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*Background:* Endoscopic third ventriculostomy (ETV) is an effective treatment of obstructive hydrocephalus (OH). However, the presence of a large or giant basilar aneurysm is a relative contraindication to ETV for treating hydrocephalus. We report the feasibility and efficacy of ETV for the treatment of hydrocephalus in the presence of such aneurysms. *Methods:* We performed a retrospective chart analysis of patients that underwent ETV for large or giant basilar aneurysm-associated hydrocephalus between January 2003 and January 2011. *Results:* During this period, 78 patients were treated by ETV. Of these, three patients presented with symptomatic hydrocephalus associated with a large giant basilar aneurysm (n=3). Two of those patients had a history of previous subarachnoid hemorrhage (SAH) with intraventricular hemorrhage (IVH) 11 years and 13 years before ETV. Both aneurysms were embolized preoperatively. The third patient presented with OH due to an unruptured basilar artery aneurysm. There was no operative complication and symptom resolution was observed in all patients at last follow-up. *Conclusion:* ETV is a safe and effective alternative to ventriculo-peritoneal shunting in patients with hydrocephalus caused by large or giant basilar artery aneurysms. In addition, a history of SAH/IVH should not be considered a contra-indication to ETV.

## F.08

### Clinical fmri for language lateralization in work up of seizure patient: single centre experience

*CA Wiens (Calgary)* B Goodyear (Calgary) A Goel (Calgary) P Fedrico (Calgary) W Hader (Calgary) M Goyal (Calgary)*

*Background:* Traditionally, lateralization of language function prior to epilepsy surgery has been confirmed by an invasive method, sodium amytal testing. Increasingly functional MRI (fMRI) is used for this role. We present our experience with clinical fMRI and its impact on patient care. *Materials and Methods:* Sixty-one patients were referred for fMRI of language lateralization, the majority of whom had epilepsy. fMRI was performed and a laterality index (LI) of brain activity for Broca's area was computed. Patient charts were reviewed to determine the impact of fMRI on surgical and clinical decision-making and surgical outcome. *Results:* 94% of results were conclusive: 55% exhibited left-hemisphere lateralization, 35% exhibited bilateral lateralization, and 10% exhibited right-hemisphere lateralization. For 60% of patients fMRI played a clear role in preoperative planning. 2/61 patients did not proceed to surgery based on fMRI results. 37 patients proceeded to surgery: 18 had a tumour, 17 had a structural abnormality, 2 had vascular malformations. One of the patients who went to surgery was lost to follow up. fMRI was congruent with surgical outcomes for the patients followed. *Conclusions:* fMRI was accurate in determining lateralization of speech. fMRI results were instrumental in preoperative surgical planning in the majority of patients.

## F.09

### RS-XRF used to quantify SPIO labelled neural stem cells in a stroke model

*S Ahmed (Saskatoon)* AM Auriat (Stanford) W Zheng (Detroit) H Nichol (Saskatoon) R Guzman (Stanford) ME Kelly (Saskatoon)*

*Background:* Synchrotron-based rapid scanning X-ray fluorescence (RS-XRF) was used to detect and quantify iron in SPIO-labelled stem cells after intraarterial (IA) or intraparechymal (IP) transplantation in an experimental stroke model. *Methods:* The middle cerebral artery occlusion model (MCAO) was used to induce stroke in Wistar rats. Three days following stroke, 500,000 SPIO labelled C17.2 mouse neural progenitor stem cells (NPCs) were transplanted either IA or IP. Bioluminescence imaging (BLI) was performed 24 hours after cell transplantation, and prior to euthanasia: 1, 10, or 30 days after transplantation. Ex-vivo MRI, RS-XRF, immunohistochemistry (IHC), and histology were performed. For quantification, SPIO labelled mouse NPCs were cultured on metal-free coverslips and mapped with RS-XRF. *Results:* RS-XRF depicted areas of Fe signal in the ischemic hemisphere correlating with areas of hypointensity on MRI, which was confirmed by BLI, IHC, and histology. Quantification using high-resolution scans demonstrated the average iron content of a single cell to be 2.38pg, with no significant differences between treatment groups. *Conclusions:* Synchrotron RS-XRF can be used to quantify SPIO-labelled stem cells. Here we demonstrate its application in a multimodality-imaging paradigm to track SPIO labelled stem cells in a stroke model. We found excellent correlation between BLI, MRI, RS-XRF, and IHC.

## F.10

### Blister aneurysms of the carotid artery: systematic review of management options

*YH Khormi (Edmonton)* C O'Kelly (Edmonton)*

*Background:* Blister aneurysms (BA) are a rare subtype of intracranial aneurysms. Whether treated with surgical or endovascular approaches, these fragile aneurysms carry an elevated risk of morbidity due to their increased likelihood of intraprocedural rupture. *Methods:* We conducted a systematic review of all ruptured internal carotid BA papers between 1980 and 2012. We restricted our analysis to papers which included individual level patient data describing demographics, presentations, aneurysm location, management and outcomes. *Results:* We have identified eighty-one patients with sufficient data to permit analysis. 80 % were female. The mean age at presentation was 52 years (range 24-74). 25 % were poor clinical grade. Fifty-four were treated surgically (direct surgical repair, wrapping, trapping with or without bypass) and twenty-seven were treated using endovascular methods (coiling, stent assisted coiling, stent alone, or trapping/vessel occlusion). Intraprocedural rupture rates were relatively high at 33 %. While definitive conclusions are difficult, there was a trend towards improved outcomes with both surgical and endovascular trapping approaches. *Conclusion:* BAs remain challenging vascular lesions. Trapping may avoid some of the morbidity associated with direct repair strategies. Further comparative studies are needed to define the optimal approach to these aneurysms.



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## F.11

### Dynamic endovascular, vascular and parencymal changes during adult ischemic stroke: a pilot study

*A Gomez Vargas (Hamilton)* L Morillo (Hamilton) R Larrazabal (Hamilton) F Ofosu (Hamilton) G Hortelano (Hamilton) W Oczkowski (Hamilton) MP Rathbone (Hamilton)*

*Introduction:* Biomarkers of cerebrovascular ischemia would greatly impact the management of stroke patients. Biochemical surrogates indicating cerebral ischemia might also play an important role by identifying novel therapeutic strategies and by facilitating early interventions. *Objective:* Our research sought to identify early endovascular, vascular and parenchymal markers of ischemic stroke. *Methods:* Blood samples were taken within 24 hours of symptoms onset from patients with: ischemic stroke (n=13), ischemic stroke who received tPA (n=6), TIA patients diagnosed by a neurologist (n=5), myocardial infarction with onset of symptoms in the previous 24 hours (n=5), and patients with two or more risk factors for ischemic stroke (n=13). Different biomarkers for platelet activation, platelet aggregation, endothelial activation, markers of neuronal death, markers of CNS inflammation and markers of CNS regeneration were analyzed using ELISA, flow cytometry western blot and special coagulation tests. *Results:* Levels of PAR1 and PAR4 in platelets are associated with early identification of ischemic stroke in a time-dependent fashion and not linked with size or location of the ischemic event. Additionally, plasmatic CCL11, marker of CNS regeneration, is statistically different in the ischemic stroke group and cerebrovascular disease in comparison with the control group. *Conclusion:* Our findings identify easily detectable blood markers of ischemic stroke that might facilitate early diagnosis, observations that should be confirmed in a larger cohort of patients.

# Multiple Sclerosis

## G.01

### An oral gene therapy strategy for developing immune tolerance as treatment for Multiple Sclerosis using DNA-chitosan nanoparticles

*A Gomez Vargas (Hamilton)* G Hortelano (Hamilton) MP Rathbone (Hamilton)*

Gastrointestinal mucosal tolerance has been successful in animal models for the prevention and treatment of a variety of autoimmune diseases. The objective of this study is to evaluate the tolerogenic potential of orally administered chitosan nanoparticles containing DNA coding for myelin basic protein (MBP) in a multiple sclerosis animal model. Chitosan protects the DNA from gastrointestinal degradation, allowing it to transfect intestinal cells, which then express MBP is as a natural folded protein. *Methods:* Caco-2 cells were transfected in vitro with nanoparticles containing the Lac-Z reporter gene. C57BLC mice were gavaged nanoparticles/Lac-Z DNA. Once the EAE animals (n=4) developed motor symptoms, they received oral nanoparticles/MBP DNA, with Clinical follow-up. Determination of immune tolerance against MBP was made by quantification of TLR expression through RT-PCR in intestinal tissue. Histological analysis and myelin integrity were evaluated. *Results:* Particles were resistant to enzymatic and pH degradation and transfect epithelial intestinal cells in vitro. In vivo expression of LacZ was for at least 7 days after a single administration. MBP expression was able to down-regulate or delete antigen specific immune response in EAE mice, and improved the clinical deficits and myelin integrity in mice. As expected, untreated animals showed no improvement. *Conclusion:* Oral administration of MBP DNA yielded clinical benefits in the Multiple Sclerosis animal model, and might disrupt the ongoing autoimmune process.

## G.02

### Analysis of the compliance with interferon beta 1a M qW (AVONEX® PS) in patients with relapsing-remitting Multiple Sclerosis (compliance with Avonex® PS in patients with relapsing-remitting MS (COMPASS))

*Morreale, Mark M Kremenchutzky (London) V Migounov (Mississauga) M Oh (Burlington)* S Wong (Burlington)*

*Background:* Interferon beta 1a IM qW (AVONEX® PS) is indicated for patients with relapsing-remitting multiple sclerosis (MS). In chronic diseases such as MS, patient compliance to therapy is critical in order to gain the therapeutic benefit. The MS Alliance™ (MSA) program provides assistance with prescribing, administering, and monitoring patients on interferon beta 1a IM qW therapy. *Design/Methods:* Compliance was assessed prospectively, while persistence was assessed both prospectively and retrospectively to make a comparison between patients participating in the current and previous MSA programs through a chart audit process. For compliance and persistence, prospective patients were assessed at 8 weeks from therapy-initiation. *Results:* An interim analysis at 8 weeks showed that 100% (n=63) of retrospective patients and 100% (n=82) of prospective patients were deemed persistent with the weekly therapy. The average age of prospective patients was 40 years-old and 82% (n=67) were female. Of 82 prospective patients, 76% (n=62) completed the survey and were deemed compliant with 89% (n=55) never missing a dose (100% compliance), 10% (n=6) missing one dose over 8 weeks (80% compliance), and 1% (n=1) missing one dose per month (60% compliance). Final results will be presented at the conference. *Conclusions:* Preliminary results demonstrated that at 8 weeks, retrospective and prospective patients were 100% persistent with therapy. Furthermore, 89% of prospective patients who completed the survey were 100% compliant with therapy.

## G.03

### A 1-year observational study of the effects of the CCSVI procedure in subjects with Multiple Sclerosis

*W Pryse-Phillips (St. John's)* M Stefanelli (St. John's) K Murphy-Peddle (St. John's) B Barrett (St. John's)*

Validation of the CCSVI hypothesis has not hitherto included a controlled clinical trial. *Subjects:* Forty MS (McDonald criteria) patients. *Methods:* Subjects were recruited after giving informed consent. Thirty who intended to undergo the 'liberation' procedure were accepted whatever their type, stage or duration of MS. Ten others who did not were matched on the same criteria. All were managed by an unblinded neurologist who recorded their clinical status and number of relapses; by an evaluating neurologist blinded



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to all subjects' treatment status who performed clinical examinations and the Addenbrooke's Cognitive Evaluation before (baseline) and at 1, 3, 6 and 12 months after the procedure was performed (or an assigned date) to complete the Kurtzke EDSS; and by the (unblinded) RN Study Coordinator who administered the MSIS-29, the MSQoL scale and the FMSC. Brain MRIs were performed at baseline and at 3 and 12 months after subjects were operated or after the defined date (controls). Because of complications noted in some operated subjects, cerebral venography was performed in all thirty at a final visit. *Results:* The results of the study (concluding in March 2012) will be presented and discussed.

## G.04

**Subcutaneous interferon β-1a in children and adolescents with multiple sclerosis**

*L Krupp (New York)* D Pohl (Ottawa) B Banwell (Toronto) A Ghezzi (Gallarate) A Boyko (Moscow) M Meinel (Geneva) L Lehr (Geneva) M Stam Moraga (Geneva) S Tenembaum (Buenos Aires)*

*Background:* Disease-modifying drugs for adult multiple sclerosis (MS) are frequently used in pediatric patients with MS despite scant data for this MS subgroup. This study reviewed safety, tolerability, and efficacy of subcutaneous interferon β-1a (sc IFNβ-1a) in children (<;12 years) and adolescents (12 to<18 years) with MS. *Methods:* Multi-national retrospective study of patients aged<18 years who received ≥1 injection of sc IFNβ-1a for demyelinating events (n=307). The observation period was from October 1988 (first medical record available) until "lost to follow-up" or December 31, 2009. *Results:* Mean age at treatment initiation: 14.0 years; 52 patients (16.9%) were aged<12 years. Patients with: ≥1 medical events (MEs) = 190 (61.9%); prespecified MEs = 168 (54.7%); serious MEs = 12 (3.9%). ME frequency and type were similar between children and adolescents. A total of 36 patients (11.7%) discontinued treatment because of MEs. Available laboratory data showed that the most frequent abnormalities were in liver enzymes. Annualized relapse rate decreased from 1.79 pretreatment to 0.47 on therapy. Median time to the first confirmed attack after treatment initiation = 19.5 months. *Conclusions:* Adult doses of sc IFNβ-1a (44 and 22 μg, three times weekly) were generally well tolerated in pediatric MS without new or unexpected adverse drug reactions. Relapse reduction was consistent with previous IFN-β experience in the pediatric MS population.

## G.05

**An open-label, survey-based, multicenter study to determine patient satisfaction with single-use prefilled AVONEX® PEN autoinjector in Multiple Sclerosis patients (AVONEX® PEN satisfaction and patients experience clinical trial (ASPECT))**

*Morreale, Mark T Campbell (Halifax)* V Migounov (Mississauga, ON) E Cass (Burlington) S Wong (Burlington)*

*Background:* Neurologic damage from multiple sclerosis can result in impaired coordination due to sensory, motor, or cerebellar deficits. These deficits may cause difficulty with self-administration of injections if the upper extremities are affected. This study will assess if simplifying injection methods will provide increased compliance and perseverance with therapy, and enhanced satisfaction with the new autoinjector device for IM IFNβ-1a (AVONEX PEN). *Design/Methods:* A non-interventional, phase IV observational study that enrolled patients 18 to 65 years-old who have been injecting IM IFNβ-1a manually for at least 12-weeks. Primary endpoint was assessed using a Subject Satisfaction Questionnaire. Secondary endpoints were assessed using an Autoinjector Instructions Grading Scale and Ease of Use Grading Scale. Patients were evaluated at initial injection with AVONEX PEN and 2 months later. *Results:* Preliminary results of 58 patients showed that 93% of patients were satisfied with the AVONEX PEN and 91% would prefer the PEN over the AVONEX prefilled syringe (PS). Eighty-six percent of patients agreed they would switch to the AVONEX PEN from AVONEX PS. The mean score for ease of use was 8.6 and mean scores for clarity of instructions were above 9, where scores range from 0 (extremely difficult) to 10 (extremely easy). Final results will be presented at the conference. *Conclusions:* Preliminary results showed high satisfaction and ease of use rates for patients using AVONEX PEN.

## G.06

**An observational study examining factors affecting quality of life in subjects receiving Tysabri and the effect of Tysabri on quality of life in Multiple Sclerosis over 12 months (quartet - quality of life in MS)**

*Morreale, Mark F Jacques (Gatineau)* V Migounov (Mississauga, ON) L Walt (Mississauga, ON) E Cass (Burlington) S Wong (Burlington)*

*Objectives:* Primary objective was to estimate the change in Quality of Life (QoL) from the initiation of natalizumab (Tysabri®) therapy to 3- and 12-months post-initiation. Secondary objectives were to examine factors influencing QoL in MS subjects receiving natalizumab and to explore baseline and 3 month QoL measures as predictors of disability and QoL after 12-months. *Design/Methods:* A 12 month, non-interventional, observational study that enrolled patients 18 to 65 years-old who have been prescribed natalizumab. Patients were evaluated at baseline, 3- and 12-months. Primary endpoint was assessed using the MS Quality of Life (MSQOL)-54 questionnaire. Secondary endpoints were assessed using the Hospital Anxiety and Depression Scale (HADS), MS Common Symptoms Checklist (MCS), and MS Capacity Checklist (MCC). *Results:* A preliminary analysis was conducted on 127 patients at 3 months. For the primary endpoint, the MSQOL-54 questionnaire's mean physical health composite score was 48.80 [95%CI = (45.87,51.73)] at baseline and 56.16 [95%CI = (52.98,59.35)] at 3 months. The mean mental health composite score was 58.64 [95%C = (55.12,62.18)] at baseline and 65.09 [95%CI = (61.48,68.69)] at 3 months. The mean overall QoL score was 58.87 [95%CI = (55.74,62.00)] at baseline and 64.04 [95%CI = (60.50,67.58)] at 3 months. These measures were statistically different between baseline and 3 months (p=<;0.0027). Final results will be presented at the conference. *Conclusions:* Preliminary results highlighted significant improvement in the QoL of patients 3 months after starting natalizumab therapy.



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## G.07

### An unusual case of recurrent tumefactive demyelinating disease

*AG Florendo-Cumbermack (London)* M Kremenchutzky (London) SA Morrow (London)*

*Background:* Tumefactive demyelinating disease (TDD) is a rare initial presentation of multiple sclerosis (MS). Information about TDD has been garnered through case reports and case series. *Methods:* Case Report. *Results/Case Description:* A 62 year-old woman presented with a three-month history of progressive right-sided hemiparesis and numbness, cognitive changes, apraxia, aphasia, right homonymous hemianopia and then complex partial seizures. MRI showed an asymmetric bihemispheric white-matter lesion, crossing the corpus callosum with ring enhancement and significant mass effect. Biopsy demonstrated demyelination with marked macrophage infiltration, few T-lymphocytes and rare B-lymphocytes. Initially she responded well to corticosteroids and was discharged home after inpatient rehabilitation. She was readmitted six weeks later with worsening aphasia, cognitive dysfunction and enlargement of her MRI lesion with significant gadolinium enhancement. She demonstrated only partial recovery after treatment with both corticosteroids and immunosuppressive agents. Four months later she still had expressive aphasia, alexia, agraphia and severe memory impairment. She first presented ten years earlier with right-sided weakness, behavioural changes, a tumefactive lesion on MRI, confirmed to be demyelinating after stereotactic biopsy. This episode had responded to corticosteroid therapy and remained quiescent for the next 10 years. *Conclusion:* This single case report highlights many unusual features of TDD.

## G.08

### Delayed posterior reversible encephalopathy syndrome

*SM Alrashidi (Halifax )* M Schmidt (Halifax ) G Pickett (Halifax )*

*Background:* Posterior reversible encephalopathy syndrome was reported after Subarachnoid Hemorrhage complications such vasospasm and treatment with "Triple-H" therapy. Delayed presentation after vasospasm treatment is not reported. *Clinical Presentation:* We describe a 53-year-old man was treated by neurosurgeon following a subarachnoid hemorrhage due to an anterior communicating artery aneurysm rupture. Endovascular coiling was used to treat this. His recovery was complicated by cerebral vasospasm which required admission to Intensive Care Unit and treated with "Triple-H" therapy. He was then discharged home however after one week, he began to develop left arm numbness, weakness and left facial droop .he was admitted and diagnosis of posterior reversible encephalopathy syndrome based on clinical presentation and radiological images. *Discussion:* in this case developed vasospasm after a week of his discharge from the hospital and a clear improvement from his vasospasm. Images findings there is patchy involvement of the right posterior temporal lobe and occipital lobe. There is also extensive involvement of the right frontal and parietal lobes, and lesser involvement of the left parietal lobe. After an improvement of the patient from his neurological deficit images repeated showed significant resolution in the temporal and occipital lobes. *Conclusion:* Posterior reversible encephalopathy syndrome may occur after vasospasm as a delayed pattern. A careful attention should be paid to neurological deteriorations with radiological images help in an early diagnosis.

## G.09

### POLG mitochondrial disorder heralded by propofol infusion syndrome: a case report

*M Savard (Québec)* N Dupré (Québec) AF Turgeon (Québec) R Desbiens (Québec) S Langevin (Québec) D Brunet (Québec)*

*Background:* POLG is the gene coding for the catalytic subunit of the mitochondrial DNA polymerase, called DNA polymerase gamma. Mutations of the POLG gene are associated with a continuum of overlapping phenotypes, including refractory status epilepticus. Propofol infusion syndrome (PRIS) is a rare and often lethal complication of propofol use, which may be related to the mitochondrial toxicity of propofol. *Methods:* Case report. *Results:* A 27 year-old epileptic woman, sleep-deprived due to a one month post-partum state, consulted in June 2011 for repetitive seizure evolving to status epilepticus with an initial occipital focus. After an initial 48 hours of high dose propofol (up to 13 mg/kg/hour), she developed metabolic acidosis, cardiac arrhythmia and shock, considered secondary to PRIS and needing hemofiltration, from which she recovered. This conducted to the discovery of two previously reported pathological mutations of the POLG gene (c.1880g>a and c.3287g>a). Despite aggressive treatment, including oxcarbazepine, levetiracetam, lacosamide, clobazam, topiramate, valproic acid (used before diagnostic confirmation), midazolam, immunoglobulin, magnesium, hormonal therapy, ketamine, isoflurane, barbituric coma, "mitochondrial cocktail" and electroconvulsive therapy, she died 75 days after her admission. *Conclusion:* PRIS, when treating status epilepticus, may evoke the presence of a mitochondrial disorder such as POLG.

## G.10

### Factors influencing helmet use among skiers and snowboarders in Nova Scotia

*DB Clarke (Halifax)* L Fenerty (Halifax) G Thibault-Halman (Halifax) J Landry (Halifax) J Young (Halifax) S Walling (Halifax)*

*Objectives:* The purpose of this study was to examine helmet use by skiers and snowboarders in Nova Scotia, with the goals of generating baseline data for future study comparisons as well as informing policy makers for decisions with respect to snow sport helmet legislation. *Methods:* A mixed methods approach gathering observational and interview data was conducted. Interview data examined demographics as well as factors affecting helmet use and non-use. *Results:* 3336 observations were collected. There were significant gender differences in helmet use, with 80% of females and 70% of males wearing helmets. Helmet use was not significantly different between skiers and snowboarders, with approximately three quarters of both groups wearing helmets. There were differences in use between ski hills, ranging from 69 % –79%. Interview data revealed that helmet users were more influenced by the benefits of using a helmet, policy and social norms while non-helmet users revealed they were influenced by social norms, comfort, and policy. *Conclusions:* More than 25% of skiers and snowboarders remain at elevated risk for traumatic brain injury on Nova Scotia's ski hills. Regulatory changes may be required to improve helmet use rates.



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## G.11

**Acute disseminated encephalomylitis in children - a single center experience**

*AM Alghamdi (London)* S Levin (London) C Campbell (London) N Prasad (London)*

*Background:* Acute disseminated encephalomyelitis (ADEM) is uncommon in childhood. The presentation is variable, and long-term outcomes are not well characterized. *Objective:* We report on single center's experience for patients diagnosed with ADEM. *Methods:* Retrospective case series of children (15 months -16 years) diagnosed with (ADEM) between 2006 to 2011. *Results:* Ten patients were included (mean age at onset was 6 years, range 1.25 – 16 years) with a significant female predominance 8:2. The most common presenting features were ataxia in 5 (50%), followed by encephalopathy in 4 (40%), seizures in 3 (30%), and visual impairment in 3 (30%). Magnetic resonance imaging (MRI) of the brain was needed to confirm the diagnosis in all 10 children. However, in two patients MRI features were atypical of ADEM and suggested alternate diagnoses. Treatment included intravenous methylprednisolone followed by oral prednisone taper in 4 (40%), IVIG in 1 (10%), IVIG and methylprednisolone in 1 (10%), and no treatment in 4 (40%). The majority showed complete recovery, 2 patients (20%) had visual and cognitive residual deficits. *Conclusion:* ADEM in childhood has a variable presentation, MRI imaging aids in an early diagnosis. Despite the severity of symptoms at presentation, the outcome appears to be good with currently available treatments.

# Neurosurgery II

## H.01

**Is double burr hole craniostomy better than single burr hole craniostomy in treating adult patients with chronic subdural hematoma (CSH), in terms of reducing the risk of reoperation for CSH? Systematic review and meta-analysis**

*S Belkhair (Halifax)* G Pickett (Halifax)*

*Objective and Design:* There is controversy among neurosurgeons regarding whether double burr hole craniostomy (DBHC) is better than single burr hole craniostomy (SBHC) in the treatment of chronic subdural hematoma (CSH), in terms of having a lower revision rate. In order to compare the revision rates after SBHC versus DBHC, we performed a meta-analysis of the available studies in the literature. *Materials and Methods:* Multiple electronic health databases were searched to identify all the studies published between 1966 and December 2010 that compared SBHC and DBHC. Data were processed in Review Manager5.0.18. Effect sizes were expressed in pooled odds ratio (OR) estimates, and due to heterogeneity between studies we used random effect of the inverse variance weighted method to perform the meta-analysis. *Results:* Five observational retrospective cohort studies were identified: four published studies and one unpublished, describing the outcomes of 355 DBHC and 358 SBHC to evacuate 713 CSH in 631 patients. Meta-analysis showed that there was no significant difference in the revision rates between double burr hole craniostomy and single burr hole craniostomy when performed to evacuate CSH. Pooled odds ratio for all the studies was 0.62 (95% confidence interval 0.26 – 1.46). *Conclusions:* The results of this meta-analysis suggest that SBHC is as good as DBHC in evacuating chronic subdural hematoma and is not associated with a higher revision rate compared to DBHC.

## H.02

**The suture-pull gasket implant technique for multi-layer reconstruction after endoscopic pituitary surgery**

*K Elayoubi (Montréal)* AG weil (Montréal) I Nikolaidis (Montréal) R Moumdjian (Montréal) M Desrosiers (Montréal)*

*Background:* The key to avoiding cerebrospinal fluid (CSF) leak following endonasal transsphenoidal surgery is an adequate reconstruction of the skull base. When there is a significant bony defect and/or intraoperative CSF leak, bony sellar reconstruction may be indicated. In patients with persistent CSF leak despite reconstruction, inadvertent oblique malpositioning of the bony buttress may be the culprit. To avoid this pitfall, a novel technique of implant placement was developed. *Case description:* We report a case of massive CSF leak following endonasal transsphenoidal surgery for pituitary macroadenoma in a 27-year-old woman. CT scan and intraoperative findings confirmed the possible cause of CSF egress, which was a malpositioning of the bony buttress. The skull base was reconstructed in a multi-layered fashion with fat graft, fascia lata, bony buttress and vascularized nasoseptal flap. In order to avoid recurrence of CSF leak from implant malpositioning, we attached a suture on the center of the synthetic implant (Medpor ®). Traction applied to the suture pulled the gasket down and allowed us to obtain intraoperative affirmation that the buttress was secured horizontally against the skull base defect. The patient did well without recurrence of CSF leak. *Conclusion:* The suture-pull gasket implant technique is a simple method to assure its horizontal position over the skull base defect, and may prevent CSF leak resulting from buttress malpositioning.

## H.03

**Gamma knife in the treatment of pituitary macroadenomas: results of a single center**

*FA Zeiler (Winnipeg)* M Bigder (Winnipeg) A Kaufmann (Winnipeg) PJ McDonald (Winnipeg) D Fewer (Winnipeg) J Butler (Winnipeg) G Shroeder (Winnipeg) M West (Winnipeg)*

*Introduction:* Gamma Knife (GK) poses a unique means of pituitary tumor control. *Methods:* We retrospectively reviewed the charts of patients treated at our center with GK for pituitary adenomas from Nov 2003 to June 2011. *Results:* We treated a total of 86 patients, with 46 males and 40 females. Ten were lost to follow-up. There were 21 (24.4%) GH adenomas, 8 (9.3%)PRL adenomas, 8 (9.3%) ACTH adenomas, 2 FSH/LH (2.3%) adenomas, and 47 (54.7%) null cell pituitary adenomas that were treated. Sixty-six of 86 (76.7%) of the patients had previous surgical debulking. Average tumor diameter and volume was 2.21cm and 5.41cm3, respectively. The average 50% isodose line dose and max dosing were 18.5 Gy and 36.8 Gy respectively. Mean optic nerve dose was 8.87 Gy. Patient follow up was on average 32.8 months. Local control rate was 75 of 76 (98.7%), for those with follow up. Thirty-three (43.4%) of patients experienced tumor stasis, while 42 (55.2%) of patients experienced tumor regression.



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Of the 39 patients with functional pituitary tumors, 7 were lost to follow up. Improved endocrine status occurred in 16 (50.0%), while 14 (43.8%) demonstrated stable hormone status on pre-treatment medication levels. Complications consisted of 29 transient complications, and 14 serious permanent complications. *Conclusions:* GK stereotactic radiosurgery for pituitary adenomas produces excellent local control rates, and endocrine improvement in our experience.

## H.04

### Are we meeting our objectives for training? A national exit survey of neurosurgical graduates and program directors

*FA Haji (London)* Y Patel (London) D Steven (London)*

*Background:* Technological advancements and reduced resident duty-hours have dramatically altered the neurosurgical training landscape. The Royal College specialty committee recently revised the Objectives for Training (OTRs), increasing training requirements from 36 to 42 months. Empirical evidence regarding the impact of these changes on the educational experience of residents is lacking. This study was undertaken to determine the opinions of graduating neurosurgical residents and program directors (PDs) regarding their readiness for independent practice, with specific reference to the revised OTRs. *Methods:* After obtaining IRB approval, an electronic survey was developed to assess graduands' clinical knowledge, procedural skills and CanMEDS competencies per the OTRs. All Canadian PDs and neurosurgical graduates completing residency training in 2011 were invited to participate. *Results:* To date, 12/23 graduand and 13/25 PD surveys have been completed, for a response rate of 52%. Preliminary results suggest both graduands and PDs feel the OTRs are being met most of the time, but for a minority deficiencies exist in various domains, including management of pituitary tumours, neuroendoscopy, intracranial aneurysms, peripheral nerve pathology, posterolateral spinal decompression/arthrodesis and CanMEDS 'manager' role. *Conclusion:* The results of this study suggest that while the OTRs are being met in the majority of cases, deficiencies exist in a small but significant cohort. Ongoing monitoring is encouraged to determine the impact of curricular changes in these areas.

## H.05

### A novel classification system for managing pituitary/parasellar tumor patients

*DB Clarke (Halifax)* AL Hebb (Halifax) L Clarke (Halifax) L Tramble (Halifax) K Legge (Halifax) SA Imran (Halifax)*

*Background:* Currently, there are several classification schemes for pituitary/parasellar tumors that are largely based on pathological or radiological features of tumors. Although some of these schemes are useful for initial assessment and for pre-operative planning, there is currently no classification that is useful in the long-term follow-up of patients with pituitary/parasellar tumors. *Methods:* The Halifax Neuropituitary Program (HNP) provides, in one clinic, comprehensive interdisciplinary care to patients diagnosed with pituitary/parasellar tumors. We have identified practical clinical factors for developing and implementing a novel classification scheme to be used in the careful follow-up of these patients. *Results:* The HNP tumor classification system categorizes tumors by type (functioning, nonfunctioning, "other"), hormonal response to treatment (uncontrolled, controlled with medication, and cured), and tumor behavior on imaging (no visible tumor, residual tumor but no growth, and tumor growth). We have used this easy-to-use classification system for tumor surveillance and the long-term follow-up of more than 1500 patients. Importantly, our classification system has reliably identified those patients requiring treatment interventions. *Conclusions:* The HNP tumor classification system is a novel and useful tool in the clinical follow-up of patients with pituitary/parasellar tumors.

## H.06

### A comparison of SSEP amplitude recorded from the scalp and brain surface

*NA Dinn (Toronto)* DA Houlden (Toronto) E Potapova (Toronto) TG Mainprize (Toronto)*

*Background:* SSEP amplitude is used to predict outcome in comatose patients with head injuries. The lower limit of normal for SSEP amplitude is 0.9 $\mu$V in patients with an intact skull . When the skull is removed (for surgical therapy), the lower limit of normal is unknown. *Methods:* Eight patients underwent craniotomies for removal of brain tumours located away from the sensorimotor cortex for the hand. Cortically generated SSEP N20-P25 amplitude was recorded from scalp electrodes placed over C3'-C4' following contralateral median nerve stimulation in the anaesthetized patient. After the brain was exposed (skull removed), N20-P25 amplitude was recorded from a 4-electrode strip placed on the brain surface as close to hand area as possible. *Results:* The mean scalp and brain surface amplitudes were 2.5 μV (range 1.17 – 4.91) and 47.2 μV (range 19.6 - 84.7), respectively. Scalp amplitude was related to surface amplitude (R=0.95, p=0.002). The brain surface:scalp amplitude ratio was 18.5 ± 3.49 (S.D.). *Conclusions:* This preliminary study demonstrates a strong relationship between scalp and brain surface N20-P25 amplitude. It furthers the goal of establishing the lower limit of normal for brain surface amplitude so it may be used to predict outcome in comatose patients with skull removed.

| Patient | Scalp amplitude (μV) | Direct Brain amplitude (μV) |
|---|---|---|
| 1 | 1.17 | 22.2 |
| 2 | 1.40 | 19.6 |
| 3 | 1.55 | 31.2 |
| 4 | 1.68 | 23.9 |
| 5 | 2.30 | 55.2 |
| 6 | 3.54 | 63.1 |
| 7 | 3.58 | 78.3 |
| 8 | 4.91 | 84.7 |



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## H.07

**Predictors of surgery in patients admitted to the EMU: a study of 414 patients**

*A Mansouri (Toronto)* A Fallah (Toronto) G Ibrahim (Toronto) T Valiante (Toronto)*

*Background:* The Epilepsy Monitoring Unit (EMU) is essential for the pre-surgical work-up of patients with medically refractory epilepsy. However, prolonged referral times and resource limitations are significant barriers to access. It is important to identify patients who would benefit most from EMU admissions, namely those who will subsequently have epilepsy surgery. *Methods:* We performed a retrospective analysis of patients admitted for pre-surgical evaluation to the EMU of Toronto Western Hospital from 2004 to 2011. As a hypothesis-generating exercise, multivariate logistic regression was used to identify variables that could independently predict patients receiving epilepsy surgery. *Results:* Of 414 patients admitted to the EMU, 42.4% received surgery. Male patients and those with a lesional MRI were 1.9 times more likely to undergo surgery (95% CI 1.18-2.98 and 0.94-3.80, respectively). Patients with non-localizable seizures were 0.14 times more likely (7 times less likely) to undergo surgery (95% CI 0.02-1.25). *Conclusion:* We find that male gender, the presence of an MRI lesion and localizable seizures independently identify patients admitted to the EMU who subsequently undergo a resective surgical procedure. These findings must be confirmed in future datasets at other centres. If robust predictors of surgical candidacy are identified, this information can be used to triage patients for EMU admission.

## H.08

**An appropriate interval and duration for follow up of subtotally resected vestibular schwannomas**

*AD Tu (Vancouver)* R Akagami (Vancouver)*

*Background:* Vestibular schwannomas are tumors with inconsistent growth patterns. They may enlarge or remain indolent indefinitely. Subtotal resection risks progressive disease while gross total resection has a negligible, albeit not complete recurrence free rate. Given the quiescent natural history of most lesions and the resources required for follow up, determining an appropriate examination interval and duration is crucial to management. *Methods:* Chart review of patients undergoing resection of a vestibular schwannoma at Vancouver General Hospital from 2002-2010. *Results:* 291 patients were identified. Overall recurrence rate was 55% in patients with a subtotally removed lesion while total resection yielded a 1.5% recurrence rate. Most recurrences were detected between 24 – 54 months with a second peak between 90 – 96 months irrespective the completeness of resection, although size and proportion of the residual was positively correlated to progression risk. *Conclusions:* This study suggest that progression appears to occur in a bimodal distribution irrespective of the extent of resection. Given the possibility for delayed recurrences, we suggest that patients undergo early imaging to establish a baseline. They should thereafter undergo an increased frequency of follow up between 24 – 54 months and then be followed indefinitely, although at a longer interval.

## H.09

**Memory outcomes following selective versus non-selective temporal lobe resections: a systematic review**

*F Girgis (Calgary)**

*Background:* Surgical resection options in temporal lobe epilepsy can be either non-selective, as with an anterior temporal lobectomy (ATL), or selective, as with a selective amygdalohippocampectomy (SAH). Although seizure outcomes are similar with both procedures, cognitive and memory outcomes remain a matter of debate. This study aims to evaluate current evidence with regards to memory outcomes in ATL and SAH. *Methods:* A systematic literature review was conducted combining the search term 'memory' with each of the search terms 'temporal lobe epilepsy surgery', 'anterior temporal lobectomy' and 'amygdalohippocampectomy', with articles from 1990 to November 2011 included. *Results:* 27 articles met inclusion criteria. Analysis revealed that verbal memory decline is significantly associated with left ATL while visual memory decline is significantly associated with right ATL. Evidence for memory outcomes in SAH, however, was inconclusive, as studies failed to show a consistent pattern with regards to type of memory decline and side of surgery. *Conclusions:* Further research is necessary to determine superiority of selective versus non-selective temporal resection methods in regard to memory outcomes.

## H.10

**Utility of an on-line questionnaire for diagnosis of trigeminal neuralgia**

*R Nguyen (Calgary)* Z Kiss (Calgary)*

# WITHDRAWN

## H.11

**High-fidelity simulation-based microsurgical training for neurosurgical residents: a pilot study**

*FA Haji (London)* L Denning (London) T Mattingly (London) MR Boulton (London) SP Lownie (London)*

*Background:* Ttraditional Halstedian training has served well in surgical education for over 100 years. Recently, however, competency-based training has generated increasing interest. As simulation-based training will likely form an essential part of this new paradigm. Thus, development of simulation curricula that not only demonstrate learning in the laboratory, but also transfer to the operating room (OR) is essential. The purpose of this pilot study was to develop and evaluate the effectiveness of a novel simulation-training curriculum in fostering microsurgical skills among neurosurgical residents. *Methods:* A microsurgical skills curriculum was devised using an evidence-based approach. Three residents completed the program over 20 sessions, beginning with inanimate objects and culminating in live vascular anastomosis on an anesthetized rat. Targeted skills included use of the microscope, dissection of delicate tissue, hemostasis and microsurgical suturing. Transfer to the OR was assessed by comparing participant's operative performance in Carotid Endaterectomy with training-level matched controls. Assessment metrics included operative statistics



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and blinded expert global ratings of simulation-tasks. *Results:* All participants successfully completed the simulation-program and operative-task. Learning curves of performance have been generated for the simulation-trained cohort and operative task performance assessment for both groups is underway. We hypothesize a significant improvement in skills will be observed within each resident over the course of the training program and when compared to controls on the operative task.

# STROKE

## I.01

### Canadian experience with the pipeline embolization device for repair of ruptured intracranial aneurysms

*WA Alshaya (Edmonton)* CJ O'Kelly (Edmonton)*

*Introduction:* The Pipeline Embolization Device, new tool in treating complex ruptured intracranial aneurysms. The initial experience with this device in treatment of complex unruptured intracranial aneurysm was promising. *Methods:* Multicentre Retrospective cohort study of all ruptured intracranial aneurysms treated with the Pipeline Embolization Device in Canadian centres. Each centre prospectively tracked their initial experience; then data was retrospectively pooled and analysis. *Results:* 16 patients was analyzed,with follow up clinically and radiographically. *Conclusions:* Pipeline Embolization Device represent safe alternative tool in the treatment of complex ruptured intracranial aneurysms.

## I.02

### Obstructive sleep apnea and cerebral aneurysms: is there a link?

*AM Alaqeel (Riyadh)* M Al-Yamany (Riyadh) S Almasri (Riyadh) A BaHammam (Riyadh) NM Alotaibi (Riyadh) Y Mohammad (Riyadh)*

*Background:* Very few factors, such as hypertension and smoking, have been identified as a risk for cerebral aneurysms. Obstructive sleep apnea (OSA) has been established as a risk factor for intractable hypertension. Additionally, recent studies have suggested an association between OSA and abdominal aortic aneurysm. However, no data are available on the association between OSA and cerebral aneurysms. *Methods:* This case control study was designed to assess for the association between OSA and cerebral aneurysms. All patients admitted with cerebral aneurysms between 2006-2011 were interviewed using a validated Arabic version of the Berlin Questionnaire (BQ). BQ has high sensitivity and specificity for detecting the risk for OSA. Controls were patients attending primary health care centers matched for age and gender. *Results:* During the study period, 53 patients, with a mean age of 50.7± 15 years (62.2% males) were admitted with cerebral aneurysms. Among those, 35 patients (66%) had a high risk of OSA based on the BQ. This prevalence is much higher than the reported prevalence of high risk of OSA among the control group of 35.4% (n=978). *Conclusion:* OSA is common among patients with cerebral aneurysms. Further studies to confirm the independent risk of OSA for the development of cerebral aneurysms is strongly recommended.

## I.03

### Epidemiology of cerebrovascular disease among the diabetic Chinese

*S Lam (Waterloo)* JY Chu (Toronto)**

Insight on how genetic and environmental factors interact can be exposed when analyzing distinctive epidemiological and cerebrovascular patterns within the Chinese-Canadian community with stroke and diabetes. We hypothesized Chinese who had stroke-history within 15 years more commonly have diabetes than Caucasians, and Chinese more frequently have small vessels disease (SVD) than Caucasians. Last name and birth country were used to select diabetic Chinese; similarly diagnosed Caucasian were age-sex matched correspondingly. Risk factors were acknowledged if patients were given explicit medical treatment. Otherwise, guideline values were obtained from the World Health Organization. Data was collected through chart-screening for the following: diabetic prevalence, etiology and stroke type comparison in patients with diabetes mellitus, risk factor differences between two populations with DM. Odds ratios and unpaired two-sample t-testing were used to confirm significance. Significance (P<;0.05) confirms Chinese had higher DM and stroke incidence than Caucasians (28.7%vs.23.2%). Chinese with diabetes more frequently had SVD (51.1%vs.44.1%), specifically lacunar stroke (47.9%vs.36.4%). Co-morbidity of SVD+ risk factor was more frequent in Chinese. Furthermore, SVD frequency dominated over large vessels disease(LVD) in the Chinese. Chinese with stroke more frequently have diabetes than Caucasians. Chinese with diabetes are especially susceptible to small vessels disease compared to the Caucasians. Risk factor prevalence and stroke types differ considerably between Chinese and Caucasians within Toronto, signifying an urgent need for tailored treatment plans.

| | Overweight | Hypertension | Hyperlipidemia |
|---|---|---|---|
| Chinese, SVD | 26.9% | 53.8% | 36.5% |
| European, SVD | 16.5% | 33.1% | 23.6% |
| OR: Chinese/European | 1.86 | 2.36 | 1.86 |

| | Overweight, SVD | Overweight, LVD | Hyperlipidemia, SVD |
|---|---|---|---|
| Proportion of Chinese | 26.9% | 7.7% | 36.5% |
| OR: SVD/LVD | 4.42 | -- | 3.26 |
| Proportion of Europeans | 16.5% | 7.9% | 23.6% |
| OR: SVD/LVD | 2.32 | -- | 1.76 |

| | Hyperlipidemia, LVD | Hypertension, SVD | Hypertension, LVD |
|---|---|---|---|
| Proportion of Chinese | 15.0% | 53.8% | 25.0% |
| OR: SVD/LVD | -- | 3.50 | -- |
| Proportion of Europeans | 15.0% | 33.1% | 26.0% |
| OR: SVD/LVD | -- | 1.41 | -- |



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## I.04

### Thrombosis heralding aneurysmal rupture: exploration of potential mechanisms in a novel swine giant aneurysm model

*TE Darsaut (Montreal)* J Raymond (Montreal) M Kotowski (Montreal) A Makoyeva (Montreal) G Gevry (Montreal) I Salazkin (Montreal)*

*Background:* The relationship between aneurysm dimensions, flow, thrombosis and rupture, remains poorly understood. *Methods:* Bilateral carotid aneurysms were constructed in 24 animals: small aneurysms with wide necks (Group 1; n = 12 aneurysms in 6 animals); small aneurysms with small necks (Group 2; n = 8) and giant aneurysms with large necks (Group 3; n = 28). Group 3 was further divided in 3 subgroups: clipped aneurysms (n=6); aneurysms lacking an endothelial lining (n= 8); and controls (n =14). Animals were followed until rupture, or for 1-4 weeks. Angiography was performed post-operatively and before euthanasia. Aneurysms were studied at pathology, paying attention to thrombosis, recanalization, wall composition, and peri-aneurysmal hemorrhage. *Results:* Groups differed significantly in aneurysm dimensions and aspect ratio (P = 0.002). Ruptures occured more frequently in animals with untreated, wide-neck giant aneurysms (7/7) than in animals with small wide-necked (0/6), or small-necked (2/4) aneurysms (P = 0.002). Ruptures occurred only in animals with thrombosed aneurysms. Aneurysms without an endothelial lining, and 5 of 6 clipped aneurysms thrombosed but did not rupture. The aneurysm wall was deficient in α-actin, infiltrated with inflammatory and erythrocytes in all thrombosed cases. Ruptures were associated with recanalizing channels in 9 of 10 cases. *Conclusion:* Thrombosis, wall inflammation and recanalization may precipitate ruptures. A giant aneurysm model in swine is useful to study this phenomenon.

## I.05

### Hemodynamic instability after carotid angioplasty and stenting

*MK Tso (Calgary)* C Wang (Edmonton) M Almekhlafi (Calgary) J Wong (Calgary) MD Hill (Calgary) M Goyal (Calgary)*

*Introduction:* Hypotension and bradycardia, also termed hemodynamic instability, may occur after carotid angioplasty and stenting (CAS), but specific parameter cutoffs are defined arbitrarily in the literature. This study investigates if there is a relationship between hemodynamic parameters and periprocedural stroke. *Methods:* In this single-institution, retrospective study, hemodynamic data was collected from patients undergoing CAS. The relationship between dichotomous hemodynamic variables created at specific cut-off values (i.e. minimum systolic blood pressure at 70mmHg, 80mmHg, 90mmHg, etc.) and clinical outcomes were determined via the Fisher exact test, with p<;0.05 indicating significance. Receiver operating characteristic (ROC) curve analysis was used to determine hemodynamic thresholds that would predict periprocedural stroke. *Results:* There were 234 CAS procedures performed on 227 patients. The mean age was 72.7 years, of which 26% were female and 87% were symptomatic. The 30-day stroke, myocardial infarction (MI), and mortality rates were 5.6%, 0.9% and 1.7% respectively. Postoperative minimum SBP< 80 was seen in 9.2%, while minimum HR< 50 was seen in 30.3%. Postoperative anti-cholinergic administration and continuous vasopressor infusion were administered in 2.6% and 0% of patients respectively. There were no significant relationships between hemodynamic variables and 30-day stroke, MI, or death rates or as a composite outcome. *Conclusions:* Postoperative hemodynamic variables were not significantly related to periprocedural complications. A clinically-significant definition of hemodynamic instability could not be obtained in this study.

## I.06

### Stenting and coiling of bifurcation aneurysms: critical evaluation of results in an experimental canine model

*TE Darsaut (Montreal)* J Raymond (Montreal) F Bing (Montreal) A Makoyeva (Montreal) M Kotowski (Montreal) G Gevry (Montreal) I Salazkin (Montreal)*

*Background:* Endovascular treatment of wide neck bifurcation aneurysms often results in incomplete occlusion or aneurysm recurrence. The goals of this study were to compare results of coil embolization with or without the assistance of self-expandable stents. *Methods:* Wide necked bifurcation aneurysms were constructed in 24 animals and after 4-6 weeks, randomly allocated to either: Coil embolization using the assstance of one (n = 5), or two braided stents in a Y configuration (n = 5) or without (n = 6) stent assistance; Y-stenting alone (n = 4) and untreated controls (n = 4). Angiographic results were compared at baseline and 12 weeks. Neointima formation at the neck at 12 weeks was compared between groups. Bench studies were also performed to assess stent porosities. *Results:* Initial angiographic results were improved with single stent-assisted coiling stenting, as compared to simple coiling (P = 0.013). Angiographic results at 12 weeks were improved with any stent-assistance (P = 0.010). Neointimal closure of the aneurysm neck was similar with or without stent-assistance (P = 0.908), with neointima more closely associated with coil loops than with stent struts. Y-stenting alone had no therapeutic effect. Bench studies showed porosities can be decreased with stent compaction, but a porous transition zone of the stent was a limiting factor. *Conclusion:* Stent-assisted coiling may improve results of embolization by allowing more complete initial coiling.

## I.07

### Very small cerebral berry aneurysms, do they rupture?

*P Dolati (Calgary)* M Tso (Calgary) W Morrish (Calgary) JH Wong (Calgary) G Sutherland (Calgary)*

*Background:* The risk of bleeding from a cerebral berry aneurysm has been estimated about 1-2% per year. Based on the previous reports, the risk of rupture from a small aneurysm is very low. We conducted this study to analyze this risk. *Methods:* We retrospectively reviewed all patients who presented with a ruptured saccular aneurysm from 2008 to 2011. The size of the dome and neck, aspect ratio (AR), and location of the aneurysms was determined using preoperative computed tomography angiography and digital subtraction angiography. *Result:* We identified 123 patients with a ruptured saccular aneurysm. Of these, 44 patients were treated by clipping and 79 patients via coiling. The average size of the dome, neck, and AR was 6.6±4.1 mm (range 5-26 mm), 3.1 mm, and 2.6±0.9, respectively. Forty-five patients (37%) had a ruptured aneurysm measuring less than 5 mm. For these very small aneurysms (range 1.5-4.9 mm), the average size of the dome, neck, and AR was 3.9±1.1 mm, 1.6 mm, and 2.1±0.6, respectively. The anterior communicating artery was the most common location regardless of size. *Conclusion:* Very small aneurysms (<;5 mm) are



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a substantial cause of aneurysmal subarachnoid hemorrhage in our center and should be considered lesions with potential for rupture. We suggest that size alone should not be the main characteristic in determining appropriateness of prophylactic aneurysm repair.

## I.08

### White blood cell count as a potential predictor of disease severity and outcomes after acute ischemic stroke

*JC Furlan (Toronto)* M Vergouwen (Utrecht) FL Silver (Toronto)*

*Background:* The degree of inflammatory response was reportedly associated with the severity of acute ischemic stroke (AIS). We hypothesized that higher white blood cell count (WBC) is a marker of worse outcomes post-AIS. *Methods:* This retrospective study included data from the Registry of the Canadian Stroke Network on consecutive AIS patients who were admitted between July/2003 and March/2008. We excluded patients with non-stroke, subarachnoid hemorrhage, or intracerebral hemorrhage; patients taking corticosteroids, anti-convulsivants or antibiotics prior to admission; patients with cancer, liver cirrhosis or on renal dialysis; pregnant patients. *Results:* Higher WBC is significantly associated with greater impairment (p<;0.0001), disability (p=0.0005), risk of a Total Anterior Circulation Stroke (p<;0.0001) and 30-day mortality (p<;0.0001) after adjustment for major potential confounders. The Kaplan-Meier curves indicate that abnormal WBC is associated with higher mortality post-AIS (p=0.001). There was no significant association between WBC and length-of-stay in the acute care center. *Conclusions:* Our results indicate that a higher WBC on the initial admission is associated with poorer prognosis regarding impairment, disability, risk of further ischemic stroke and 30-day mortality. Those results are robust since they were properly adjusted for major potential confounders. Length-of-stay in the acute stroke care center was not adversely affected by WBC.

## I.09

### Clinical prediction models in aneurysmal subarachnoid hemorrhage – a systematic review

*Ja Ja, Blessing BW Lo (Toronto)* D Ilodigwe (Toronto) R Macdonald (Toronto)*

*Background:* Clinical prediction models enhance clinical decision making, but none of the available ones in aneurysmal subarachnoid hemorrhage (aSAH) is commonly used. Models lacking transportability or those developed using suboptimal approaches are unlikely to be used. We evaluated the methodological validity of available models and relevance of the main predictors, to identify potentially reliable models and to guide future attempts to develop and validate clinical prediction models in aSAH. *Methods:* We searched EMBASE, MEDLINE and Web of Science databases (01/1995 – 01/2011) to identify studies reporting clinical prediction models for mortality and functional outcome in aSAH . Validated methods were used to minimize bias. *Results:* Eleven studies were identified - 3 developed models from datasets of phase III clinical trials, 8 from single centre records. Median sample size was 340 (IQR 149-733). Main predictors were age (n=8), fisher grade (n=6), WFNS grade (n=5), Hunt and Hess grade (n=3), aneurysm size (n=5). Age was consistently dichotomized. Potential predictors were pre-screened by univariate analysis in 36% of studies. Only one study penalized for model optimism. Often, study details were insufficiently described. We did not find published studies externally validating existing models. *Conclusion:* Lack of external validation reduces utility of existing models for research or clinical purposes. In view of the identified methodological limitations, further studies are needed to develop and validate reliable models.

## I.10

### Biochemical prognostic markers in aneurysmal subarachnoid hemorrhage – a systematic review

*BW Lo (Toronto)* A Fox-Robichaud (Hamilton) V McCredie (Toronto) B Ja Ja (Toronto) T Schweizer (Toronto) M Meade (Hamilton) D Cook (Hamilton) R Macdonald (Toronto)*

*Background:* Intracranial aneurysmal rupture triggers both primary and secondary injurious cascades in immediate and delayed phases, leading to release of inflammatory cytokines and markers of brain damage. This systematic review collects, critically appraises and synthesizes evidence regarding CSF biochemical markers used to determine prognosis in aSAH. *Methods:* Eligible studies included observational studies of biochemical prognostic factors in aSAH. Two investigators searched MEDLINE, EMBASE, CINAHL, PROCEEDINGSFIRST, PAPERSFIRST and conference proceedings (2000-2010). QUADAS tool for quality assessment of studies of diagnostic accuracy assessed representativeness of patient inclusion, selection criteria, description of index and reference tests, interpretation of test results and clinical utility of measures. *Results:* From 750 citations, 10 observational studies met our inclusion criteria. Increased CSF concentrations of several markers were significantly associated with poor neurologic outcome – (1) S100B (n=1) – marker of brain damage, (2) malondialdehyde (MDA) (n=1) – end product of lipid peroxidation, (3) ICAM-1 (n=3) and VCAM-1 (n=1) – cell adhesion molecules, (5) neurofilament (n=1) – marker for axonal degeneration, (6) corticotrophin-releasing factor (n=1) and beta endorphins (n=1) – neuropeptides released from the hypothalamic-pituitary-adrenal axis. *Conclusions:* CSF biochemical prognostic markers signal ongoing neuronal damage, axonal degeneration, oxidative stress and hypothalamic-pituitary axis dysfunction, potentiated by release of inflammatory chemokines and cell adhesion molecules. Further studies are needed to characterize the inter-relationships between these markers.

## I.11

### Endoscopic third ventriculostomy for hemorrhage-related obstructive hydrocephalus due to intraventricular hemorrhage

*K Elayoubi (Montréal)* AG weil (Montréal) S Obaid (Montréal) MW Bojanowski (Montréal)*

*Background:* Endoscopic third ventriculostomy (ETV) is the first-line treatment for most of obstructive hydrocephalus (OH). We report our experience with ETV with/without endoscopic clot evacuation for hemorrhage-related OH. *Methods:* Retrospective chart analysis of 11 consecutive patients undergoing ETV for hemorrhage-related OH with IVH. *Results:* ETV was performed for hemorrhage-related OH in 11 patients with mean age 58 years. All patients had IVH (n=11) at the time of ETV, occuring either alone (n=3) or in association with ICH (n=3) or SAH (n=5). The etiology of hemorrhage was ruptured aneurysm in 3, ruptured AVM in 1, coagulopathy in 2, hypertensive in 3, and idiopathic in 2 patients. Clot evacuation was performed in 6 cases. Nine patients had EVDs:



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In 3 of these patients, EVD wean was unsuccessful or not performed (mortality). In 7 other patients, EVD was weaned on average 5.2 days postop. Hydrocephalus improved in 9 patients and IVH severity (Graeb score) improved on average from 4.6 to 2.7 postoperatively. At last follow-up, all survivors had a mRS< 3 and 80% (n=8) were VP-shunt-free. All three shunt-dependent patients had significant SAH. *Conclusion:* ETV and endoscopic clot evacuation are safe treatments for patients with hemorrhage-related OH. Potential advantages include avoiding/ reducing duration of EVD and preventing VP-shunt. Patients with significant SAH seem to develop VP-shunt dependent despite ETV and clot evacuation.

# Spine

## J.01

### Cost-effectiveness of spinal cord stimulation in management of neuropathic pain

*Kumar, Krishna SA Rizvi (Regina)* M Abbas (Regina)*

*Background:* We performed an economic evaluation of spinal cord stimulation (SCS) and conventional medical management (CMM). Data was collected from 313 patients with neuropathic pain secondary to refractory angina pectoris post-CABG (RAP), failed back surgery syndrome (FBSS), complex regional pain syndrome (CRPS), and peripheral vascular disease (PVD). *Methods:* The analysis takes the perspective of a Canadian provincial Ministry of Health. A Markov model simulated patient costs, transitions, and outcomes over 20 years in six-month cycles. Cost-effectiveness was judged on a willingness to pay (WTP) threshold of $23,400 per quality adjusted life year (QALY) gained. We performed deterministic and probabilistic sensitivity analyses. Outcome measures were cost, QALY gained, cost-effectiveness acceptability curve and frontier, expected value of perfect information, strategy selection frequency, net monetary benefit, and a tornado diagram to rank variable influence. *Results:* The incremental cost-effectiveness ratio (ICER) for SCS was: $12,269 (CRPS), $11,704 (FBSS), $9,653 (PVD), $9,423 (RAP) per QALY gained. SCS provided the highest expected net monetary benefit at all willingness to pay values over $17,000 per QALY. The probability of SCS serving as a cost-effective alternative to CMM ranged from 63-95% (dependent on pathology). The probabilistic sensitivity analyses indicated that results were robust to plausible variations in model costs and effectiveness inputs. *Conclusion:* SCS is a robust, cost-effective therapy for the management of neuropathic pain compared to CMM.

## J.02

### Supraspinal modulation of gait abnormalities in experimental radiculopathy

*MF Shamji (Calgary)* P Hwang (Durham) M Gabr (Durham) KD Allen (Jacksonville) BA Mata (Durham) SB Adams (Durham) WJ Richardson (Durham) J Huebner (Durham) VB Kraus (Duham) LA Setton (Durham)*

*Background:* Lumbar disc-herniation radiculopathy involves compression and inflammation of apposed neural elements, but mechanisms underlying symptom resolution remain elusive. In rodents, heterotopic disc material induces allodynia and gait asymmetry, and this study evaluated the molecular profile at the dorsal root ganglion (DRG) and midbrain periaqueductal grey in an animal disc-herniation model. *Methods:* Radiculopathy was induced in Sprague-Dawley rats by placing autologous tail nucleus pulposus (NP) onto the L5 dorsal root ganglion (DRG). Animals were evaluated for allodynia and gait, compared against controls undergoing surgical exposure only. Following sacrifice, midbrain and DRG were evaluated for neurotransmitter receptor and cytokine expression. *Results:* Persistent mechanical allodynia occurred at 1 and 4 weeks in rats exposed to NP, although gait asymmetry and impaired impulse was observed only early with late normalization. Immunohistochemical evaluation of the ventral periaqueductal grey revealed persistently high glutamate and serotonin receptor expression at 1 week with late normalization, contrasting early normal opioid receptor expression with late escalation. *Conclusion:* Persistent mechanical allodynia with transient gait abnormality in non-compressive disc herniation suggests early deficits are mediated by both spinal and supraspinal mechanisms. Early midbrain serotonin and glutamate receptor expression may aggravate allodynia while late opioid receptor expression may permit adaptive response to normalize gait.

## J.03

### Treatment of herniated lumbar disc by sequestrectomy or conventional discectomy

*MF Shamji (Calgary)* I Bains (Calgary) G Sutherland (Calgary) RJ Hurlbert (Calgary)*

*Background:* Optimal surgical technique to treat herniated lumbar disc radiculopathy remains uncertain. Advocates of sequestrectomy cite less perioperative pain and preserved disk architecture, whereas advocates of conventional discectomy cite less frequent reherniation. We evaluated the comparative success of each procedure. *Methods:* Consecutive discectomy patients were evaluated retrospectively. Parameters included demographic, radiographic, and outcomes data, to assess clinical outcome and reherniation with or without need for further operation. Continuous and categorical variables were analyzed by ANOVA and Pearson likelihood ratio with surgical technique as factor. *Results:* Among 172 patients (74 conventional discectomy, 98 sequestrectomy) followed for median 6 years, there were no differences in age, gender, smoking status, and level of disc herniation. Intraoperatively, conventional discectomy did not associate with greater blood loss or longer duration of surgery, nor with perioperative longer length of stay. Postoperatively, reoperation among conventional discectomy was 10% (6% same-level, 4% adjacent-level), lower than sequestrectomy with 19% (15% same-level, 4% adjacent-level). For sequestrectomy patients, a reherniation trend was observed among smokers. *Conclusion:* The overall reoperation rate in this cohort was 14%, more frequent with sequestrectomy. No differences occurred for blood loss, surgical time, or hospital length of stay. This study supports a more conventional surgical approach for treatment of disc-herniation radiculopathy.

| | Discectomy - Non.Smoker | Discectomy - Smoker |
|---|---|---|
| No Reherniation | 47 (96%) | 24 (96%) |
| Reherniation | 2 (4%) | 1 (4%) 17 |

| | Sequestrectomy - Non.Smoker | Sequestrectomy - Smoker |
|---|---|---|
| No Reherniation | 62 (78%) | 13 (68%) |
| Reherniation | 17 (22%) | 6 (32%) |



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## J.04

### A clinical prediction model for functional outcome after traumatic spinal cord injury

*JR Wilson (Toronto)* A Kulkarni (Toronto) AM Davis (Toronto) A Kiss (Toronto) RG Grossman (Houston) MG Fehlings (Toronto)*

*Background:* To improve prognostication after spinal cord injury(SCI) and to help classify patients within clinical trials, we created a prediction model relating acute factors to long-term functional outcome. *Methods:* Data were obtained from two prospective datasets. The primary outcome was Functional Independence Measure (FIM) motor score at 1-year follow-up. Predictor variables were obtained within 3 days of injury and included: 1) ASIA grade; 2) neurological level; 3) age; 4) MRI intramedullary signal characteristics. These predictors were chosen based on expert opinion and literature support. A linear regression model was created and validated using bootstrap re-sampling, with performance judged by R-squared values. FIM-motor score was then dichotomized and logistic modeling was used to classify patients achieving functional independence (score ≥6 for all FIM-motor items). Model discrimination was judged by the area under receiver operator curves (AUC). *Results:* Of 729 patients, 376 met the inclusion/exclusion criteria. The mean FIM-motor score at 1-year was 62.9 (±28.6). The linear model demonstrated an R-square of 0.54 in the original dataset and 0.53 across the 200 bootstraps, with mean parameter estimates for each covariate across the bootstraps closely approximating estimates from the original dataset. Functional independence was achieved by 148 patients (39.4%). For the logistic model, the AUC was 0.92, indicating excellent predictive discrimination. *Conclusion:* We anticipate that this model will have important impact to guide decision making and for counseling patients and families.

## J.05

### Minimally invasive removal of spinal tumors

*AG Weil (Montreal) A Nzokou (Montreal)* K Elayoubi (Montreal) D Shedid (Montreal)*

*Introduction:* Resection of spinal schwannomas traditionally requires bilateral muscles stripping, laminectomy and, in cases of foraminal extension, radical facectomy. Fusion is often warranted in cases of facectomy in order to prevent deformity, pain, and neurological deterioration. We report our experience with the minimally invasive removal of ED foraminal and ID-EM shwannomas using the non-expandable Spotlight tubular retractor. *Methods:* Retrospective chart analysis. *Results:* Between January 2010 and October 2011, 7 patients underwent minimally invasive removal of spinal tumors at Notre Dame Hospital. The patient population consisted of 3 lumbar ID-EM, 2 thoracic ED foraminal and 2 lumbar ED foraminal tumors. Gross total resection was achieved in 6 patients. The average duration of surgery was 197 minutes, average blood loss was 232 mL, and average length of hospitalization was 65 hours. Pain and motor deficit improved in all patients improved. *Conclusion:* ID-EM and ED tumors can be completely and safely resected through a minimally invasive approach using the non-expandable Spotlight tubular retractor. This approach may be associated with even less tissue destruction than mini-open techniques, translating in a quicker functional recovery. In cases of foraminal tumors, by eliminating the need for facectomy, this minimally invasive approach may decrease the incidence of postoperative deformity and eliminate the need for adjuctive fusion surgery.

## J.06

### A novel case of communicating hydrocephalus caused by an un-ruptured perimedullary arteriovenous fistula in the lumbar region of an infant

*MP Wilson (Edmonton)* KE Aronyk (Edmonton) JA Pugh (Edmonton)*

*Introduction:* Perimedullary ateriovenous fistulas (PMAVFs) are rare spinal diseases that compose 14-34% of spinal AVMs. Presentations include acute or progressive myelopathic symptoms, hematomyelia, or subarachnoid hemorrhage. To date, no known reports of an un-ruptured PMAVF causing communicating hydrocephalus have been published. *Case Report:* A 17-month-old girl presented to clinic with a six-month history of gait regression, constipation and marked hyperlordosis of her lumbar region secondary to a PMAVF with primary feeders from L1 spinal arteries. An MRI brain also demonstrated marked communicating hydrocephalus. The patient underwent fluid embolization with Onyx of two feeders from the right L1 and one feeder from the left L1 lumbar arteries. Post-embolization follow-up and imaging demonstrated a reduction in size of the L1 pedicles and no residual supply of the fistula. A three-year clinical follow-up has shown complete recovery of bowel function with significant improvements in gait and hyperlordosis. Her ventricular enlargement has improved without directed management. *Discussion:* This is the first known reported case of communicating hydrocephalus caused by an un-ruptured PMAVF. The authors postulate the origin of the hydrocephalus as either central venous hypertension caused by the high-flow fistula or an obstruction of arachnoid granulations in the lumbar region of the spinal cord reducing re-absorption. Treatment of this complication should focus initially on management of the fistula with additional hydrocephalus management if necessary.

## J.07

### MRI artifact following ACDF with trabecular metal cage

*CA Elliott (Edmonton)* R Fox (Edmonton) A Nataraj (Edmonton)*

*Background:* Persistent symptoms following ACDF may require repeat MRI on which an intervertebral trabecular metal cage (TMC) imparts paramagnetic artifact. We investigated the impact of this artifact on assessment of ongoing spinal cord or root compression at the level of previous surgery. *Methods:* MRI images of patients who underwent ACDF with an intervertebral TMC or with bone graft were randomly displayed to blinded spinal surgeons. Each surgeon was asked if they were able to assess the anatomy of the spinal cord and nerve roots and if so, whether there was ongoing cord or root compression at the level of the previous surgery. *Results:* 66 patients with an ACDF and post-operative MRI were identified: 30 with an ACDF with intervertebral TMC and 36 with an ACDF with intervertebral bone graft. Spinal surgeons were unable to assess ongoing root compression in 41% of patients with ACDF with intervertebral TMC compared to 14% of those with ACDF with intervertebral bone graft, based on preliminary analysis. Assessment of cord compression on the other hand is not significantly affected. Interobserver and intraobserver reliability will be calculated. *Conclusions:* Intervertebral TMC imparts significant paramagnetic artifact on MRI that limits assessment of ongoing root compression.



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## J.08

**Chordoma and chondrosarcoma: a study of outcome measures, utility and health status**

*S Mohammed (Toronto)* M Cusimano (Toronto)*

*Introduction:* Chordomas and chondrosarcomas are rare slow-growing infiltrative neoplasms arising from the remnants of the primitive cells. *Objectives:* To develop an outcome measure, to determine a utility value and to measure the health status of these patients. *Methods:* The process of this questionnaire development was divided into 5 steps: identification of patient population, item selection, item reduction, questionnaire design, and questionnaire validation. *Results:* A total of 8 sessions of Focus group interviews were done. This included 41 patients in total. A total of 432 items were thus generated. After redundant item were removed 105 items were left. Impact scores were then calculated for each item and the top 25 items in each of the domains (General, Cranial and Spinal) were selected. There were a total of 201 respondents to the item reduction questionnaire, of which 143 had chordoma and 58 had chondrosarcoma 46.3% male. Average age was 47. Each of the health scales and summary measures were significantly lower than the norms. The calculated overall health related QoL utility score was 0.71. Correlation between demographic data and health status measurements yielded relationships. *Conclusion:* The quality of life of chordoma and chondrosarcoma patients is a quantity that can be reliably measured.

## J.09

**Cervical spine morphometric changes after ACDF and Cervical Disc Arthroplasty**

*MF Shamji (Calgary)* A Fichadi (Calgary) S Casha (Calgary) S Duplessis (Calgary) RJ Hurlbert (Calgary) WB Jacobs (Calgary)*

*Background:* While ACDF effectively treats cervical degenerative disc disease, concern about degeneration at adjacent levels prompted development of cervical disc arthroplasty (CDA) devices. This technology permits operated-level movement and may reduce adjacent level stress. We used cervical spine radiography to evaluate spine morphometry after these procedures. *Methods:* Consecutive single-level ACDF and CDA patients were evaluated retrospectively. Parameters included demographic and cervical spine radiographic data, obtaining preoperative and postoperative measurements of static disc heights alongside dynamic angulation for whole-cervical spine and targeted near the operated level. Data were analyzed with timepoint and treatment group as factors. *Results:* Among 34 patients (20 ACDF, 14 CDA), there were no differences in age, gender, smoking status, and operated level. Subaxial cervical spine flexibility was higher after CDA than ACDF, as was local three-segment motion through the operated region. Movement subjacent to an ACDF was greater than preoperative measurement and CDA. Decreases in adjacent disc height were more prevalent after ACDF, particularly among female patients. *Conclusion:* This study demonstrates decreased whole-spine flexibility following ACDF, although with greater motion subjacent to the fusion. CDA patients have no compromise of spine flexibility and unchanged adjacent dynamic characteristics. Further prospective work will reveal how this altered motion affects symptomatic adjacent degeneration.

## J.10

**Effect of age on cervical spine degenerative disorders**

*A Yassin (Hamilton)* E Kachur (Hamilton) M Bennardo (Hamilton)*

*Objective:* To identify an age effect on the level of degenerative cervical spine disorders. *Method:* A retrospective review of the medical records of patients underwent surgical treatment of degenerative cervical spine disorders from Jan. 2007 to Sep. 2011. *Results:* A total of 142 patients (n=93 males and n= 49 females; 65% and 34%, respectively) met the inclusion criteria. Of these, 62% had smoking history. Forty-eight percent (n=68) underwent one-level surgery and 52% (n=74) underwent multi-level surgery with a total of 243 cervical level manipulation. There was a statistically significant difference between groups as determined by a one-way ANOVA ($F(3,239) = 8.751$, $P=0.0001$). A Tukey post-hoc test revealed that the age associated with cervical level degeneration was significantly lower for levels C6-C7 (50±10.7 yrs, $P = 0.0001$) and C5-C6 (54.5±12.3yrs, $P= 0.011$) than the other levels tested and no difference was seen in level C4-C5 (60.0±13.6 yrs, $P= 1.00$) when compared to level C3-C4 (61.8±12.5 yrs) . *Conclusion:* Cervical degeneration beginning in higher cervical levels (C3-C4 and C4-C5) prior to 60 years old is unlikely. However, as a person ages past 60, the cervical degeneration in these higher levels is very likely. Although there is some speculation as to why there are differences in cervical level of degeneration over time, this matter is still not well understood.

## J.11

**Cost utility analysis: anterior cervical discectomy and fusion versus cervical disc arthroplasty**

*CC Gillis (Vancouver)* C Hoelscher (New York) J Goldstein (New York) D Warren (Vancouver)*

*Background:* Several randomized controlled trials (RCT) have demonstrated that cervical disc arthroplasty (CDA) achieves equivalent results to anterior cervical discectomy and fusion (ACDF) on short-term clinical outcomes. We examined whether ACDF or CDA has greater cost-utility in the treatment of single-level disc herniation. *Methods:* This was a retrospective review of single institution data from a multi-center RCT to comparing the efficacy of ACDF and CDA. *Results:* There were 28 patients included in our analysis. Medicare reimbursements yielded an average cost of $16,162 USD for ACDF and $13,171 for CDA. Quality adjusted life years (QALYs) were calculated based on SF-36 scores. ACDF provided a cost-utility of $70,269/QALY at one-year follow-up, compared to CDA at $87,806/QALY. At two years, the cost-utility was $34,387/QALY for ACDF compared to $41,159/QALY for CDA. Cost utility analysis (CUA), otherwise known as an incremental cost-effectiveness ratio (ICER), was performed demonstrating that ACDF came at a cost of $37,387/QALY at one year, and $19,940/QALY at two years. *Conclusions:* Based on our patients at a 2-year time point, we demonstrate that cost/QALY values are in favor of ACDF, giving it a better cost-utility profile. However, based on the CUA, the greater utility comes at a significant price close to the accepted threshold of $50,000.



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# Poster Presentations

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

### P.001

**Epilepsy, epileptics and epilepsy surgery; what do Saudi's know?**

*AM Alaqeel (Riyadh)* AJ Sabbagh (Riyadh)*

*Background:* Epilepsy is prevalent in Saudi Arabia, approaching 6.54 per 1000 population. We conducted this study to verify the level of public awareness toward epilepsy. *Methods:* A survey of 29 questions, pertaining to epilepsy awareness was distributed to Saudi population. *Results:* Of the 7078 subjects who completed the questionnaire, 6756 (95.5%) have heard about epilepsy. 3660 (51.7%) named mass media as the source of their knowledge. 5164 (73%) agreed for their children to mix with epilepsy patients. However, 5382(76%) objected having their children marry an epilepsy patient. 1004 (14.2%) think that epilepsy is infectious and 574 (8.1%) believe that epilepsy is a type of madness. 1509 (21.3%) did not know a single cause of epilepsy. 3493 (50.6%) will not seek medical advice if one of their relative had epilepsy. 2221 (31.4%) did not know how to deal with epileptic patient during attack. 7014 (99.1%) did not know about the existence of an epilepsy surgery. 1128 (15.9%) would not abide by a physician's advice not to drive a car because of their illness, 563 (50%) of which listed public transportation's difficulties as a reason for that. The effect of age and level of education was statistically significant on most of the study variables. *Conclusion:* The level of epilepsy awareness needs substantial improvement. Prompt public health measures should be urgently adapted to raise the level of epilepsy awareness.

### P.002

**Treatment of neurosis with anti-epileptic medications!**

*A Rana (Toronto)* M Rana (Toronto) A Al-Shahrani (Riyadh) AN Rana (Toronto) H Cader (Toronto)*

*Objective:* To discuss use of AEDs in non-neurological causes of loss of consciousness. *Background:* Determining the exact cause of LOC may be difficlut. Once started, stopping of AEDs may be challenging in these patients. *Methods:* A 29 year-old female had multiple episodes of LOC preceeded by dizziness corresponding to sinus tachycardia of 137 on loop recorder. Ambulatory EEG while episode of loss of consciousness, CT, MRI, Echocardiogram, Routine EEG was normal. Neurologist declined patients requests of starting AED till she had one episode in cardiologists office. Tilt table testing was positive. An 87 year-old female had nine episodes of LOC only with blood draw, bronchoscopy, ultrasound, echocardiogram and noramal CT, MRI, Carotid ultrasound, Ehocardiogram was sent to ER and ended up being on phenytoin while her episodes were clearly non-epileptic. Third patient was a 49 year-old female who had long standing history of episodes of LOC with hyperventilation. Neurologist did not start her on AED but she presented to ER, was admitted to hospital, and was started on three AEDs. After investigations were normal and she had two episode witnessed by two different neurologists, her AEDs were discontinued. *Results:* As above *Conclusion:* Need for AEDs should be carefully assessed in LOC. Carefully history taking, use of prolong heart monitoring and EEG are helpful in further assessment and may avoid unnecessary treatment with AED.

### P.003

**Temporal lobe disconnection for intractable epilepsy in an intraoperative MRI setup with electrocorticography: a technical report**

*SM Alrashidi (Halifax )* AJ Sabbagh (Riyadh) S Sinha (Riyadh) F Bamogaddam (Riyadh) K Siddiqui (Riyadh)*

*Cases:* The first patient was a 24 year-old right handed male his Video-EEG evaluation confirmed left TLE for 16 years with left mesial temporal sclerosis, on neuroimaging. The second patient was a 33 year-old right handed female who had Video- EEG proven right TLE for 24 years and a constant lesion seen in the right amygdala. *Surgical Methodology:* Procedure involved through a small temporal craniotomy, both patients had neuronavigation guided amygdalohippocampectomy (including the lesions. In the first patient intraoperative electrocorticography (ECoG) was done at that point suggestive of temporal pole discharges thus it was decided to disconnect the temporal lobe. In the second patient, there was a relatively large temporal pole veins hence we decided to not remove the temporal pole and to just disconnect it. Both had intraoperative MRI (iMRI) to prove resection and disconnection. *Result:* The first patient is seizure free for twenty months post OP and is a practicing nurse. The second patient is fourteen months post op and seizure free and none of the patients had any visual field defects. *Conclusion:* Temporal disconnection technique is a minimally invasive technique as it involves less brain tissue resection and may potentially decrease risk of optic radiation injury. iMRI is a useful tool to evaluate the amount of resection and to prove the extent of disconnection.

### P.004

**Surgical predictors in patients undergoing iEEG monitoring: a study of 71 patients**

*A Mansouri (Toronto)* A Fallah (Toronto) G Ibrahim (Toronto) T Valiante (Toronto)*

*Background:* Relative indications for invasive intracranial EEG (iEEG) monitoring include normal imaging, extratemporal seizure foci, discordant noninvasive data and proximity to eloquent cortex. Given the risks of iEEG implantation and the substantial portion of patients that do not go on to surgery, we sought to identify factors associated with subsequent surgery following invasive monitoring. *Methods:* We performed a retrospective observational study of patients who underwent iEEG implantation at Toronto Western Hospital (2004-2011). Logistic regression was used to identify variables that could independently predict subsequent resective



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surgery. *Results:* 414 patients were admitted to the EMU; 71 (17%) underwent iEEG monitoring, of which, 35 (49%) went on to resective surgery. On univariate analysis, a history of febrile seizures and lesional MRI were associated with subsequent epilepsy surgery (p = 0.051 and 0.027 respectively). On multivariate analysis, patients with a history of febrile seizures were 8.2 (95% CI 1.0 - 70.7; p = 0.055) times more likely to have resective surgery. *Conclusion:* A history of febrile seizures is likely associated with increased odds of having mesial temporal sclerosis and may be an independent predictor of surgical candidacy. If true, this may facilitate triaging and improve selection of patients that undergo iEEG implantation.

# HISTORY, EDUCATION

## P.005

### Founder of nursing profession: the Florence's Nightingale or the Islamic Eagle

*AM Alaqeel (Riyadh)* S Almasri (Riyadh) H Jradi (Riyadh) Y Mohammad (Riyadh)*

*Background:* It is often recognized that the nursing profession was founded by Florence Nightingale in 19th century. However, data on the history of nursing profession in the Islamic world is scarce. *Methods:* We searched the MEDLINE for any original or review article that pertains to the history of nursing profession. *Results:* nursing was founded at a time that predates the era of Florence Nightingale. Rufaidah Al-Aslamiya was the first nurse identified in Islam. She lived during the time of the Prophet Mohammad (PBUH) in the 8th century (CE). Like Nightingale, Rufaidah set up a training school for nurses, developed the first code of conduct and ethics, and was a promoter of community health. She cared for patients in a tent erected outside the Prophet's (PBUH) mosque and led nurses in caring for the wounded during the time of the Holy Wars. And after the wars, Rufaida continued nursing in a mosque improving her skills and laid its basics using the experience she had acquired. Therefore we consider her the first to establish the technological roots for nursing, guided by the teachings of Islam and serving God. Rufaidah had a kind and empathetic personality that soothed the patients in addition to the medical care that she provided. *Conclusion:* Rufaidah Al-Aslamiya, who practiced and founded nursing 14 hundred years ago, is the mother of nursing.

## P.006

### Increasing the appeal of neurosurgery to qualified medical students in Canada

*MP Wilson (Edmonton)* JA Pugh (Edmonton)*

In the past ten years, the number of students entering the Canadian Resident Matching Service (CaRMS) has more than doubled to over 2500, while the number of students applying to Neurosurgery as a first choice discipline has remained relatively constant with an average of 18. In five of the past ten years, fewer students have ranked Neurosurgery as a first choice discipline than the number of residency positions available. Given the steady increase in students entering CaRMS without a paralleled increase in students applying to Neurosurgery, we can no longer be assured that Neurosurgery is attracting top applicants. While several factors contribute to disproportionate application rates: awareness, career concerns, and gender disparities may be specifically addressed to reduce deterrents for qualified applicants. A letter to the Editor of the Canadian Journal of Neurological Sciences has been submitted addressing student concerns with Neurosurgery as well as provide suggestions to increase appeal to Neurosurgery. Suggestions to increase appeal which have shown success in other specialties and institutions have included establishing mentorship, shadowing and student research programs, establishing Neurosurgery interest groups, increasing exposure during pre-clinical years, providing positive experiences during electives and establishing a website for easy access to student information.

## P.007

### Simultaneous good work in neurosurgery and neuroscience: myth or reality?

*F Girgis (Calgary)**

*Background:* Performing good work in either neurosurgery or neuroscience alone is a challenge. Despite this, a large number of neurosurgeons divide their careers between the two fields, and attempt to perform good work in both arenas simultaneously. The purpose of this study is to determine if it is possible to do good work in both neurosurgery and research simultaneously, or whether one field suffers at the expense of the other. *Methods:* This question was put to practicing neurosurgeons via an electronic survey that was distributed to resident and staff neurosurgeons in Canada. In addition, select scientists, clinical neurosurgeons, and neurosurgeon-scientists were interviewed for a more in depth view of the same issues. *Results:* 54 surgeons completed the survey, 32 of whom were current or intended neurosurgeon-scientists. Themes explored through the survey included motives behind the pursuit or absence of research in one's neurosurgical career, the quality and feasibility of a dual career, and alternatives to one individual assuming a dual role. *Conclusions:* The opinions obtained revealed that it is possible to do good work in both neurosurgery and neuroscience simultaneously, but in reality it is very difficult to do. Alternatives to this dual career, such as collaboration between clinical neurosurgeons and pure scientists for example, may help bridge the gap between clinical and research arenas.

## P.008

### Contribution of Donald Calne in neurology

*A Rana (Toronto)* M Rana (Toronto) AN Rana (Toronto) H Cader (Toronto)*

*Objective:* To discuss contribution of Donald Calne in Neurology. *Background:* Canadian neurologists have always played an active role in the research and education of neurology. Donald Calne and Ali Rajput are the two recently retired neurologists who are known for their work in Movement disorders at national and international levels. *Methods:* We reviewed all available resources including internet, pubmed, and medline to study the work of Donald Calne. *Results:* Dr. Calne was one of the first Neurologists who initially used synthetic dopamine to treat Parkinson's disease. He worked as a neurologist at the Hammersmith Hospital and Royal Postgraduate Medical School in London. He was also a Clinical Director and Chief of the Experimental Therapeutics Branch of the National Institutes of Neurological Diseases at the NIH. He was among the



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first few scientists who observed the subclinical damage in the brain before symptoms of Parkinson's would become apparent. Calne and Dr. J.W. Kebabian also defined the two different types of dopamine receptors. He headed a team of 13 researchers using brain imaging technology for research in Parkinson's disease. He published over 500 papers and book chapters in neurology, as well as several books. Dr. Calne was professor of neurology and retired few years ago as the Director of the Neurodegenerative Disorders Centre at UBC, Vancour. *Conclusion:* Work of Donald Calne in Neurology and Movement disorders is unsurpassable.

# Movement Disorders (Basic Science, Neurology, Imaging & Functional Neurosurgery

## P.009

### Medication ordering practices for Parkinson's Disease patients admitted to hospital

*KM Wiltshire (Calgary)* S Furtado (Calgary) GA William (Calgary) D Southern (Calgary) S Kraft (Calgary)*

*Background:* Patients with Parkinson's disease (PD) often have complex treatment regimens. Abrupt discontinuation or under-dosing of anti-parkinsonian medications, or administration of central dopamine blocking agents can worsen PD symptoms. *Methods:* Patients with PD from the city's movement disorders clinic database were cross-referenced with the city's hospital admissions database for admissions occurring in 2010. Medication reconciliation of anti-parkinsonian medications and ordering of central dopamine blocking medications during admission was evaluated. *Results:* 403 patients were screened. 55 admissions for 44 PD patients were analyzed. Differences between outpatient and admission prescriptions of antiparkinsonian medications or prescription of dopamine blocking medications during admission were noted in 44/55 (80%) admissions. Differences between pre-admission and admission levodopa orders were noted in 26/53 (49.0%) admissions. In 19/55 (34.5%) admissions the patients were taking PD medications in addition to levodopa. 7/19 (36.8%) had differences in the ordering of these medications at the time of admission. Dopamine blocking agents were ordered during 24/55 (43.6%) admissions. *Interpretation:* Our study identifies significant deficiencies in the in-hospital prescribing of medications for PD patients. This includes a failure to seamlessly continue home medications on admission and the addition of dopamine blocking agents during their hospital stay. Widespread education of providers and safe-prescribing protocols are urgently needed to address this unsafe care.

## P.010

### Causes of shortness of breathing in Parkinson's Disease

*A Rana (Toronto)* M Rana (Toronto) AN Rana (Toronto) M Al-Shehri (Toronto) S Khondkar (Toronto)*

*Objective:* To discuss different causes of shortness of breathing in Parkinson's disease. *Introduction:* Shortness of breathing is an important non-motor symptom experienced by PD patients. It is important to identify the cause of shortness of breathing to ensure the appropriate treatment is initiated and unnecessary invasive investigations are voided. We report a patient with PD who was taking levodopa and developed both shortness of breathing and hyperventilation during wearing off periods. *Methods:* A 61-year-old male with PD developed a wearing off effect approximately one hour prior to every dose of levodopa. During off periods, he complained of shortness of breathing and hyperventilation, which would make him very anxious and consequently worsen his symptoms. These complications resulted in numerous visits to the emergency room, and investigations including a chest X-ray, CT scan of his chest, ECG, spirometery, pulmonary and cardiac assessments, which were unremarkable. Careful history taking revealed that his shortness of breathing was in fact a wearing off symptom. Addition of a COMT inhibitor caused an improvement in his condition. *Results:* Shortness of breathing in PD can also be due to anxiety, and dyskinetic effect of levodopa in additions to wearing off periods. *Conclusion:* Shortness of breathing in PD should be assessed carefully because of variety of its causes and difference in treatments to avoid unecessary invasive investigations.

## P.011

### The pill questionnaire in a non-demented Parkinson's Disease population

*W Reginold (Toronto)* MJ Armstrong (Toronto) S Duff-Canning (Toronto) A Lang (Toronto) S Fox (Toronto) B Rothberg (Toronto) C Zadikoff (Chicago) N Kennedy (Chicago) D Gill (Hershey) P Eslinger (Hershey) M Mapstone (Rochester) K Chou (Anne Arbor) C Persad (Anne Arbor) I Litvan (Louisville) B Mast (Louisville) C Marras (Toronto)*

*Background:* We assessed the Pill Questionnaire as a screen for mild cognitive impairment in non-demented Parkinson's disease patients. *Methods:* The relationship between performance on the Pill Questionnaire, mild cognitive impairment and deficits on neuropsychological tests was assessed in movement disorders clinic patients. *Results:* In 109 subjects, impaired performance on the Pill Questionnaire was associated with lower scores on the Montreal Cognitive Assessment, the Scales for Outcomes in Parkinson's disease-Cognition and with deficits in memory, attention, executive function-inhibitory control and language. Poor performance was also associated with mild cognitive impairment, positive predictive value 71% and sensitivity 41%. *Conclusions:* The Pill Questionnaire is not sensitive enough to be used as the sole screening tool for mild cognitive impairment. The combination of its convenience and association with cognitive impairment make the Pill Questionnaire a practical adjunct to the clinical evaluation of patients with PD, serving as a red flag for cognitive impairment.

## P.012

### Missense mutations in the ITPR1 are associated with SCA 29: autosomal dominant nonprogressive spinocerebellar ataxia

*Huang, Lijia J Warman (Ottawa)* R Zou (Ottawa) M Carter (Toronto) T Dudding (Newcastle) J Schwartzentruber (Montreal) D Bulman (Ottawa) K Boycott (Ottawa)*

Congenital nonprogressive spinocerebellar ataxia is characterized by early gross motor delay, hypotonia, gait ataxia, and mild dysarthria and dysmetria. Linkage to 3pter has been demonstrated in one large



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Australian family with autosomal dominant congenital nonprogressive spinocerebellar ataxia and designated as spinocerebellar ataxia 29. We report another Canadian family diagnosed with autosomal dominant congenital nonprogressive spinocerebellar ataxia and identified missense mutations in the ITPR1 gene in both families. ITPR1 encodes inositol 1, 4, 5-trisphosphate receptor, type 1, a ligand-gated ion channel that mediates calcium release from the endoplasmic reticulum. Deletions in ITPR1 are known to cause spinocerebellar ataxia 15, a very slowly progressive form of cerebellar ataxia with onset in middle age. Our study demonstrates that, in addition to spinocerebellar ataxia 15, mutations in ITPR1 can also cause congenital nonprogressive spinocerebellar ataxia. This finding expanded the phenotypical spectrum caused by ITPR1 mutations suggesting a molecular diagnosis of the ITPR1 in patients with congenital nonprogressive spinocerebellar ataxia.

# Neuro-Oncology (Medical and Radiation Oncology, Imaging, Tumour Surgery, Basic Science)

## P.013

### Cystic meningiomas: case series

*N Chaudhary (London)* S Das (London) J Megyesi (London) LC Ang (London) D Macdonald (London)*

*Introduction:* Cystic meningiomas represent 2-4% of meningiomas. Given their heterogeneous radiographic appearance, they are difficult to distinguish from high-grade lesions. *Methods:* We present two cases of cystic meningiomas. In one case, solid meningioma was discovered incidentally. Transformation into a cystic meningoma was captured by serial MRI scans. In the second case, the patient was presumed to be a high-grade glioma based on initial radiographic appearance. *Results:* Patient 1 is a 57 year-old woman who presented with an incidental meningioma. A cyst developed at 4-year radiographic follow-up, at which time she developed seizures. Patient 2 is a 49 year-old woman who presented with progressive left sided weakness. Imaging revealed a parasagittal mass. Pathology was WHO grade I meningioma in both cases. Both patients remain free of tumor progression at a 1 year follow-up, respectively. *Conclusion:* Cystic meningiomas are difficult to distinguish from higher grade lesions. Given rapid growth of the cyst, surgery is necessary to rule out: 1) high grade lesions and 2) transformation of a low grade meningioma into a higher grade meningioma. Although both patients had low grade lesions, it is unclear whether these would have transformed into a higher grade over time, without intervention. Given rapid growth and progressive symptoms, following the natural history of these cystic meningiomas was not feasible in either of our patients.

## P.014

### Thyroid metastases to an anaplastic meningioma: a rare and aggressive histopathological entity

*N Chaudhary (London)* S Das (London) D Macdonald (London) LC Ang (London) J Megyesi (London)*

*Introduction:* Tumor-to-tumor metastases has become an increasingly described entity. Case reviews have revealed meningiomas as the 3rd most common recipient tumor, following renal cell carcinoma and sarcoma. The most common donor tumors include breast cancer followed by lung cancer. *Method:* To the best of our knowledge, we present the first documented case of thyroid carcinoma metastases to an intracranial anaplastic meningioma. *Results:* A 64 year-old woman was diagnosed with papillary thyroid cancer 3 years earlier. She was treated with thyroidectomy, neck dissection, and radioactive iodine. The following year, CT revealed lymphadenopathy, leading to a modified neck dissection and second radioactive iodine treatment. Subsequently, an MRI revealed a right parietal scalp/extra-axial lesion. A craniotomy was performed, and she received a third radioactive treatment. Pathology was consistent with metastatic papillary thyroid carcinoma. Follow-up MRI revealed recurrent growth, and she had a repeat craniotomy for tumor resection. She is currently receiving postoperative radiation. *Conclusion:* Our patient meets the criteria for tumor to tumor metastases, as imaging and pathological analysis confirms the presence of both an intracranial menigioma and thyroid cancer. The aggressive nature of this lesion may be explained by both the donor tumor and recipient tumor. In our patient, it is likely that the prognosis is even further worsened when occurring in conjunction with an anaplastic meningioma.

## P.015

### Primary lymphoma isolated to the trigeminal nerve

*A Jack (Edmonton)* C Elliott (Edmonton) C McDougall (Edmonton) J McCombe (Edmonton) J Findlay (Edmonton)*

*Background:* Primary CNS Lymphoma (PCNSL) is a hemispheric and sometimes multifocal disease comprising 0.5-1.5% of primary brain tumors. Its presentation as an isolated cranial neuropathy is exceedingly rare. We report a case of PCNSL which at initial presentation localized to the trigeminal nerve. *Case Presentation:* A 57-year-old man presented with isolated left trigeminal V1 distribution pain. Over several months and during medical investigation his clinical condition worsened to include diplopia, left-sided ptosis, agitation and then stupor. Serial MRI studies over a 4-month period demonstrated isolated trigeminal nerve enhancement followed by progressive frontal lobe and deep nuclei edema. Investigation (including positron emission tomography and bone marrow biopsy) for an extracerebral malignancy was negative. A trigeminal nerve biopsy was performed as a last resort and pathological examination revealed a large B-cell lymphoma. The patient was treated with methotrexate, procarbazine, vincristine, rituximab, and cytarabine. At last follow-up the patient's confusion, pain and diplopia had cleared, although facial numbness persisted. *Conclusion:* PCNSL presenting as an isolated trigeminal neuropathy is rare, but it should be considered when investigation for metastatic disease is negative. Trigeminal nerve biopsy was necessary in the patient reported here, and chemotherapy was effective in ameliorating most of his symptoms and signs.



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# Neuromuscular Diseases (Basic Science, EMG/NCS & Peripheral Nerve Surgery)

## P.016

### Supramaximal stimulus intensity in demyelinating and axonal neuropathies

*V Tang (Ottawa)* J Mills (Ottawa) C Goldsmith (Ottawa) P Bourque (Ottawa)*

*Background:* The ability of an electrical stimulus to excite the nerve depends on electrical impedance of the intervening tissues, including the endoneurium, and axonal excitability. We routinely acquire data on the supramaximal stimulus intensities in normal subjects, patients with Charcot-Marie-Tooth (CMT), chronic inflammatory demyelinating polyneuropathy (CIDP), acute inflammatory demyelinating polyneuropathy (AIDP) and amyotrophic lateral sclerosis (ALS). *Methods:* Supramaximal intensities in milliamperes (mA) were retrospectively obtained from median and ulnar motor nerve conduction studies in normal subjects (n=42 median and ulnar); CMT with demyelinating features (n=15 median and ulnar); CIDP (n=20 median, n=16 ulnar); AIDP (n=13 median and ulnar); and ALS (n=18 median, n=10 ulnar). *Results:* In the median and ulnar nerve studies, the mean supramaximal intensities were significantly higher in patients with CMT (median 43.4 mA; ulnar 47.7 mA) and CIDP (median 38.9 mA; ulnar 49.3 mA) than normal controls (median 25.3 mA; ulnar 19.0 mA) (p<;0.05). There was no significant difference in supramaximal intensities between CMT and CIDP. In the ulnar but not the median studies, higher supramaximal intensities were required in CIDP compared to AIDP (median 30.3 mA; ulnar 27.2 mA). *Conclusions:* Chronic demyelinating neuropathies, both hereditary and acquired, require higher supramaximal stimulation intensities than normal. This may be due to increased electrical impedance from chronic pathological changes in the myelin or alterations in nodal properties.

## P.017

### Axonal misdirection in a femoral nerve neuroma in continuity injury model

*JD Alant (Calgary)* JM Forden (Calgary) R Midha (Calgary)*

*Background:* Management of traumatic neuroma-in-continuity (NIC) poses ongoing challenges to peripheral nerve surgeons. Axonal misdirection with non-specific reinnervation, frustrated regeneration and axonal attrition following NIC injuries, are believed to be among the anatomical substrates that result in poor functional recovery and neuropathic pain. *Methods:* Our novel experimental NIC injury model employs a combination of intense compression and minimal traction forces. 42 male Lewis rats were randomized into one of 7 groups for left femoral nerve surgeries. Sham-injury, Crush, Compression, Compression+traction, Double Compression+traction, Transection and Tansection+repair constituted the experimental groups. At 28 days femoral motoneurons were back-labeled from the distal motor and sensory divisions with immunofluorescent dyes. Spinal cords were harvested 13 days later for motoneuron counting. Distal nerve segments and injury zones were harvested for histomorphometry and histological evaluation. *Results:* Axonal misdirection and motoneuron counts of the Double Compression+traction injury group showed statistically significant differences compared to the Sham and Crush groups, similar to the Transection and Transection+repair groups (p<;0.05). *Conclusion:* Our results further characterizes this injury model by confirming a high degree of axonal misdirection and attrition in severe NIC injuries, consistent with long held but previously unproven theories, in the absence of a relevant experimental model.

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

## P.018

### Transverse sinus stenting for cerebral venous sinus thrombosis and refractory intracranial hypertension - a case report

*L Hnenny (Saskatoon)* D Fiorella (Stony Brook) M Kelly (Saskatoon)*

*Background:* Cerebral venous thrombosis (CVT) is a potentially devastating condition. Predisposing factors include hypercoagulable state, infection, pregnancy, oral contraceptive use, and female sex. Symptoms may include headache, nausea, vomiting, and visual changes. Papilledema, focal neurologic deficits, strokes, and seizures may occur. Treatment consists of systemic anticoagulation and management of the underlying process. Acetazolamide and cerebrospinal fluid (CSF) diversion techniques are reserved for cases with refractory, severe intracranial hypertension. More recently, cerebral venous stenting techniques have shown promise in the treatment of this condition. *Case Report:* We report a 50-year-old female who presented with progressive headache, visual blurring, and papilledema from bilateral thrombosis of her transverse-sigmoid junctions. The patient had significant contraindications to surgical CSF diversion (mechanical heart valve and multiple abdominal surgeries for Crohn's disease). She was treated with placement of a Zilver self-expanding nitinol stent (Cook Medical Inc., Bloomington, IN) across the left transverse-sigmoid junction with improvement of her cerebral venous drainage. Post-operatively, she had resolution of her headache, visual blurring, and papilledema. *Conclusion:* Cerebral venous sinus stenting is a viable option for treatment of refractory, symptomatic intracranial hypertension in the setting of CVT. Consideration for cerebral venous stenting should be given to patients with contraindications to CSF diversion.

## P.019

### The role of balloon angioplasty for the treatment of cerebral vasospasm in aneurysmal subarachnoid hemorrhage: a systematic review

*D Reddy (Hamilton)* D Jichici (Hamilton) F Farrokhyar (Hamilton) A Algird (Hamilton) P Klurfan (Hamilton)*

*Background:* Cerebral vasospasm is a cause of significant morbidity and mortality following aneurysmal subarachnoid hemorrhage. The purpose of this study is to determine whether the use of balloon angioplasty (alone or with additional intra-arterial therapies)



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compared to standard medical care (alone or with intra-arterial therapies) will improve the clinical and/or radiographic outcomes, infarction and Glasgow outcome scale scores in patients with cerebral vasospasm. *Methods:* A systematic review protocol was established a priori detailing the research question, search strategy, outcome measures, study inclusion and exclusion criteria, and method of statistical analysis. Two reviewers performed independent database searches in Ovid MEDLINE, EMBASE, Cochrane Library, ISRCTN Register and ClinicalTrials.gov. 383 articles were reviewed (title and abstract), 14 were selected for full text review, and of these 9 were selected for qualitative analysis, which included 6 for quantitative analysis. *Results:* The meta-analysis included 1 randomized controlled trial and 5 cohort studies. The primary outcome measure is the dichotomized Glasgow Outcome Scale score. Pooled data resulted in an odds ratio of 0.87 (95% CI, 058-1.28) favoring balloon angioplasty, which was not statistically significant. *Conclusions:* Balloon angioplasty demonstrates improvement in clinical and radiographic vasospasm though is yet to show benefit in long-term functional outcome. The triggers and thresholds for intervention vary from study to study and there is considerable variability in outcome measures.

## P.020

### Mechanical thrombectomy of the superior sagittal sinus using the penumbra device for cerebral venous thrombosis - a case report

*L Hnenny (Saskatoon)* D Fiorella (Stony Brook) M Kelly (Saskatoon)*

*Background:* Cerebral venous thrombosis (CVT) is a potentially devastating condition. Predisposing factors include hypercoagulable state, infection, pregnancy, oral contraceptive use and female sex. Symptoms may include headache, nausea, vomiting, and visual changes. Papilledema, focal neurologic deficits, strokes, and seizures may occur. Treatment consists of systemic anticoagulation and management of the underlying process. Acetazolamide and cerebrospinal fluid (CSF) diversion are reserved for cases with refractory, severe intracranial hypertension. Recently, neuro-interventional techniques have shown promise in the treatment of this condition. *Case Report:* We report the case of a 47-year-old male who presented with seizures and intracerebral hemorrhage. CT angiography showed near-complete occlusion of the superior sagittal sinus and occlusion of both transverse sinuses. Anticoagulation was initiated, but he continued to have seizures and his level of consciousness deteriorated. ICP monitoring confirmed increased intracranial pressure. He was therefore taken to angiography and mechanical thrombectomy of his sagittal sinus was performed with the Penumbra device (Penumbra Inc., Alameda CA). Flow was markedly improved in the superior sagittal sinus, and he recovered well post-operatively. He was discharged home on antiepileptic medication with no neurologic deficits. *Conclusion:* Mechanical thrombectomy is a viable option for revascularization of the superior sagittal sinus in the setting of CVT.

## P.021

### Change in cognition following gcsf therapy to treat ischemic stroke

*A Eitzen (Ottawa)* L Walker (Ottawa) H Atkins (Ottawa) G Stotts (Ottawa) M Hogan (Ottawa) A Hakim (Ottawa) S Black (Toronto) D Gladstone (Toronto) M Sharma (Ottawa)*

*Background:* Ischemic stroke can impair cognition with 30% of individuals impaired at 90 days. *Method:* The GIST Study is a double blind randomized controlled pilot trial (GCSF vs placebo) of safety and feasibility of stem cell mobilization in acute stroke to promote recovery. GCSF was administered to adults with incident ischemic stroke affecting motor function within 7 days of stroke, repeated at 12 weeks. Neuropsychological tests measuring information processing speed (IPS), attention, language, memory and executive functioning were administered at baseline (before treatment) and six months post-treatment. Reliable Change Index (RCI) (modified for practice) determined whether change in cognition was significant beyond chance or practice. *Results:* Nine subjects were recruited. For subjects with data at both time points, significant improvement in cognition in at least one measure was demonstrated in each domain: 83% improved in IPS, 86% in attention, 25% in language, 38% in memory and 80% in executive functioning. Overall, 56% of subjects improved in 3 or more domains. Only 2 subjects declined (isolated to memory). *Conclusions:* Our results, in a limited number of participants, do not suggest a deleterious effect of GCSF in the acute phase of stroke. Improvement is compatible with the natural history of post-stroke recovery.

## P.022

### Deployment of the solitaire stent as a bailout in failed mechanical thrombectomy - a case series

*L Hnenny (Saskatoon)* D Fiorella (Stony Brook) M Kelly (Saskatoon)*

*Background:* Mechanical thrombectomy for patients with acute thromboembolic stroke has been shown to be beneficial. Rapid advancements have occurred in the devices available and the techniques used to treat this potentially debilitating condition. Recently, self-expanding stents have been used in these cases to restore flow across an occluded vessel segment. *Case Report:* We report two cases of patients presenting with acute thromboembolic hemispheric strokes and large vessel occlusions. In both cases, mechanical thrombectomy was attempted, but was unsuccessful. After failure to recanalize the vessel, the Solitaire self-expanding stent (ev3, Irvine CA) was deployed across the thrombus and detached as a bailout technique. Using this technique, we were able to re-establish good flow across the stented segment in both cases. *Conclusion:* Deployment of the Solitaire self-expanding stent can result in restoration of flow across an occluded vessel segment that has failed mechanical thrombectomy. This technique should be considered as a potentially effective bailout when thrombectomy has failed.



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## P.023

**Carotid occlusion and restenosis after endarterectomy: a single centre experience**

*Z Ivanishvili (Saskatoon)* L Hnenny (Saskatoon) K Meguro (Saskatoon)*

Up to 23 randomized controlled trials (RTC) exist which compare routine patching with primary closure in carotid endarterectomy. Meta-analyses of these studies have demonstrated statistically significant differences favouring patching in terms of reducing the rates of carotid occlusion in perioperative period (<; 30 days) and the rates of restenosis in long-term follow-up (>30 days). Regardless, primary closure has remained the preferred approach in many institutions, including ours. The clinical significance of restenosis has been questioned by many surgeons, and the RTC's have been criticized for small samples and for limited follow-up periods. In the absence of a universally accepted approach, sharing personal experiences at an individual institution can be very beneficial. In this poster we present our 10-year experience with primary closure, treating 96 patients with carotid endarterectomy. We routinely shunt but do not patch the carotid artery. Our follow-up period ranges from 1 to 9 years, and includes yearly carotid Doppler ultrasound testing, followed by computed tomography angiography if necessary. Our results demonstrate 3% perioperative occlusion and 6% restenosis in long-term follow-up. The majority of patients with restenosis remain symptom-free. Interestingly, up to 9% of patients who demonstrated> 50 % lumen stenosis at the initial period of follow-up have no stenosis in subsequent studies.

# General Neuroradiology

## P.024

**Enlarging pediatric cerebral AVMs - case series**

*L Hnenny (Saskatoon)* D Fiorella (Stony Brook) M Kelly (Saskatoon)*

*Background:* Factors influencing the development and potential growth of cerebral arteriovenous malformations (AVMs) have been difficult to define. Prevailing theories focus on pro-angiogenic factors. Lesions exhibiting rapid growth, even following complete angiographic obliteration, have been reported. It is unknown whether pediatric AVM's are more prone to growth over time. *Case Report:* We report two pediatric patients harboring AVM's exhibiting significant growth. The first patient underwent surgical and endovascular treatment resulting in complete angiographic obliteration of his AVM. He experienced recurrence of his lesion and subsequently underwent radiosurgery. The second patient was diagnosed on presentation with a 2 cm right frontal AVM that grew to 6 cm over the course of two years. No therapy was instituted. *Conclusion:* There is potential for AVM's to grow over a short period of time. Pediatric lesions and partially treated lesions may be more susceptible. The durability of cure with endovascular therapy is also unknown. The factors that contribute to this are uncertain, but may include robust expression of pro-angiogenic proteins. Longer radiographic follow-up of treated AVM's and close surveillance of untreated AVM's, particularly in the pediatric population, is recommended.

# Dementia

## P.025

**The incidence and prevalence of dementia: a systematic review and meta-analysis**

*JI Roberts (Calgary)* CJ Maxwell (Waterloo) K Fiest (Calgary) D Hogan (Calgary) P Roach (Calgary) JJ Dykeman (Calgary) A Kirk (Saskatoon) L Day (Calgary) D Pearson (Calgary) A Cohen (Calgary) EE Smith (Calgary) A Venegas-Torres (Calgary) T Steeves (Toronto) T Pringsheim (Calgary) N Jette (Calgary)*

*Background:* Understanding the epidemiology of dementia is essential for accurately anticipating the future health care needs of Canadians affected by this condition. *Methods:* MEDLINE and EMBASE databases were searched using pre-specified terms for the incidence, prevalence and epidemiology of dementia and its common subtypes (i.e. Alzheimer's disease (AD), frontotemporal (FTD), vascular (VaD), mixed and Lewy body (DLB) dementias). Population-based studies reporting the incidence and/or prevalence of dementia were included. International studies published before 2000 and Canadian studies published before 1990 were excluded. Two reviewers independently reviewed all abstracts, full text articles and abstracted data. A third reviewer was consulted when required. Reported prevalence and/or incidence were abstracted for each study. Pooled prevalence will be examined (in appropriate cohorts) using fixed effect or random effects models depending on study heterogeneity. *Results:* 7923 original abstracts were screened for eligibility with 706 selected for full text review. Of 141 studies meeting all eligibility criteria, incidence or prevalence was reported for AD in 49 studies, VaD in 32, FTD in 8, and DLB in 5. There were 5 Canadian studies. The results of the meta-analysis will be presented at the congress. *Conclusions:* Our findings on the incidence and prevalence of dementia will be discussed.

# General Neurology

## P.026

**Role of of Calcium-stimulated Adenylate cyclase 1 in the functional recovery after lesion in AC1 mutant mice**

*H Nait Taleb Ali (Marrakech)**

The mammalian corticospinal tract (CST),arising from layer V neurons in the Somatosensory and motor cortex, is the only direct cortical pathway to the spinal cord. Guidance molecules such as Ephrins and Slits are involved at various decision points for guiding the CST axons. However, previous analyses of the corticospinal tract guidance defects in mutant mice lacking these molecules have suggested that there are other molecules involved in CST axon guidance that are yet to be identified. The role of the calcium-stimulated adenylate cyclase 1 (AC1) has been revealed in the fine patterning of the retinal maps. Because the AC1 gene is highly expressed in layer V cortical neurons during the development of the CST,we questioned whether AC1 is involved in the targeting of the CST and in regeneration after a lesion. We used the barrelless (brl) mouse strain which carry a spontaneous mutation of the AC1 gene and investigated the projections of the CST in the cervical spinal cord using anterograde tracers.To investigate the effects of AC1 on



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axon regeneration in vivo, the brl mice were tested in a model of spinal cord injury: dorsal hémisection at (T8-T10). Our study shows an increase in the number of contralateral and ipsilateral projections in the cervical spinal cord in brl mice. Moreover, the Brl mice showed greater functional improvement compared to controle mice.

## P.027

### A case report of ovarian teratoma associated limbic encephalitis with detected voltage-gated potassium channel (VGKC) autoantibodies

*E Bangert (Hamilton)**

Paraneoplastic limbic encephalitis (PLE), as one of the paraneoplastic syndromes of the nervous system, is associated with a number of tumors, with ovarian teratomas accounting for 4% of cases. It usually affects relatively young women. The Anti-NR1/NR2 of NMDA receptor antibodies are commonly associated with ovarian teratoma. We report a case of a 63-year-old female who presented to the Emergency Department with an acute onset of short-term memory impairment, agitation, visual hallucinations, delusions, and hyponatremia. She subsequently developed generalized tonic-clonic seizure episodes. Her examination revealed gait and balance impairments. Her past medical history was only significant for her 50 lb weight loss over the last six months. Neuropsychological testing revealed multifocal impairment ranged from mild to moderate. Brain MRI showed T2/FLAIR hyperintensity of mesial temporal regions.VGKC antibodies were present at a level of 5441 pM. The abdominal CT scan showed a left ovarian teratoma. The ovarian teratoma was removed and the patient's condition subsequently improved. VGKC-Ab titre gradually reduced to the normal level. The case has demonstrated that PLE associated with ovarian teratoma may present in the older age group. Anti-NR1/NR2 of NMDA receptor antibodies which are commonly associated with ovarian teratoma were not identified. However, VGKC antibodies were detected. The case has shown that ovarian teratoma associated limbic encephalitis may present with VGKC antibody. Evaluation for VGKC antibodies is recommended in such cases.

## P.028

### Respiratory insufficiency in the rigid spine syndrome (RSS)

*FB Panosyan (Kingston)* MF Fitzpatrick (Kingston) CF Bolton (Kingston)*

In rigid spine sydrome (RSS) weak diaphragms are suspected by a history of nocturnal dyspnea and abnormal spirometry. These signs had not been elicited in a 71 year-old male, who presented with a long standing mild fatigue and a peculiar slouched posture on standing. Despite having no discomfort on lying supine, typical thoracoabdominal paradoxical respiration was observed. Serum analysis showed mild elevation of creatine phosophokinase. MRI studies showed replacement of paraspinal muscles by fibrous tissue and fat. Bilateral phrenic nerve conduction revealed absence responses and needle electromyography (EMG) showed absence of insertional activity, spontaneous activity and motor unit potentials. The results were consistent with replacement of the diaphragms by fibrous and adipose tissue. There was sparing of chest wall and limb muscles, which explains the mild and unusual presentation. A literature search revealed that phrenic nerve conduction and needle EMG have been reported in only one other case of RSS. Our case illustrates how respiratory and other electophysiological studies are valuable in RSS. There is marked variation in the severity of respiratory insufficiency in this condition, and genetic studies have identified a subgroup of patients with selenoprotein N1 gene (SEPN1) mutation.

## P.029

### Vagal nerve stimulation suppresses trigeminal pain in a rat model of headache

*ML Oshinsky (Philadelphia)* M Cooper (Philadelphia) BJ Simon (Morris Plains)*

*Background:* The objective of this study was to study the effect of acute vagal nerve stimulation on trigeminal pain in a rat model of recurrent headache. *Methods:* We induced dural nociceptor activation by infusing an inflammatory soup (IS) through a dural cannula in awake rats. This was repeated 3 times per week for 4 weeks. Periorbital von Frey sensory testing was used to monitor changes in trigeminal sensitivity. One week after the last infusion, we attached an Elizabethan collar with electrodes positioned on the shaved skin of the neck over the vagus nerve and stimulated for 1 min. The VNS parameters were 1ms bursts of sine waves repeated at 25 Hz. There were 5, 5 kHz sine waves during each burst. The peak voltage applied to the animals via the two small metallic electrodes was ~22 V. *Results:* Following the 10 infusions of the IS, the rats had morning thresholds of<2g (n=7). Following VNS stimulation, thresholds significantly increased to>7g (p<;0.1, ANOVA). The treatment effect was maintained for 2.5 hr. The next morning, all of the stimulated rats had returned to the pre-VNS levels. There was no change in the threshold of the control group that received collar placement only, without VNS stimulation *Conclusions:* These data demonstrate that 1min of vagal stimulation can provide hours of relief from trigeminal pain.

Funding: NIH/NINDS:1R01-NS061571 (PI:MLO), ElectroCore LLC (PI:MLO)

## P.030

### The incidence and prevalence of spinal cord injury: a systematic review and meta-analysis

*S Mah (Calgary)* JI Roberts (Calgary) JJ Dykeman (Calgary) K Fiest (Calgary) S Casha (Calgary) C Cunningham (Calgary) C St. Germaine-Smith (Calgary) S Patten (Calgary) T Pringsheim (Calgary) N Jette (Calgary)*

*Background:* Spinal cord injury (SCI) occurs in all age groups and is frequently associated with severe disability. A systematic review and meta-analysis was completed to estimate the international incidence and prevalence of SCI. *Methods:* MEDLINE and EMBASE databases were searched using terms specific to SCI, incidence, prevalence and epidemiology. Included studies reported a population-based incidence and/or prevalence of SCI after 1985. Two reviewers independently reviewed all abstracts, full-text articles and abstracted data. A random effects model was used to pool the average annual incidence (AAI) [95% confidence interval] of SCI per 100,000 people (after testing for heterogeneity). *Results:* 2717 abstracts were screened for eligibility with 143 selected for full-text review. Of 39 studies meeting all eligibility criteria, 38



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reported incidence and 3 reported prevalence. 29 studies of 547 million people had an AAI of 3.07 [2.44-3.85]. 4 studies of 78 million children had an AAI of 1.15 [0.65-2.06]. Due to substantial heterogeneity, AAI was not pooled for the 3 adult only studies. AAI was significantly lower in pediatric studies compared to those including all ages (p=0.0052). *Conclusion:* More studies examining the incidence/prevalence of SCI are required in order to better understand the burden of this condition on patients and society.

## P.031

### Treatment of muscle cramps : neurologist practice patterns

*M Lim Fat (Ottawa)* HD Katzberg (Toronto)* S Kokokyi (Toronto)*

*Background:* Muscle cramps are a prevalent neuromuscular symptom with non-pharmacological and pharmacological treatment options. Our study describes practice patterns among Ontario neurologists for muscle cramps. *Methods:* A 18-question survey designed to capture physician practice type, demographics and treatments was faxed or mailed to all 369 neurologists registered under the College of Physicians and Surgeons of Ontario in March 2011. Responses were collected and qualitative statistics performed to analyze the data. *Results:* Sixty-three physicians with a wide range of clinical experience responded, 49% adult general neurologists and 17% neuromuscular specialists. Most neurologists saw patients with mild-moderate cramps; 15% saw patients with severe cramps. The most common causes of cramps are idiopathic (47%) and neurological disease (47%), with pregnancy, medication and physiological causes also reported. Most neurologists used non-pharmacological treatments alone or in combination with medications, with stretching exercises being the most popular (57%) followed by hydration (24%) and massage therapy (13%). Thirty-five percent favored pharmacological treatment only. Baclofen (24%), quinine and derivatives (25%) and gabapentin (19%) were the preferred pharmacological agents. *Conclusions:* Most muscle cramps are mild-moderate in severity and are managed with non-pharmacological therapies alone or in combination with medications, of which baclofen, quinine derivatives and gabapentin represent the preferred choices.

## P.032

### Prevalence of the muscular dystrophies: a systematic review and meta-analysis

*L Korngut (Calgary)* J Mah (Calgary) L Day (Calgary) J Dykeman (Calgary) M Lowerison (Calgary) S Patten (Calgary) N Jette (Calgary)*

*Background:* The muscular dystrophies (MD) are a broad group of hereditary muscle diseases with variable phenotype. Population-based prevalence estimates exist but more precise pooled estimates are unavailable. *Methods:* We performed a systematic review of worldwide population-based studies reporting MD prevalence using MEDLINE and Embase databases. The search strategy was developed including key terms related to muscular dystrophy, incidence, prevalence and epidemiology. Two reviewers independently reviewed all abstracts, full text articles and abstracted data using standardized forms. Agreement at the abstract review stage was calculated using the Kappa value. Pooling of prevalence estimates between studies by specific MD type was performed using random effect models. *Results:* The search identified 1104 abstracts and 167 full text articles were reviewed. Kappa was 0.64 (0.58-0.70). Thirty-one studies met all eligibility criteria and were included in the final analysis. The pooled prevalence estimates per 100,000 people were as follows: Duchenne 12.6 (9.0-17.5), Becker 1.3 (0.2-7.9), facioscapulohumeral 4.0 (2.9-5.4), myotonic 8.3 (5.0-13.7), limb girdle 1.6 (0.9-2.8), Emery-Dreifuss 0.4 (0.1-1.3), the congenital muscular dystrophies 1.0 (0.6-1.6) and MD overall was 20.9 (16.7-26.2). *Conclusion:* This is the first meta-analysis of worldwide prevalence estimates for the muscular dystrophies. The importance of these findings and limitations of the methodology will be discussed.

## P.033

### Familial amyotrophic lateral sclerosis in Alberta

*T Pfister (Calgary)* R Sekhon (Edmonton) S Munro (Calgary) M Johnston (Calgary) C White (Calgary) S Kalra (Edmonton) L Korngut (Calgary)*

*Background:* Systematic review data demonstrates that 5% of ALS cases are familial (FALS). Causative superoxide dismutase 1 (SOD1) mutations are identified in 10-20% of FALS. Few reports of FALS epidemiology exist in Canada. *Methods:* We completed a retrospective review of all FALS cases in Alberta over the past decade. The Calgary and Edmonton ALS Clinic databases were used to identify subjects with possible or definite FALS. Consent was obtained from living patients and clinic charts were reviewed and abstracted. Descriptive summaries of genotypes identified and calculation of prevalence's were performed. *Results:* We reviewed 946 ALS database records and 50 FALS subjects were identified (5.3%). 48/50 clinic charts were reviewed. Causative SOD1 mutations were observed in 17/48 (35%) of the FALS cohort. The period and point prevalences of FALS in Alberta are approximately 1.76 per 100,000 (95% CI 1.26 to 2.26) and 4.0 per 1,000,000 (95% CI 1.73 to 6.27) respectively. *Conclusions:* We report 48 cases of FALS in Alberta over the past decade. The proportion of SOD1-positive FALS cases is higher than reported elsewhere. Mutations observed, importance and limitations of the methods and findings will be discussed. This study was funded by a donation from the Quirk Family.

## P.034

### A case of VGKC positive limbic encephalitis

*K Koochesfahani (Saskatoon)* W Fitzpatrick (Saskatoon)*

*Background:* VGKC limbic encephalitis can present with behavioral changes, memory deficit and seizures. SIADH and mild dysautonomia, such as hyperhidrosis and hypothermia, have been described. Here we present a case with atypical autonomic features. *Methods:* Case report *Results:* A 67 y/o male presented with a 6 week history of progressive cognitive impairment, abulia and escalating complex partial seizures. He scored 13/30 on MOCA, with an otherwise normal examination. Laboratory investigations revealed hyponatremia due to SIADH. He developed severe hypothermia and hypotension, necessitating ICU support. He required anesthetic coma for recurrent episodes of non-convulsive status epilepticus, despite treatment with three anticonvulsants. CSF was normal, with negative HSV PCR. MRI revealed T2/FLAIR hyperintensity and diffusion restriction within the medial temporal regions, insula and cingulate bilaterally, with gyriform cortical



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enhancement. EEGs showed bitemporal spikes and electrographic seizures. VGKC antibody titers were positive, with an otherwise normal paraneoplastic panel. Malignancy work up was negative. He responded to IVIG, followed by plasmaphoresis. *Conclusion:* Our patient with VGKC limbic encephalitis had extremely prominent dysautonomia, which is more common with Morvan's syndrome. His dysautonomia was slower to respond to immune therapy, but did fully resolve. Our patient had no other features of Morvan's syndrome.

## P.035

### Two cases of early onset Lance-Adams syndrome

*K Koochesfahani (Saskatoon)* G Hunter (Saskatoon)*

*Background:* Myoclonic status epilepticus in the first 24 hours after cardiac arrest has generally been a reliable predictor of poor outcome. Lance-Adams syndrome is characterized by action myoclonus after emergence from anoxic coma, and generally has a more favorable prognosis. *Methods:* Case reports *Results:* Case 1: A 57 year-old male became comatose after unwitnessed cardiac arrest. Prior to transfer to ICU he developed generalized, stimulus sensitive myoclonus. The movements were highly refractory to multiple anticonvulsants. The patient regained consciousness after 10 days, with high doses of valproate, levetiracetam, and clonazepam. He now has persistent action myoclonus and impaired cognition. Case 2: A 67 year-old male developed early myoclonus of similar description after cardiac arrest. On waking, cognition was normal but he had severe action myoclonus. He had excellent response to clonazepam and levetiracetam, with some mild myoclonus persisting. *Conclusions:* Differentiating between myoclonic status epilepticus and Lance-Adams syndrome in the first 24 hours of coma can be difficult or impossible. Cases of recovery after myoclonic status have been reported elsewhere, and caution should be exercised not to prognosticate on this feature alone. Lance-Adams syndrome may begin early, and outcomes can be favorable.

## P.036

### Registry-based epidemiological surveillance of amyotrophic lateral sclerosis (ALS) in Saguenay-Lac-Saint-Jean region, Quebec, Canada, 1985-2010

*E Lareau-Trudel (Sherbrooke)* J Mathieu (Jonquière)*

The Neuromuscular Registry of Saguenay-Lac-Saint-Jean (SLSJ) was established for epidemiological surveillance of neuromuscular disorders including ALS. The geographic and sanitary characteristics specific of the SLSJ region allowed an almost complete ascertainment of patients with neuromuscular diseases and a full population-based survey of these disorders. Data on study participants were generated from the Neuromuscular Registry, a registry of all ALS patients living in SLSJ region. The Registry was validated by a revision of the medical records maintained at the CSSS Chicoutimi. The study period covers years 1985 to 2009 and presents trends in the prevalence of ALS. Overall, the clinical features of ALS observed in SLSJ population are similar to those described in the literature. We observed a significant increase in the incidence rate of ALS. During period 2005-2009, incidence rate was 3,01 (CI 2,09-3,93) compared to 0,91 to 1,37 in the previous period (1985-2004). This is due to a significant increase in the incidence rates from 4,68 (CI 2,88-6,48) in 1985-2004 to 12,22 (CI 7,43-17,02) in 2005-2009 specific for the group older than 65 yo. Given the small size of SLSJ population (273 264) , a longer observation period is needed to conclude in a real increase in incidence rate of ALS in this region. The register of the CMNM is a valid tool for epidemiological monitoring of neuromuscular disease.

## P.037

### Steroid-responsive cavernous sinus lesions: a diagnostic and treatment dilemma

*T Atkins (Saskatoon) CB Gervais (Saskatoon)**

*Background:* The differential diagnosis of steroid responsive cavernous sinus lesions is considerable. These lesions are difficult to image and often not amenable to biopsy. Cerebrospinal fluid may be normal. *Methods:* Case report *Results:* A 39 year-old male presented with one month of painful ophthalmoplegia OD. He had emigrated from the Philippines three years earlier. On exam, he had a complete cavernous sinus syndrome with proptosis. MRI showed an enhancing right cavernous sinus mass measuring 2.3 x 1.8 x 2.2 cm. Lumbar opening pressure and cerebrospinal fluid were normal. The periorbital pain, proptosis, and ophthalmoplegia unexpectedly improved immediately post-lumbar puncture, prior to steroid therapy. Neurosurgery would not perform a biopsy in this location. Repeat MRI after five days of high-dose intravenous methylprednisolone showed a significant decrease in size of the mass. After two months of tapering oral prednisone therapy symptoms fully resolved, but MRI showed a stable, persistent enhancing mass. Diagnosis remained uncertain, and careful follow-up was arranged. *Conclusions:* This case illustrates the challenges of confirming a diagnosis in the setting of steroid responsive cavernous sinus lesions. There was an interesting direct pressure effect contributing to painful ophthalmoplegia alleviated by lumbar puncture. Duration of steroid therapy is uncertain, and chance of recurrence is high.

## P.038

### Cerebral vasculitis in rheumatoid arthritis patient on a TNF-alpha antagonist

*A Jahangirvand (Saskatoon)* A Kirk (Saskatoon) JF Tellez-Zenteno (Saskatoon)*

*Background:* We report a case of cerebral vasculitis in a First Nations patient treated with etanercept for rheumatoid arthritis (RA). *Method:* Case report *Results:* A 55 year-old woman presented with one month of progressive cognitive impairment. She had a history of seropositive RA treated with etanercept for over five years. On examination, she was encephalopathic with mild left hemiparesis. She had an elevated ESR (79) and CRP (124). Investigation for other rheumatologic, autoimmune, and infectious disorders were negative. Lumbar puncture revealed pleocytosis with elevated lymphocytes and normal chemistry. Gadolinium-enhanced MRI revealed extensive hyperintensities in T2 and FLAIRE-weighted sequences, with leptomeningeal enhancement over the frontal lobes. Conventional angiogram was characteristic of vasculitis. This prompted discontinuation of the etanercept and subsequent treatment with pulse steroids followed by oral prednisone and monthly cyclophosphamide for 6 consecutive months. *Discussion:* Inflammatory vasculitis of the central nervous system is exceedingly rare in patients with RA. A potential link between TNF-alpha



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antagonist and vasculitides has been suggested in literature. The improvement of symptoms after the discontinuation of etanercept can support an association in this case. Although a definitive diagnosis would require a cerebral and leptomeningeal biopsy, this procedure is less frequently done with the improvement of imaging techniques.

## P.039

### Mosaic deletion of both Filamin A and Emerin in a female with periventricular nodular heterotopia

*J Warman (Ottawa)* S Aradhya (Gaithersburg) K Boycott (Ottawa)*

Periventricular nodular heterotopia is a rare neuroblast migration disorder with a wide clinical spectrum, ranging from clinically asymptomatic to severe cognitive impairment with seizures. The vast majority of X-linked dominant periventicular nodular heterotopia is caused by mutations in Filamin A at Xq28. Centromeric to Filamin A at Xq28 is the Emerin gene. Mutations in the Emerin gene cause Emery-Dreyfuss Muscular Dystrophy and present with humoperoneal weakness, cardiac involvement and early contractures. We describe the clinical features of a patient presenting with a mosaic pattern of a complete deletion of Filamn A and Emerin genes. DNA analysis revealed a deletion with a minimum size of 34.5 kb, extending from chrX:153576890-153611431, and the maximum deleted region was 67.6 kb extending from chrX:153560505-153628073. The log2 ratios for probes in Filamin A demonstrated a mosaic deletion, and the deleted interval included both the complete Filamin A and Emerin genes. This is the first report describing mosaic deletions of both Filamin A and Emerin genes in a patient with periventricular nodular heterotopia.

## P.040

### Idiopathic intracranial hypertension with a false-localizing sign

*T Atkins (Saskatoon) CB Gervais (Saskatoon)**

*Background:* We report a case of Idiopathic Intracranial Hypertension (IIH) in that involved facial nerve palsy as a false-localizing sign. *Methods:* Case report and review of the literature *Results:* An 18 year-old female presented with progressive headache. She had a normal body mass index. Symptoms included pulsatile tinnitus, nausea, and diplopia. She had severe papilledema with peripheral constriction of visual fields. There was left lower motor neuron facial weakness. CT venogram, MRI brain and orbits, and MR venogram were all normal. Lumbar opening pressure was 55 cm of water and cerebrospinal fluid was normal. She was diagnosed with IIH according to the Modified Dandy criteria. Symptoms improved significantly following lumbar puncture, and acetazolamide was initiated. There are only a few previously published case reports of facial nerve palsy in IIH, and some authors have suggested treatment with prednisone. We did not treat the facial nerve palsy with prednisone, since there was improvement post lumbar puncture, and the facial weakness was felt to be related to direct intracranial pressure effect. *Conclusions:* This case is remarkable for the association of lower motor neuron facial weakness as a false-localizing sign in the setting of IIH. Our case is consistent with those few that have been previously reported.

## P.041

### Guillain barré syndrome alert: mistaking evolution to chronic active demyelination for axonal GBS

*JD Stewart (North Vancouver)**

*Introduction:* Patients with severe Guillain Barré Syndrome (GBS) who fail to improve after intravenous immunoglobulin (IVIg) usually have axon damage and a poor prognosis. *Objective:* Alerting neurologists that acute, severe GBS may evolve into chronic, active demyelinating neuropathy mimicking axonal GBS. *Patient:* A 72 year old man had 3 days of limb numbness and weakness; examination and nerve conductions (NCS) were characteristic for GBS. IVIg was given. Week 2: weaker with worse respiratory function; IVIg was restarted. The next day he was intubated. Week 3: no limb or craniobulbar movement. Week 12: he regained some of the latter. Week 14: this disappeared. Following a 3rd course of IVIg craniobulbar strength returned in 7 days. 50Gm of IVIg was then given weekly. Week 20: Extubated; limb strength improved steadily; weekly IVIg was continued. NCS at week 27 showed many of the original features. EMG showed mild-moderate fibrillations and abundant reinnervation. *Conclusions:* Most patients with GBS and prolonged, severe deficits have axon damage and more IVIg is ineffective. This case suggests that prolonged myelin damage can mimic axonal GBS, and that "maintenance" IVIg can be effective.

# Multiple Sclerosis

## P.042

### The diagnostic dilemma of seronegative neuromyelitis optica spectrum disorder

*A Jahangirvand (Saskatoon)* W Fitzpatrick (Saskatoon) C Gervais (Saskatoon)*

*Background:* We report a case of probable neuromyelitis optica (NMO) in a Caucasian patient with a progressive monophasic condition. *Methods:* Case report *Results:* A 28 year-old female presented with 6 months of progressive gait difficulty, bladder incontinence and refractory hiccups. She denied any visual disturbance. On examination, she had a spastic gait with mild weakness in finger extensors and proximal right leg. A C4 sensory level was elicited. Investigations for metabolic and infectious disorders were negative. Spinal MRI revealed hyperintensity in T2 and FLAIRE-weight sequences extending from C1 to C5. Lumbar puncture revealed mild pleocytosis with elevated lymphocytes and positive oligoclonal bands. The CSF and serum NMO-IgG serology were negative. She did not respond promptly to steroids and had minimal benefit with IVIG or plasmapheresis. She is currently being treated with maintenance immunosuppressive therapy. *Discussion:* The presence of a highly specific NMO-IgG antibody marker distinguishes NMO from other demyelinating disorders. However, up to 25% of patients clinically diagnosed are seronegative. Whether the lack of this antibody is indicative of inadequate clinical diagnostic criteria, suboptimal assay sensitivity, or if it represents a closely related disorder is unclear. This case demonstrates how seronegative patients appear to have a monophasic disease with lower frequency and severity of relapses.



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# General/Intracranial Neurosurgery

## P.043

### Pancraniosynostosis following endoscope-assisted strip craniectomy for sagittal suture craniosynostosis in a non-syndromic patient

*GH Jenkins (Halifax)* PD McNeely (Halifax)*

*Background:* A variety of surgical strategies are used to correct sagittal craniosynostosis. There is increasing experience with the use of endoscope-assisted techniques. There is no consensus regarding the optimal technique. Pancraniosynostosis occurring after surgical repair of a single suture craniosynostosis is an unusual complication. *Methods:* We present the case of a non-syndromic patient who underwent an endoscope-assisted strip craniectomy with subsequent use of a helmet orthosis for correction of an isolated sagittal suture craniosynostosis. Her early post-operative course was uneventful. *Results:* She subsequently developed pancraniosynostosis that required a much more extensive surgical correction. *Conclusion:* Awareness of this potential complication is necessary to ensure its recognition and appropriate management.

## P.044

### Outcome of treatment of medulloblastoma in adolescent and adult age groups

*SM Alrashidi (Halifax )* M Al-Yamany (Riyadh ) W Al Shakweer (Riyadh )*

*Introduction:* Medulloblastoma was defined as a pathological entity in 1925, Its highest incidence in pediatric age group and relatively rare occurrence in adults suggests its embryonic predisposition. *Methods*: Retrospective review of our data base of brain tumors in adolescents and adults (Aged more than 12 years) between 2006 and 2011 was carried out. Medulloblastoma cases in the named age group were separately studied regarding resection, pathological variations, management plan, recurrence-rate, clinical and radiological outcomes. *Result:* A total of 12 patients diagnosed as medulloblastoma were found in our review, with a mean age of 18.3 year. Eight patients were males. The most common presentation was headache, vomiting, gait disturbances, along with signs of raised intracranial pressure. One patient presented with epsilateral hearing loss. Gross total resection followed by chemotherapy and cranio-spinal radiotherapy was carried out in the entire series. Mean follow up was 17.6 months (20.5 months in the 10 patients between 2006 and 2010). There was no clinical or radiological evidence of recurrence of the tumors in the latest follow-up studies and 3 patients showed no recurrence over 4 years follow-up *Conclusion:* There may be a higher tendency for medulloblastomas in adolescents and adults in our series. The response to combined management of gross total resection, chemo and radiotherapy might be much better in adolescent and adult age groups than in pediatrics.

## P.045

### Vasospasm post pituitary surgery: 3 cases and systematic review of literature

*A Mansouri (Toronto)* A Fallah (Toronto) M Cusimano (Toronto) S Das (Toronto)*

*Background:* Vasospasm is a known complication of aneurysmal subarachnoid hemorrhage (SAH) and is a major cause of neurological morbidity and mortality. However, it is infrequently cited as a complication of pituitary adenoma (PA) surgery. We report 3 cases from Saint Michael's Hospital along with a systematic review of the literature. *Results:* Including our experience, vasospasm complicating PA surgery is documented in 27 patients (mean age of 45). Twenty-one cases were associated with postoperative SAH. Nine cases developed a postoperative hematoma within the surgical site requiring evacuation. Initial clinical deterioration attributable to vasospasm ranged from postoperative days 2-12 (most commonly day 5). Digital subtraction angiography and medical management were the most common diagnostic and therapeutic strategies, respectively. The latest outcome was evaluated as a Glasgow Outcome Scale ≤3 in 57% of cases. Multivariate logistic regression analysis identified later diagnosis of vasospasm and surgery for hematoma evacuation to be independently associated with better outcomes. *Conclusion:* Vasospasm should be considered in the differential diagnosis of patients demonstrating altered mental or neurological status post PA surgery. Prompt treatment should be instituted to optimize outcome.

## P.046

### Accurate insertion of external ventricular drains in ICU settings

*A Al Jishi (Montreal)* K Bajunaid (Montreal) M Basamh (Montreal) A Al Turki (Montreal) J Marcoux (Montreal) D Sinclair (Montreal)*

*Introduction:* An External Ventricular Drain enables ICP monitoring and serves as a proxy for assessing cerebral perfusion in patients with aneurysmal SAH. Nonetheless, it has few pitfalls such as poor positioning or injury to vital structures. The need for an efficient grading scale for better EVD insertion peaked our interest to review the procedure and it's complications at MNH through a novel grading system is proposed. *Methodology & Results:* The data were reviewed for patients aneurysmal SAH (July 2006-May 2009). We included all EVDs that were inserted through frontal lobe. An original grading system was developed and applied to each EVD insertion (Grades I-IV). Approximately 160 EVDs were inserted in 132 patients. 60% of the EVDs were placed in an 'adequate entry zone'. Of these catheters, 26.6% landed in the optimum zone "foramen of Monro" (grade I), 23.4% landed in the third ventricle (grade II) while 50% landed in the lateral ventricles (grade III). This latter group of catheter placements was associated with either a higher risk complications. *Conclusion:* EVD insertion, based on external surface landmarks is associated with a high chance of missing the intended intraventricular target. We propose a grading system measuring both external and internal landmarks to better aid in EVD insertion and as a useful tool in the ongoing assessment of current EVD insertion techniques.



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## P.047

### Impact of delayed nerve repair and brief electrical stimulation on regeneration-associated gene expression in longterm axotomized sensory neurons

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*Background:* Successful peripheral nerve regeneration is fraught with challenges. When injured peripheral nerves undergo immediate repair, 1 hour electrical stimulation (ES) proximal to the repair site is associated with improved degree and accuracy of regeneration, and increased expression of regeneration-associated genes (RAGs). We examined whether longterm (2 month) axotomized sensory neurons are capable of mounting a robust cell body response following neuroma removal and repair, and whether this is enhanced by ES. *Methods:* Female Sprague Daley rats received a unilateral injury of the common peroneal (CP) nerve and were then divided into 3 groups: CUT (2 month injury); REPAIR (2 month injury + repair); and REPAIR+STIM (2 month injury + repair + 1 hr ES). Neuroma was removed and CP nerves were micro-anastomosed to fresh distal tibial nerve graft with or without one hour ES. Relevant DRG were removed and processed for in situ hybridization to examine alterations in RAG mRNA expression. *Discussion/ Conclusion:* Neuroma removal is akin to a CL. Contrary to the positive impact of a short term CL on the cell body response, long term injured neurons may be compromised to a point where further injury attenuates rather than enhances this response. Here, electrical stimulation appears to mitigate the cell body response to neuroma removal and repair, but does not improve it beyond that observed in two month chronically injured neurons.

## P.048

### Iatrogenic pre-sacral spinal subarachnoid-peritoneal fistula

*Sahjpaul, Ramesh L. A Tu (Vancouver)**

*Introduction:* Perineural cysts are uncommon lesions usually arising from dorsal sacral roots. They have very rarely been reported in a presacral location and misdiagnosed as gynecological entities. The recognition of the nature of perineural cysts, especially when they occur in atypical locations, is crucial to prevent mismanagement. We report a case of a large pre-sacral arachnoid cyst treated by marsupilization due to a misdiagnosis as gynecological cyst, which resulted in a subarachnoid-pelvic CSF fistula with severe symptomatic intracranial hypotension syndrome. This is only the second such reported case. *Method:* A 53yo female with known NF Type I presented with protracted headache shortly after elective marsupialization of a suspected benign pelvic wall cyst. The gynecologist confirmed the presence of a presacral cystic structure which was drained of clear colourless fluid. Pathology report confirmed the cyst wall was composed of simple epithelial cells. Clinical and imaging findings upon presentation to the neurosurgical service confirmed the presence of intracranial hypotension secondary to a subarachnoid-pelvic CSF fistula. Surgical repair of the fistula was carried out through a transperitoneal retroperitoneal approach. *Results:* Postoperative course was favourable with complete resolution of symptoms and imaging abnormalities. *Conclusions:* Prineural cysts can rarely occur in a pre-sacral location. Recognition of this entity is crucial to avoid mis-management and potential catastrophic consequences.

## P.049

### Gamma knife radiosurgery in the treatment of metastatic breast cancer

*AC Thielmann (Winnipeg)* FA Zeiler (Winnipeg) A Kaufmann (Winnipeg) PJ McDonald (Winnipeg) D Fewer (Winnipeg) J Butler (Winnipeg) G Schroeder (Winnipeg) MM West (Winnipeg)*

*Background:* Gamma Knife (GK) radiosurgery in treating cerebral breast metastasis has been demonstrated to improve survival. Here we reviewed our institutional experience with GK in treating these lesions. *Methods:* We retrospectively reviewed all patients treated for cerebral breast metastases from Nov 2003 to July 2011. Demographics, tumor characteristics, treatment parameters, and outcomes were recorded. *Results:* Sixty-five patients were treated in 99 sessions, of which 41 demonstrated symptoms (headache, weakness, imbalance). The median number of metastases treated was 2 (range: 1-16). Mean tumour volume was 1.69 milliliters (range: 0.019-10.10) with average maximum diameter 14.04 millimeters. Mean prescription dose was 17.4 Gy to the 50% isodose line with maximum dose range 20-50 Gy. Median survival was 12 months (range: 1-53), with survival rates of 63% and 37% at 6 and 12 months respectively. Six-month local control was achieved in 37%, while 12-month local control was achieved in 18%. There were no acute complications. Adverse radiation effects occurred in 11 patients, 3 with neurological symptoms. Pre-treatment symptoms improved in six patients. *Conclusions:* GK is a safe and effective treatment for patients with brain metastases. Our results are comparable to the literature, and contribute further evidence to support GK treatment of cerebral breast metastases.

## P.050

### Therapeutic challenge of orbito-cranial penetrating injuries

*A Al Jishi (Montreal)* A Al Kuwaiti (Montreal) B Maleki (Montreal) J Marcoux (Montreal) M Maleki (Montreal)*

*Background:* Penetrating head injury (PHI) with retained foreign body are uncommon cause of traumatic brain injury, yet they present a therapeutic dilemma between risk of infection and the operative risk of significant hemorrhage and further damage, whenever orbito-cranial neurovascular structures are involved. *Method:* Two cases of orbito-cranial PHI with retained wood are presented. Because of the nature of the retained object, a surgical removal was favored to decrease the risk of infection. The pre-operative evaluation, and imaging, the intra-operative anatomy and management, the post-operative outcome, and a review of the literature will be presented. *Results:* Although the foreign body penetrated the intracranial content from the orbit through the superior orbital fissure (SOF), the trajectory was different, and the surgical approach was extradural for one and intradural for the other. None developed intra- or post-operative hemorrhage or infection. However, both remained with some degree of impairment of ocular motility and vision. *Conclusion:* Retained wooden objects through the SOF pose a therapeutic challenge. A meticulous analysis of the imaging is crucial for adequate surgical planning in order to minimize the risk of complications.



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## P.051

### Secondary hypophysitis due to ruptured Rathke's Cleft Cyst: case report

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*Background:* Hypophysitis due to ruptured Rathke's cleft cyst is extremely rare. There are only a handful of cases reported. A case report will be presented together with review of the literature. *Method:* 59 year-old female presented with a recent onset of diabetes insipidus and hypopituitarism secondary to a pituitary lesion. She also had marked visual field defect with right temporal hemianopsia. She underwent a transphenoidal and transfrontal removal of the cyst. Recurrence of the cyst prompted insertion of a permanent T tube. The pathology was that of inflammatory changes compatible with hypophysitis due to the rupture of the cyst. *Result and Discussion:* The presence of thick, whitish fluid from the sella should raise the possibility of an inflammatory lesion and conservative management to avoid damage to the pituitary should be thought.

## P.052

### Hydro-pneumocephalus - a complication of spinal dural invasion from rectal cancer: a case report

*Y Qureshi (St. John's) G Murray (St. John's) FB Maroun (St. John's)* D Pace (St. John's) N Hache (St. John's)*

*Background:* Pneumocephalus is a rare but well known condition that denotes a pathological presence of air in the cranial cavity. Most of these cases are secondary to trauma, tumour, infection and fistulation into intracranial cavity. We present a case which presented as pneumo-hydrocephalus requiring drainage of the ventricular system and subsequent presence of an advanced rectal cancer. *Case Description:* A 64 year-old female who lived alone, was found unresponsive. She had severe diarrhoea. Initial GCS was 11. She was found febrile with neck rigidity and was started on IV antibiotics empirically. CT scan of head showed pneumo-hydrocephalus and CT chest, abdomen and pelvis showed pneumoperitoneum, a pelvic abscess and an advanced rectal mass invading the dural space, free air was found in sacral neural foramina and thoracic subdural space. The patient had external ventricular drain inserted for hydrocephalus. She had an exploratory laparotomy whereby a pelvic abscess was drained and a fixed nonresectable rectal tumour invading all adjacent structures, including sacrum, was found. She had a defunctioning colostomy. A pathological diagnosis of poorly differentiated adenocarcinoma was established. The patient made a satisfactory recovery with no residual neurological deficits. *Conclusion:* Pneumocephalus causing symptomatic hydrocephalus is a known entity and in our case it was secondary to spinal dural invasion by rectal cancer which was not known until presentation.

## P.053

### Brain tumour stem cells can be found outside of the enhancing rim of glioblastoma multiforme

*PA Mercier (Calgary)*

Brain tumor stem cells (BTSCs) are the new paradigm for initiation and growth of Glioblastoma Multiforme (GBM) and may be at the root of tumor recurrence and resistance to treatment. BTSCs from human tumors can grow in culture, generate astrocytes, oligodendrocytes, and neurons and form tumors in SCID mice. Samples taken from within different regions of the enhancing rim and from outside the rim of the tumor suggest that MGMT promoter methylation status (a marker of increased survival) was similar suggesting tumors are homogeneous. Expression analysis indicate that while there are few differences in expression patterns within the tumor mass, genes involved in GBM signaling are upregulated within the tumor compared to outside of the tumor margin. Here we report the isolation of BTSCs from tumor tissue from different regions, including outside of the enhancing margin of a GBM patient. These cells grow as neurospheres and demonstrate multipotency. Additionally, key genes frequently mutated in GBM have different mutations in BTSCs established from the within the tumor mass and from outside the enhancing rim. These results suggest that there may be different stem cell populations within a single tumor. The detection of BTSCs from in brain frequently not removed during surgery suggest that large scale screening of BTSCs with different drugs is a valid strategy to identify new chemotherapeutics against GBM.

## P.054

### Utility of Foramen Ovale Electrodes in mesial temporal lobe epilepsy

*C Kwon (Boston)* S Sheth (Boston) N Velez-Ruiz (Boston) M Mian (Boston) A Cole (Boston) E Eskandar (Boston)*

*Background:* FO electrodes (FOE) are useful in pre-surgical evaluation of mesial TLE. Studies demonstrate potential for misdiagnosis of laterality in TLE with ictal scalp EEG. Significant rates of false negative and positive lateralization of temporal lobe seizures by scalp EEG emphasize importance of FOEs in appropriate circumstances. *Methods:* We retrospectively reviewed records of all patients who underwent FOE investigation. Indications for FOEs were grouped into 4 categories: Bilateral fronto-temporal ictal activity on scalp EEG; Unclear scalp EEG laterality onset due to muscle artifact or significant delay following clinical manifestation; Discordance between ictal and interictal discharges; Interrogating specific anatomical abnormality or competing putative focus. *Results:* 28 consecutive patients with medically intractable epilepsy underwent investigation. Conclusive information was seen in 24/26 patients with ATL performed in eight, ATL pending in five and seven deemed as not surgical candidates either due to risk of memory damage or true bilateral temporal foci. Two patients had inconclusive studies and were referred for bilateral orthogonal depth electrodes. *Conclusions:* FOEs deliver greater sensitivity and earlier detection of mesial temporal epileptiform activity than surface recordings, bypass muscle artifacts, and can be combined with scalp recordings. When FOEs are employed to test appropriate hypotheses, they provide important diagnostic information for surgical decision-making.



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## P.055

### Formation of de novo aneurysms in two patients following skull base meningioma resection

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*Background:* Most meningiomas are benign tumors that may be cured with total resection, however lesions of the skull base present a risk to adjacent structures including the cerebral vasculature. Aneurysmal dilation of the internal carotid artery is a well recognized occurrence after removal of pediatric tumors, but is an uncommon finding in adults. We present two cases of de novo aneurysm formation following resection of anterior clinoid meningiomas and discuss possible pathogenesis and treatment strategies. *Methods:* A 39 year-old woman underwent resection of a right clinoid meningioma. Follow-up MRI and CTA demonstrated aneurysmal dilation of the right internal carotid artery. Subsequent catheter angiogram revealed two lesions of the artery. A 70 year old woman had clinoid meningioma resection followed by stereotactic radiosurgery. Follow-up imaging demonstrated a wide necked posterior communicating artery aneurysm. *Results:* Both patients underwent successful stent assisted coiling of their de novo aneurysms. One patient required a second endovascular treatment after delayed imaging demonstrated aneurysm recurrence. Neither patient suffered subarachnoid hemorrhage and both remain free of neurolgic deficit. *Conclusions:* De novo aneurysm formation can occur following tumor resection adjacent to intracranial arteries, and endovascular treatment of these lesions can be effective and allow for less artifact on subsequent imaging. The pathogenesis, risk factors and optimal follow up for this type of aneurysm remains controversial.

## P.056

### Rosette-forming neuroglial tumor occurring in the posterior third ventricle

*IM Alnaami (Edmonton)* K Aronyk (Edmonton) J Lu (Edmonton) C O'Kelly (Edmonton)*

*Background:* Rosette-forming neuroglial tumor (RFNT) is a rare brain tumor found almost exclusively within the fourth ventricle. These grade 1tumors were first included in the World Health Organization Classification for the central nervous system in 2007. Since then, approximately 45 cases have been published. *Methods:* We report a case of a 57 year-old male who presents with headaches, nausea, and ataxia. Investigations revealed obstructive hydrocephalus secondary to an enhancing lesion in the posterior third ventricle at the level of the aqueduct. *Results:* The patient underwent an endoscopic procedure comprising a third ventriculostomy and biopsy of the lesion. Tumor debulking was not attempted as the Lesion was adherent to the right thalamus. Following surgery the patient's symptoms resolved and his hydrocephalus improved radiographically. Pathologic examination revealed a biphasic tumor consisting of neurocytic and glial components. The neurocytic component was composed of well-differentiated cells forming neurocytic rosettes and perivascular pseudorossettes. These features are compatible with a diagnosis of RFNT. The patient has remained stable on clinical and radiographic follow-up. As such, further intervention or adjuvant treatment has been deferred. *Conclusion:* We report the first case in the literature of RFNT occurring within the posterior third ventricle.

## P.057

### Post-operative facial nerve preservation after vestibular schwannoma (vs) resection: a comparative meta-analysis of endoscopic vs open resection surgery

*AO Alobaid (Hamilton)* M Aref (Hamilton) K Reddy (Hamilton) F Farrokhyarp (Hamilton)*

*Introduction:* Some groups in the world start using endoscope for vestibular schwannoma, with promising results. *Objective:* To determine whether patient outcomes and complications differ depending on surgical approach of either endoscopic or open resection methods for the removal of Vestibular Schwannoma. The primary Outcome: rate of facial nerve preservation. Secondary Outcomes: CSF leak, Vestibular nerve preservation, tumour size, degree of resection, wound infection, recurrence rate, and death. *Method:* Retrospective meta-analysis.

Inclusion Criteria:

- Case series with> 20 adult patients
- Endoscopic or open resection
- Retrosigmoid approach
- Adults
- English language.

Exclusion Criteria:

- Other approaches: translabyrinthine, middle fossa
- Animal, cadaver, and basic science studies
- Comparative studies.

*Results:* 1861 articles, 44 articles included with 48.5% agreement level. After review, 25 articles: 4 endoscopic and 21 open. Total population: 3026 for open, 790 for endoscopic. Tumor size was not significantly different between the two groups. Good facial outcome (House and Brackmann I or II) was more in the endoscopic group (94 vs. 67%). Better cochlear nerve function, less CSF leak, more GTR all were more seen in endoscopic group too.

Limitations:

- Heterogeneity.
- Many information not available.
- Different definitions.
- Cross population between some studies
- This is a summation of case series.

## P.058

### Gushot wound to the head:prognostic factors and surgical decision making

*IU Haq (Thunder Bay)**

Civilian gunshot injuries to the head are relatively rare. Survival after a gunshot wound to the head is becoming more common.The exposure of neurosurgeons with this kind of traumatic head injury is not very common.The aim of this study was to analyse prognostic factors which help to decide whether or not to operate. We present a 47 year-old man who shot himself with shotgun and presented with fixid dilated pupils with GCS 5/15. He survived after an emergency decpmressive craniotomy for an associated small acut subdural hematoma. Hospital record was retrospectively reviewed for the last 20 years for patients admitted to the regional center with gunshot



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wound to the head. Moreover, literature search was carried out to look for the prognostic indicators for surgery and recovery. Predicting factors on admission i.e;Glasgow coma scale, status of the pupils, bullet track, hemodynamic stability, midline shift, intracranial pressure and associated vacular injury/crnail fracutre were evaluated.

# SPINE

## P.059

### What are the factors that may predict regain of independent walking after surgery for patients with advanced cervical spondylotic myelopathy?

*A Al Habib (Riyadh) AM Alaqeel (Riyadh)* A AlDakkan (Riyadh) F Albadr (Riyadh)*

*Introduction:* Cervical spondylotic myelopathy (CSM) is a common spine disease that can be associated with devastating consequences, one of which is impairment of walking. Factors that may predict the ability of walking following surgery are not well defined. *Methods:* Retrospective review including CSM patients with inability to walking dependently (Nurick4 and 5)who underwent surgery from 2003-2010. A neuroradiologist, blinded to the clinical data, reviewed all MRI studies. 38% of patients were contacted to update their follow-up status. *Results:* Forty-eight patients were included (males 83%) with a mean follow-up of 24.7 months. Patients with a better pre-operative neurological status had a significantly better chance of walking after surgery (83.33% for Nurick4 Vs 33.33% for Nurick5,P<;0.01). Independent walking after surgery was less likely with longer signal change on T2WI MRI study for all patients (20.5mm Vs 7.5mm, p<;0.0001) and when stratified to Nurick4 (12.8mm Vs 7.3mm, p=0.018) and Nurick5 (22.4mm Vs. 8.1mm,P=0.0001) separately. Additionally, narrow spinal canal width was a predictor for independent walking (6.3mm Vs. 7.5mm, p=0.015) and for Nurick4 alone (4.88mm Vs. 7.53mm,P<;0.05). *Conclusions:* Patients with advanced CSM who have better baseline walking and pre-operative MRI features of less signal change in the spinal cord and wider spinal canal have a better chance of independent walking following surgery. Surgery should be recommended before patients progress into advanced stage where recovery is less and the need for resources is large.

## P.060

### A cost-utility analysis comparing early versus late surgical decompression of spinal cord for acute traumatic cervical spinal cord injury SCI)

*JC Furlan (Toronto)* MG Fehlings (Toronto)*

*Background:* This cost-utility analysis (CUA) examines whether early (≤24 hours post-SCI) surgical decompression is more cost-effective than late surgery in the management of SCI patients. *Methods:* Cases were grouped into patients with complete motor SCI (Group-I) and individuals with incomplete SCI (Group-II). A CUA was performed for each patient group using clinical data and utilities from STASCIS during the first year post-injury. The perspective of public health care insurer was adopted. *Results:* When considering the late decompression as the baseline strategy, the incremental cost-effectiveness ratio (ICER) is CAN$8,523,852 per quality-adjusted life year (QALY) for Group-I and CAN$275,390/QALY for Group-II. The probabilistic analysis indicated that no strategy is dominant. Using Monte-Carlo simulation, early surgery was more cost-effective in 23.32% of the times in Group-I, but it was more costly and less effective than late decompression in 26.21% of the times in Group-I. Early decompression was dominant in 30.46% of the times in Group-II, but it was dominated in 16.73% of the times in Group-II at CAN$50,000 willingness-to-pay. *Conclusions:* Our results suggest that early decompression of spinal cord can be more cost effective than delayed surgery in one quarter of patients with complete SCI and one third of individuals with incomplete SCI.

## P.061

### ESR and CRP reliably increase in immune compromised patients with spinal infections

*AC Bradi (Kingston)* S Ferrara (Kingston) D Zoutman (Kingston) R Pokrupa (Kingston)*

*Background:* Spinal infections potentially can cause irreversible neurological deficits. Recognition based on early symptoms of back pain and tenderness, and fever is challenging. We examined whether laboratory tests are reliable even in the presence of immune compromise to identify patients who would benefit from imaging-based investigation. *Methods:* All spinal infections (spinal epidural abscess, osteomyelitis or discitis) admitted to Kingston General Hospital in the past 8 years were retrospectively analyzed for associations between demographics, ESR, CRP and leukocyte count (WBC) at admission using independent samples t-tests and chi-square tests. Four subgroups analyzed were: Age ≥ 70, Intravenous drug users (IVDU), Immune compromise (diabetes mellitus, Hepatitis C, HIV, steroid use, immune modulation, chemotherapy, IVDU) and non-compromised. *Results:* At admission, average age was 59.5 ± 14.7 years (mean ± SD, n=115). 29% were ≥ 70 years old, 26% were IVDUs, and 45% were immune compromised. 28% had no infection risks. ESR, CRP and WBC were elevated in 99%, 97% and 53% of patients respectively. All patient groups were equally likely to have elevated inflammatory and infectious markers (p>0.05). *Conclusions:* These findings suggest that immune compromise from advanced age, intravenous drug use, comorbid conditions or multiple factors does not stop a rise in ESR or CRP in spinal infections. ESR and CRP were more reliably elevated than WBC.

## P.062

### Ketamine's effect on astrocyte migration and neural progenitor cell proliferation

*U Shanmugalingam (Ottawa)* MJ Coyle (Ottawa) X Cao (Ottawa) EC Tsai (Ottawa)*

*Background:* Post spinal cord injury (SCI), glutamate excitotoxicity, cell loss and glial scar formation can impede repair. We examined whether ketamine, a widely used anesthetic, altered the effect of glutamate on proliferation of endogenous neural progenitor cells (eNPCs) present in the spinal cord and affected astrocyte migration using a cell culture model. *Methods:* Rat eNPCs derived neurospheres were exposed to glutamate (50 uM) and ketamine (dose ranging from 0-100ug/mL) for two days, then visualized using



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immunocytochemistry. Cells were exposed to 5-bromo-2-deoxyuridine 24 hours prior to fixation. Proliferation was assessed using cell counts. Migration was assessed by measuring the distance from the edge of the neurosphere to the centre of the respective cell body. *Results:* There was a significant increase in eNPCs proliferation following 100ug/mL ketamine exposure (student t-test, p<;0.001). There was also a significant decrease in eNPCs derived astrocyte migration when ketamine doses greater than 13.7ug/mL were applied (student t-test, p<;0.001). *Conclusions:* Following SCI, ketamine, may be useful in augmenting eNPCs proliferation to replace lost cell populations and in restricting astrocytic migration at the injury site. Therefore, ketamine may be a useful therapeutic component for SCI repair.

## P.063

### Effect of wait-times on spinal cord stimulation outcomes in chronic pain

*K Kumar (Regina) M Abbas (Regina)* S Rizvi (Regina) R Nguyen (Regina) V Murthy (Regina)*

*Background:* To identify barriers in spinal cord stimulation (SCS) implantation and suggest areas for improvement. *Methods:* A retrospective analysis of 410 SCS patients with neuropathic pain (mean follow-up=97.6 months). We calculated time-lapse from initial symptom onset to first medical contact, use of conventional medical management (CMM), investigations, referral patterns, and SCS implant. *Results:* Results are presented as average values. Patients waited 64 days for primary care physician (PCP) assessment. The mean duration of CMM was 8.3 months, time lapse to see a specialist took a further 3.3 months. Specialists managed patients for 11.2 months before referral to an SCS implant surgeon which took 4 months. Neurosurgeons and neurologists tended to refer patients earlier to an implant surgeon in contrast to anesthetists and orthopedic surgeons. 46% of patients needed further investigations (e.g. imaging) which required an additional 7.7 months. Time from implant surgeon assessment to actual implant took 4.4 months. Mean wait-time from symptom onset to SCS implantation was 66 months. *Conclusion:* Improvements in diagnosis, referral patterns, surgical wait-times, and rational use of CMM are needed to maximize patient outcomes. Our study suggests that best results are achieved when SCS is implanted within 2 years of symptom onset. The success of SCS is inversely proportional to implantation delay, which is considerably influenced by wait-times.

## P.064

### Spinal Dural AVF: a case series

*S Fox (Saskatoon)* L Hnenny (Saskatoon) K Meguro (Saskatoon) R Griebel (Saskatoon) M Kelly (Saskatoon)*

*Background:* Spinal dural arteriovenous fistulae (AVF's) are rare lesions. Patients typically present with slowly progressive myelopathy that is often mistaken for degenerative cervical or lumbar stenosis. On MRI, multisegmental T2 hyperintensities within the spinal cord and associated flow voids are pathognomonic. Definitive diagnosis and localization is achieved with spinal angiography. Treatment consists of open surgical ligation, endovascular embolization, or multimodality treatment. *Case Series:* We present 10 cases of spinal dural AVF's treated at our centre over an 8-year period. The clinical presentation, radiographic findings, lesion classification, treatment undertaken, and neurologic outcome are reviewed. Two atypical cases are highlighted. The patients in our series were predominantly male (70%), the mean age was 62.6 years, and the most common type of lesion was the dorsal dural AVF with single feeder (type IA). All patients underwent surgical ligation, with some undergoing pre-operative coil embolization. Eight patients showed improvement in their myelopathy following treatment as graded by the Nurick system. Two patients failed to improve. None of the patients worsened. *Conclusions:* The successful treatment of spinal dural AVFs requires a detailed understanding of the specific lesion type and its angioarchitecture. This helps ensures successful endovascular or surgical treatment.

## P.065

### Assessment of type and level of evidence in four spine journals

*SM Alrashidi (Halifax )* M Halawani (Riyadh) A Alyahya (Riyadh)*

*Introduction:* The level of evidence varies into: Randomized control trials, Cohort study, Case control study, Case series and case control study. Of above mentioned the randomized control trials are of the strongest evidence however they are difficult to conduct. *Purpose:* The goal of this study is to assess the type and level of evidence found in four different spine journals by applying level of evidence rating system. *Methods:* The authors reviewed all clinical articles published from January through December 2008 in four spine journals. Exclusion criteria are Studies of animals, studies of cadaver, basic-science articles, review articles, case reports, and expert opinion . Reviewer determined whether the studies were therapeutic, prognostic, diagnostic, or economic, and each rated the level of evidence as I, II, III, or IV. *Result:* Our review indicated most of published articles are case series of therapeutic oriented studies 50% both. It is followed by case control studies 24% with Diagnostic type 30%. Randomized control trials and cohort studies are 14% both. Prognostic studies are 15% followed by economic studies 5%. *Conclusion:* Most published articles are case series and therapeutic goal studies. This is because of difficulty of randomized control trials to be conducted.

# PEDIATRICS (NEUROLOGY, NEUROSURGERY)

## P.066

### Spontaneous hemorrhage in two cases of cerebellar pilocytic astrocytomas in children

*MP Wilson (Edmonton)* W Alshaya (Edmonton) JA Pugh (Edmonton)*

*Introduction:* Pilocytic astrocytomas are common low-grade pediatric brain tumors, slowly progressive, and amenable to treatment. While 67% of pilocytic astrocytomas arise in the cerebellum, only 7 known cases have reported presentation with spontaneous hemorrhage. *Case Reports:* We present two cases of cerebellar pilocytic astrocytomas presenting with delay for spontaneous hemorrhage leading to brainstem compression and death. The first was a 12-year-old boy with developmental delay and a 1-year history of progressive nausea, vomiting, ataxia and lethargy



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who had a sudden severe headache and subsequent loss of consciousness. He was first transferred to a local hospital before presenting to our service. The second case was a previously healthy 5-year old girl who had a sudden loss of consciousness. She was observed for several hours at home without improvement before being taken to hospital. Despite aggressive neurosurgical intervention, both patients died as a result of tumor hemorrhage. Atypical vascular infiltration was noted in the first case and malignant tumor differentiation was noted in the second. *Conclusion:* Delayed presentation of cerebellar pilocytic astrocytomas presenting as spontaneous hemorrhage can result in rapid deterioration and detrimental outcomes. Diagnosis has been difficult due to the insidious progression of symptoms in non-hemorrhaged tumors and rarity of spontaneous hemorrhages in the posterior fossa. Early presentation and imaging with aggressive treatment is necessary to improve prognosis in children.

## P.067

### Encephalocraniocutaneous lipomatosis: a case of long-term follow up

*H Bauld (Halifax)* PD McNeely (Halifax)*

Encephalocraniocutaneous lipomatosis (ECCL) is a rare neuro-cutaneous syndrome, with only 54 cases reported worldwide in 2006. The syndrome is characterized by hallmark lesions including psiloliparus naevi, lipomas of the central nervous system, and ocular abnormalities such as choristomas and colobomas. There is little information available regarding the long-term outcome of patients who have this uncommon diagnosis. We report the case of a patient with ECCL who was diagnosed in infancy and has been followed for over 12 years. He has an extensive intraspinal lipoma and is quadriparetic. His neurological deficit has remained stable over time, the dimensions of the lipoma have regressed slightly, and his scoliosis has progressed quite markedly, requiring corrective surgery. He has not been operated on for the lipoma itself. Implications for neurosurgical management of patients who have ECCL are reviewed.

## P.068

### Enhanced frontal lobe EEG connectivity in children with febrile seizures

*A Birca (Montréal)* S Lippé (Montréal) L Carmant (Montréal) A Lortie (Montréal) P Vannasing (Montréal) M Lassonde (Montréal)*

*Background:* Studies reported that patients with photosensitive epilepsy are characterised by abnormal EEG hyperconnectivity, primarily involving the anterior cortical regions under resting conditions and during intermittent photic stimulation (IPS). In this study, we investigated whether children with febrile seizures (FS) show similar abnormalities of functional coupling involving the anterior cerebral regions. *Methods:* EEG was recorded during rest and 5, 7.5, 10 and 12.5 Hz IPS in 12 FS patients, 5 siblings and 15 control children between 6 and 36 months of age. Original EEG data were transformed into source space using a multiple regional source model. Source coherence values were calculated for the interfrontal and occipito-frontal connections for the delta, theta, alpha, beta and gamma frequency bands during rest and IPS. *Results:* FS patients showed significantly higher source coherence across all connections and frequency bands studied, during resting state and IPS, when compared to siblings and control children (p<;0.05). *Conclusions:* Similar to older epileptic patients, children with FS show a pattern of frontal lobe cortical hyperconnectivity that probably underlies their propensity to have seizures with fever. Future prospective studies could assess whether these abnormalities persist later in life or have a prognostic value for the development of epilepsy following FSs.

## P.069

### Spectrum of cerebral malformation in fetuses with Trisomy 21

*F Jacob (Boston)* P Grant (Boston) O Khwaja (Boston)*

*Background:* Trisomy 21 (T21) has become recognized as the most common viable trisomy. Even though it is invariably associated with mild to severe developmental delay and mental retardation, no gross central nervous system (CNS) malformation has been consistently identified in individuals with T21. The aim of this study was to establish the spectrum of cerebral abnormalities in individuals with T21 identified on fetal MRI. *Methods:* We retrospectively identified a series of fetuses with T21 diagnosed pre or postnatally referred to Advanced Fetal Care Center (AFCC) at Children's Hospital Boston between 2003 and 2011 who underwent fetal MRI. *Results:* A total of 115 fetuses with T21 were evaluated at the AFCC with 17 pregnancies, and 18 fetuses (1 twin pregnancy) undergoing a total of 23 fetal MRI studies. The average gestational age at the time of first imaging assessment was 24+0 weeks (+/-5+5). In total 12 fetuses were male, and 6 were female. Of the 17 pregnancies 12 were continued, and 5 were terminated, resulting in 13 live births. In total 14 fetuses undergoing MRI had CNS abnormalities identified: the most prevalent being ventriculomegaly (n=9), followed by cerebellar hypoplasia (n=6) and partial agenesis of the corpus callosum (n=4). *Conclusion:* The spectrum of congenital cerebral malformation in fetuses with T21 includes ventriculomegaly, partial ACC and cerebellar hypoplasia.

## P.070

### Subependymal hemorrhage at the contralateral side following a neuro-endoscopic procedure for a large arachnoid cyst – a case report and review of literature

*D Notta (Hamilton)* B Baronia (Hamilton)**

Intracranial arachnoid cysts are benign fluid-filled lesions that are largely asymptomatic, although neurologic symptoms may ensue from a mass effect. While neuroendoscopy allows for relatively safe and minimally invasive drainage or removal of the cyst, various complications have been reported following this procedure. Complications following neuroendoscopy can include direct trauma to nearby structures resulting in contusion or laceration. Intracranial hemorrhages at the area of the procedure can include subdural, intracerebral, and intraventricular hemorrhages. There are various reports on intracranial hemorrhages after the evacuation of a subdural hematoma, with some being located at remote sites. We have not yet encountered similar cases of subependymal hemorrhages at the contralateral side following a neuroendoscopic procedure. We are reporting a 4-day-old baby boy who presented acutely with signs of raised intracranial pressure. Cranial imaging revealed complex hydrocephalus with a large cystic lesion occupying the right temporal fossa extending to the posterior fossa. The patient required an immediate transfontanel ultrasound guided



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ventriculostomy. Subsequent neuroendoscopic fenestration of the cyst was done successfully. The patient improved following the procedure. A routine post-op ultrasound revealed a subependymal hemorrhage on the contralateral side of the cyst. This was followed-up conservatively. We are reviewing the relevant literature.

## P.071

### The interburst interval in comatose children can be modulated by photic stimulation

*DA Nita (Toronto)* M Moldovan (Kopenhagen) CD Hahn (Toronto)*

*Background:* The EEG pattern of burst-suppression (BS) reflects severe encephalopathy due to a variety of brain pathologies. Our aim was to explore whether the BS pattern is reactive to photic stimulation (PS) and whether BS responsiveness to PS is more likely to reflect the severity of encephalopathy than the baseline BS pattern. *Methods:* Five consecutive critically ill children undergoing continuous EEG monitoring with BS at the onset of monitoring were included in this study, irrespective of the underlying etiology. One minute long trains of 1 Hz photic stimuli were applied and the influence of PS on inter-burst intervals (IBI) and burst duration (BD) was quantified and compared to IBI and BD during baseline epochs. *Results:* PS consistently elicited bursts with less than 1 second latency and similar BD. At stimulation onset there was an increased bursting rate followed by a decreased bursting rate at stimulation offset. A mathematical model of cumulative increases in the threshold of subsequent burst generation followed by an exponential recovery can reproduce the IBI behaviour during PS. *Conclusions:* IBI is modulated by PS. Further studies are needed to assess if BS reactivity is a biomarker that can assist with prognostication in critically ill children.

## P.072

### Unilateral sensorineural hearing loss presentation associated with posterior fossa pathology

*IM Alnaami (Edmonton)* H Al-Hakim (Edmonton) J Pugh (Edmonton) V Mehta (Edmonton) K Aronyk (Edmonton)*

*Background:* An isolated unilateral sensorineural hearing loss in paediatric patients is usually due to more common temporal bone pathology but may also be due to intracranial pathology. Investigations usually center around audiology and temporal bone imaging but brain imaging is sub-optimal with these measures alone. A delay in diagnosis and treatment may result if the investigations do not include studies designed to assess intracranial brain structures. *Method:* We collected the retrospective case data of two paediatric patients (7 and 8 years old) who presented with pure isolated sensorineural hearing loss as a cardinal symptom. In both cases, symptoms and signs progressed and both were found to have intracranial posterior fossa pathology. *Results:* Both patients had cerebellopontine angle mass lesions: one a parasitic abscess and the other a posterior fossa malignant cerebellar tumor. *Conclusion:* We report two cases of intracranial posterior fossa pathology presenting as isolated unilateral sensorineural hearing loss in paediatric patients and recommend brain imaging in the work up of this particularly difficult patient group.

## P.073

### Can neurophysiological monitoring predict outcome in fatty filum release?

*IM Alnaami (Edmonton)* J Pugh (Edmonton) V Mehta (Edmonton) K Aronyk (Edmonton) J Norton (Edmonton)*

*Background:* Intraoperative neurophysiological monitoring (IOM) has been used for many years to assist in the surgical treatment of brain and spinal cord pathologies. However, no data exist on the use of IOM in predicting the outcome of fatty filum release in asymptomatic paediatric patients. *Method:* We report a consecutive series of pediatric patients whom underwent release of an incidental fatty filum at our institution. In accordance with our standard practice all patients had IOM. *Results:* Over the course of 2 years, 3 patients with incidental findings of a fatty filum underwent surgical release. All patients exhibited abnormalities on IOM at baseline which altered within 5 minutes of the filum release and continued to trend towards normal values over the course of the procedure. *Conclusion:* IOM is a useful adjunct in fatty filum releases, and may have potential as a prognostic and diagnostic tool in these patients.

## P.074

### An atypical case of SCN9A mutation with global motor delay and erythromelagia

*IA Meijer (Montreal)* M Vanasse (Montreal) E Rossignol (Montreal)*

*Background:* Erythromelalgia is characterized by recurrent episodes of burning pain and redness of the extremities. It is caused by heterozygote gain-of-function mutations in the *SCN9A* gene, coding for the NAv1.7 channel. It usually presents as a pure sensory autonomic disorder. We describe a patient with an *SCN9A* mutation and an usual phenotypic presentation of gross motor delay, childhood-onset erythromelalgia, extreme visceral pain episodes, followed by hypoesthesia and automutilation. *Methods:* The investigation of the patient's motor delay included various biochemical analyses, an EMG, a muscle biopsy, and a quantitative PCR of *SMN1* . Once erythromelalgia was suspected, the *SCN9A* gene was sequenced. Sequential therapeutic trials of amitriptyline and gabapentin were attempted, and treatment with carbamazepine was initiated. *Results:* The EMG, CGH, EEG and metabolic tests were negative. The sural nerve biopsy showed an axonal neuropathy, whereas the muscle biopsy showed signs of neurogenic atrophy. Sequencing of the *SCN9A* gene revealed a heterozygote missense mutation in exon 7; p.I234T. *Conclusions:* We present the first case of global motor delay and erythromelalgia associated with an *SCN9A* mutation. The gross motor delay might be attributed to the extreme pain episodes or to a developmental perturbation of proprioceptive inputs.



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## P.075

### Central nervous system venulitis presenting as confusional migraine

*SL Orr (Ottawa)* A Doja (Ottawa)*

*Background:* Primary angiitis of the central nervous system (PACNS) is a rare, albeit increasingly well-recognized cause of morbidity in children. It is thought to primarily affect the arteries and arterioles of the central nervous system (CNS), and has only rarely been found to also involve the veins and venules. There is only one previously published case of a pediatric patient presenting with symptoms of PACNS, who was found to have isolated CNS venulitis on brain biopsy. *Methods:* Case report and literature review. *Results:* A 17-year-old female with a 4-year history of confusional migraines presented with increasingly frequent hemiplegic migraines and right-sided hemiplegia. Infectious, hematologic and rheumatologic work-ups were negative. MRI brain showed increased signal intensity in the deep white matter of the left hemisphere and in the subcortical white matter of the left temporal area, with calcifications and perilesional edema. CT angiogram showed stenosis of the venous structures of the brain. Brain biopsy demonstrated CNS venulitis. The patient was treated with a course of steroids and cyclophosphamide, followed by maintenance therapy with mycophenolate mofetil, and displayed clinical improvement. *Conclusions:* We describe a case of pediatric CNS venulitis presenting with confusional migraine. CNS venulitis may constitute a novel form of CNS inflammation, where the target of the inflammatory response is the venule, or may represent a new variant of PACNS.

## P.076

### Timing of hypoxic-ischaemic insult in perinatal HIE

*E Marcotte (London)* D Lee (London) B Richardson (London) SD Levin (London)*

*Background:* Neonatal encephalopathy presenting with seizures and findings of HIE on MRI are invariably ascribed to a hypoxic-ischemic insult during labour and delivery. *Methods:* We present two infants whose clinical and MRI findings following delivery were consistent with HIE but whose labour, delivery or subsequent progress were not consistent with intrapartum asphyxial insult. *Results:* Patient 1 was born at 41 weeks gestation by c-section for failure to progress. Pregnancy was uneventful. Birth weight 3450g, Apgar scores were 1, 5, 7 and 10. Umbilical cord arterial pH was 7.22. Seizures were seen. MRI showed multicystic leukoencephalomalacia. Other organs were minimally affected. Patient 2 was born at 41 weeks gestation by c-section for concerning fetal heart rate decelerations after an uneventful pregnancy. Birth weight 3430g, Apgar scores were 2, 5, 7 and 8. Cord arterial pH was 7.17. She had seizures. MRI showed cerebral oedema and repeat imaging showed cerebral atrophy. *Conclusions:* The clinical presentation and MRI findings were consistent with HIE. However, the absence of evident asphyxia during labour and delivery with the cord pH well above 7.00, the rapid improvement in Apgar scores and sparing of other organ systems indicate that intrapartum hypoxic insult was not the cause of the encephalopathy. Physicians must ensure that all criteria for perinatal HIE are fulfilled and consider antecedent causes before concluding that the insult occurred at birth.



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# Maxalt®

*rizatriptan benzoate tablets*

# Maxalt RPD®

*rizatriptan benzoate wafers*

## Prescribing Summary

## Patient Selection Criteria

**THERAPEUTIC CLASSIFICATION:** 5-$HT_1$ Receptor Agonist

**INDICATIONS AND CLINICAL USE**

**Adults**

MAXALT® is indicated for acute treatment of migraine attacks with or without aura in adults. MAXALT® is not intended for the prophylactic therapy of migraine or for use in the management of hemiplegic, ophthalmoplegic or basilar migraine (see CONTRAINDICATIONS in the Supplemental Product Information section). Safety and effectiveness of MAXALT® have not been established for cluster headache, which is present in an older, predominantly male population.

**Pediatrics (<18 years of age)**

The safety and efficacy of MAXALT® has not been established in patients under 18 years of age and its use in this age group is not recommended (see WARNINGS AND PRECAUTIONS).

**Geriatrics (>65 years of age)**

The safety and effectiveness of MAXALT® has not been adequately studied in individuals over 65 years of age. Its use in this age group is, therefore, not recommended (see WARNINGS AND PRECAUTIONS).

**Special Populations and Conditions**

For use in special populations ( see Supplemental Product Information, WARNINGS AND PRECAUTIONS, Special Populations and Conditions).

**CONTRAINDICATIONS**

**MAXALT® is contraindicated in patients with history, symptoms, or signs of ischemic cardiac, cerebrovascular or peripheral vascular syndromes, valvular heart disease or cardiac arrhythmias (especially tachycardias). In addition, patients with other significant underlying cardiovascular diseases (e.g., atherosclerotic disease, congenital heart disease) should not receive MAXALT®. Ischemic cardiac syndromes include, but are not restricted to, angina pectoris of any type (e.g., stable angina of effort and vasospastic forms of angina such as the Prinzmetal's variant), all forms of myocardial infarction, and silent myocardial ischemia. Cerebrovascular syndromes include, but are not limited to, strokes of any type as well as transient ischemic attacks (TIAs).**

**Peripheral vascular disease includes, but is not limited to, ischemic bowel disease, or Raynaud's syndrome (see WARNINGS AND PRECAUTIONS).**

**Because MAXALT® may increase blood pressure, it is contraindicated in patients with uncontrolled or severe hypertension (see WARNINGS AND PRECAUTIONS).**

**MAXALT® is contraindicated within 24 hours of treatment with another 5-$HT_1$ agonist, or an ergotamine-containing or ergot-type medication like dihydroergotamine or methysergide.**

**MAXALT® is contraindicated in patients with hemiplegic, ophthalmoplegic or basilar migraine.**

**Concurrent administration of MAO inhibitors or use of rizatriptan within 2 weeks of discontinuation of MAO inhibitor therapy is contraindicated (see Drug Interactions).**

**Because there are no data available, MAXALT® is contraindicated in patients with severe hepatic impairment.**

**MAXALT® is contraindicated in patients who are hypersensitive to rizatriptan or any component of the formulation.**

## Safety Information

**WARNINGS AND PRECAUTIONS**

**General**

MAXALT® should only be used where a clear diagnosis of migraine has been established.

For a given attack, if a patient has no response to the first dose of rizatriptan, the diagnosis of migraine should be reconsidered before administration of a second dose.

**Psychomotor Effect**

Dizziness, somnolence and asthenia/fatigue were experienced by some patients in clinical trials with MAXALT® (see ADVERSE EVENTS). Patients should be advised to avoid driving a car or operating hazardous machinery until they are reasonably certain that MAXALT® does not adversely affect them.

**Cardiovascular**

**Risk of Myocardial Ischemia and/or Infarction and Other Adverse Cardiac Events**

**MAXALT® has been associated with transient chest and/or neck pain and tightness which may resemble angina pectoris. Following the use of other 5-$HT_1$ agonists, in rare cases these symptoms have been identified as being the likely result of coronary vasospasm or myocardial ischemia. Rare cases of serious coronary events or arrhythmia have occurred following use of other 5-$HT_1$ agonists, and may therefore also occur with MAXALT®. Because of the potential of this class of compounds (5-$HT_{1B/1D}$ agonists) to cause coronary vasospasm, MAXALT® should not be given to patients with documented ischemic or vasospastic coronary artery disease (see CONTRAINDICATIONS). It is strongly recommended that MAXALT® not be given to patients in whom unrecognized coronary artery disease (CAD) is predicted by the presence of risk factors (e.g., hypertension, hypercholesterolemia, smoker, obesity, diabetes, strong family history of CAD, female with surgical or physiological menopause, or male over 40 years of age) unless a cardiovascular evaluation provides satisfactory clinical evidence that the patient is reasonably free of coronary artery and ischemic myocardial disease or other significant underlying cardiovascular disease. The sensitivity of cardiac diagnostic procedures to detect cardiovascular disease or predisposition to coronary artery vasospasm is unknown. If, during the cardiovascular evaluation, the patient's medical history, electrocardiographic or other investigations reveal findings indicative of, or consistent with, coronary artery vasospasm or myocardial ischemia, MAXALT® should not be administered (see CONTRAINDICATIONS).**

**For patients with risk factors predictive of CAD, who are considered to have a satisfactory cardiovascular evaluation, the first dose of rizatriptan should be administered in the setting of a physician's office or similar medically staffed and equipped facility. Because cardiac ischemia can occur in the absence of clinical symptoms, consideration should be given to obtaining on the first occasion of use an electrocardiogram (ECG) during the interval immediately following MAXALT®, in these patients with risk factors. However, an absence of drug-induced cardiovascular effects on the occasion of the initial dose does not preclude the possibility of such effects occurring with subsequent administrations.**

**Intermittent long-term users of MAXALT® who have or acquire risk factors predictive of CAD, as described above, should receive periodic interval cardiovascular evaluation as they continue to use MAXALT®.**

**If symptoms consistent with angina occur after the use of MAXALT®, ECG evaluation should be carried out to look for ischemic changes.**

***The systematic approach described above is intended to reduce the likelihood that patients with unrecognized cardiovascular disease will be inadvertently exposed to MAXALT®.***

**Discomfort in the chest, neck, throat and jaw (including pain, pressure, heaviness and tightness) has been reported after administration of rizatriptan. Because drugs in this class may cause coronary artery vasospasm, patients who experience signs or symptoms suggestive of angina following dosing should be evaluated for the presence of CAD or a predisposition to Prinzmetal's variant angina before receiving additional doses of medication, and should be monitored electrocardiographically if dosing is resumed and similar symptoms recur. Similarly, patients who experience other symptoms or signs suggestive of decreased arterial flow, such as ischemic bowel syndrome or Raynaud's syndrome following MAXALT® administration should be evaluated for atherosclerosis or predisposition to vasospasm (see CONTRAINDICATIONS).**

**Cardiac Events and Fatalities Associated with 5-$HT_1$ Agonists**

MAXALT® may cause coronary artery vasospasm. Serious adverse cardiac events, including acute myocardial infarction, life-threatening disturbances of cardiac rhythm, and death have been reported within a few hours following the administration of 5-$HT_1$ agonists. Considering the extent of use of 5-$HT_1$ agonists in patients with migraine, the incidence of these events is extremely low.

*Premarketing Experience with MAXALT®*

Among the approximately 4200 patients who were treated with at least a single oral dose of either 5 or 10 mg rizatriptan in premarketing clinical trials of MAXALT®, electrocardiac adverse experiences were observed in 33 patients. One patient was reported to have chest pain with possible ischemic ECG changes following a single dose of 10 mg.

*Postmarketing Experience with MAXALT®*

Serious cardiovascular events have been reported in association with the use of MAXALT®. The uncontrolled nature of postmarketing surveillance, however, makes it impossible to determine definitively the proportion of reported cases that were actually caused by MAXALT® or to reliably assess causation in individual cases.

**Cerebrovascular Events and Fatalities Associated with 5-$HT_1$ Agonists**

Cerebral hemorrhage, subarachnoid hemorrhage, stroke, and other cerebrovascular events have been reported in patients treated with 5-$HT_1$ agonists; and some have resulted in fatalities. In a number of cases, it appears possible that the cerebrovascular events were primary, the agonist having been administered in the incorrect belief that the symptoms experienced were a consequence of migraine, when they were not. Before treating migraine headaches with MAXALT® in patients not previously diagnosed as migraineurs, and in migraineurs who present with atypical symptoms, care should be taken to exclude other potentially serious neurological conditions. If a patient does not respond to the first dose, the opportunity should be taken to review the diagnosis before a second dose is given. It should be noted that patients with migraine may be at increased risk of certain cerebrovascular events (e.g., stroke, hemorrhage, transient ischemic attack).

**Special Cardiovascular Pharmacology Studies with Another 5-$HT_1$ Agonist**

In subjects (n=10) with suspected coronary artery disease undergoing angiography, a 5-$HT_1$ agonist at a subcutaneous dose of 1.5 mg produced an 8% increase in aortic blood pressure, an 18% increase in pulmonary artery blood pressure, and an 8% increase in systemic vascular resistance. In addition, mild chest pain or tightness was reported by four subjects. Clinically significant increases in blood pressure were experienced by three of the subjects (two of whom also had chest pain/discomfort). Diagnostic angiogram results revealed that 9 subjects had normal coronary arteries and one had insignificant coronary artery disease.

In an additional study with this same drug, migraine patients (n=35) free of cardiovascular disease were subjected to assessments of myocardial perfusion by positron emission tomography while receiving a subcutaneous 1.5 mg dose in the absence of a migraine attack. Reduced coronary vasodilatory reserve (~10%), increased coronary resistance (~20%), and decreased hyperemic myocardial blood flow



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(~10%) were noted. The relevance of these findings to the use of the recommended oral dose of this 5-$HT_1$ agonist is not known.

Similar studies have not been done with MAXALT®. However, owing to the common pharmacodynamic actions of 5-$HT_1$ agonists, the possibility of cardiovascular effects of the nature described above should be considered for any agent of this pharmacological class.

### Other Vasospasm-Related Events

5-$HT_1$ agonists may cause vasospastic reactions other than coronary artery vasospasm. Extensive postmarket experience has shown the use of another 5-$HT_1$ agonist to be associated with rare occurrences of peripheral vascular ischemia and colonic ischemia with abdominal pain and bloody diarrhea.

### Increase in Blood Pressure

Significant elevation in blood pressure, including hypertensive crisis, has been reported on rare occasions in patients receiving 5-$HT_1$ agonists with and without a history of hypertension. In healthy young male and female subjects who received maximal doses of MAXALT® (10 mg every 2 hours for 3 doses), slight increases in blood pressure (approximately 2-3 mmHg) were observed. Rizatriptan is contraindicated in patients with uncontrolled or severe hypertension (see CONTRAINDICATIONS). In patients with controlled hypertension, MAXALT® should be administered with caution, as transient increases in blood pressure and peripheral vascular resistance have been observed in a small portion of patients.

### Endocrine and Metabolism

### Phenylketonurics

Phenylketonuric patients should be informed that MAXALT RPD® Wafers contain phenylalanine (a component of aspartame). Each 5 mg wafer contains 1.05 mg phenylalanine, and each 10 mg wafer contains 2.10 mg phenylalanine.

### Hepatic/Biliary/Pancreatic

Rizatriptan should be used with caution in patients with moderate hepatic insufficiency due to an increase in plasma concentrations of approximately 30% (see ACTION AND CLINICAL PHARMACOLOGY, Special Populations and Conditions in the Product Monograph and DOSAGE AND ADMINISTRATION). Since there are no data in patients with severe hepatic impairment, rizatriptan is contraindicated in this population (see CONTRAINDICATIONS and DOSAGE AND ADMINISTRATION).

### Immune

Rare hypersensitivity (anaphylaxis/anaphylactoid) reactions may occur in patients receiving 5-$HT_1$ agonists such as MAXALT®. Such reactions can be life threatening or fatal. In general, hypersensitivity reactions to drugs are more likely to occur in individuals with a history of sensitivity to multiple allergens. Owing to the possibility of cross-reactive hypersensitivity reactions, MAXALT® should not be used in patients having a history of hypersensitivity to chemically-related 5-$HT_1$ receptor agonists.

### Neurologic

Care should be taken to exclude other potentially serious neurologic conditions before treating headache in patients not previously diagnosed with migraine or who experience a headache that is atypical for them. There have been rare reports where patients received 5-$HT_1$ agonists for severe headache that were subsequently shown to have been secondary to an evolving neurological lesion. For newly diagnosed patients or patients presenting with atypical symptoms, the diagnosis of migraine should be reconsidered if no response is seen after the first dose of MAXALT®.

### Seizures

Caution should be observed if MAXALT® is to be used in patients with a history of epilepsy or structural brain lesions which lower the convulsion threshold. There have been very rare reports of seizures following administration of MAXALT® in patients with or without risk factors or previous history of seizures (see ADVERSE REACTIONS, Post-Marketing Adverse Reactions, Nervous System in the Supplemental Product Information).

### Ophthalmologic

### Binding to Melanin-Containing Tissues

The propensity for rizatriptan to bind melanin has not been investigated. Based on its chemical properties, rizatriptan may bind to melanin and accumulate in melanin-rich tissue (e.g., eye) over time. This raises the possibility that rizatriptan could cause toxicity in these tissues after extended use. There were, however, no adverse ophthalmologic changes related to treatment with rizatriptan in the one-year dog toxicity study. Although no systematic monitoring of ophthalmologic function was undertaken in clinical trials, and no specific recommendations for ophthalmologic monitoring are offered, prescribers should be aware of the possibility of long-term ophthalmologic effects.

### Renal

Rizatriptan should be used with caution in dialysis patients due to a decrease in the clearance of rizatriptan, resulting in approximately 44% increase in plasma concentrations (see ACTION AND CLINICAL PHARMACOLOGY, Special Populations and Conditions in the Product Monograph, and DOSAGE AND ADMINISTRATION).

### Selective Serotonin Reuptake Inhibitors/Serotonin Norepinephrine Reuptake Inhibitors and Serotonin Syndrome

Cases of life-threatening serotonin syndrome have been reported during combined use of selective serotonin reuptake inhibitors (SSRIs)/serotonin norepinephrine reuptake inhibitors (SNRIs) and triptans. If concomitant treatment with MAXALT® and SSRIs (e.g., sertraline, escitalopram oxalate, and fluoxetine) or SNRIs (e.g., venlafaxine, duloxetine) is clinically warranted, careful observation of the patient is advised, particularly during treatment initiation and dose increases. Serotonin syndrome symptoms may include mental status changes (e.g., agitation, hallucinations, coma), autonomic instability (e.g., tachycardia, labile blood pressure, hyperthermia), neuromuscular aberrations (e.g., hyperreflexia, incoordination) and/or gastrointestinal symptoms (e.g., nausea, vomiting, diarrhea) (see DRUG INTERACTIONS).

### Special Populations and Conditions

For use in special populations (see Supplemental Product Information, WARNINGS AND PRECAUTIONS, Special Populations and Conditions).

## ADVERSE REACTIONS

**(see Supplemental Product Information for full listing)**

### Adverse Drug Reaction Overview

**Serious cardiac events, including some that have been fatal, have occurred following use of 5-$HT_1$ agonists. These events are extremely rare and most have been reported in patients with risk factors predictive of CAD. Events reported have included coronary artery vasospasm, transient myocardial ischemia, myocardial infarction, ventricular tachycardia, and ventricular fibrillation (see CONTRAINDICATIONS, WARNINGS AND PRECAUTIONS).**

### Long-Term Safety

In long-term extension studies, a total of 1854 patients treated 16,150 migraine attacks with MAXALT® 5 mg Tablets and 24,043 attacks with MAXALT® 10 mg Tablets over a period of up to 1 year. In general, the types of clinical adverse experiences observed in the extension studies were similar to those observed in the acute studies. However, the incidences of most clinical adverse events were approximately 3-fold higher in extension, as expected, based on increased observation time. The most common adverse events per attack (defined as occurring at an incidence of at least 1%) for MAXALT® 5 mg and 10 mg, respectively, were as follows: nausea (3%, 4%), dizziness (2%, 2%), somnolence 2%, 4%), asthenia/fatigue (2%, 2%), headache (1%, 2%), vomiting (1%, <1%), chest pain (<1%, 1%) and paresthesia (<1%, 2%). Due to the lack of placebo controls in the extension studies, the role of MAXALT® in causation cannot be reliably determined.

To report a suspected adverse reaction, please contact Merck Frosst Canada Ltd. by:

Toll-free telephone: 1-800-567-2594
Toll-free fax: 1-877-428-8675
By regular mail: Merck Frosst Canada Ltd., P.O. Box 1005, Pointe-Claire – Dorval, QC H9R 4P8

## DRUG INTERACTIONS

### Ergot-Containing Drugs

Ergot-containing drugs have been reported to cause prolonged vasospastic reactions. Because there is a theoretical basis that these effects may be additive, use of ergotamine-containing or ergot-type medications (like dihydroergotamine or methysergide) and rizatriptan within 24 hours is contraindicated (see CONTRAINDICATIONS).

### Monoamine Oxidase Inhibitors

Rizatriptan is principally metabolized via monoamine oxidase, 'A' subtype (MAO-A). In a drug interaction study, when MAXALT® 10 mg was administered to subjects (n=12) receiving concomitant therapy with the selective, reversible MAO-A inhibitor, moclobemide 150 mg t.i.d., there were mean increases in rizatriptan AUC and $C_{max}$ of 119% and 41%, respectively; and the AUC of the active N-monodesmethyl metabolite of rizatriptan was increased more than 400%. The interaction would be expected to be greater with irreversible MAO inhibitors. Drug interaction studies were not conducted with selective MAO-B inhibitors.

The specificity of MAO-B inhibitors diminishes with higher doses and varies among patients. Therefore, co-administration of rizatriptan in patients taking MAO-A or MAO-B inhibitors is contraindicated (see CONTRAINDICATIONS).

### Nadolol/Metoprolol

In a drug interactions study, effects of multiple doses of nadolol 80 mg or metoprolol 100 mg every 12 hours on the pharmacokinetics of a single dose of 10 mg rizatriptan were evaluated in healthy subjects (n=12). No pharmacokinetic interactions were observed.

### Oral Contraceptives

In a study of concurrent administration of an oral contraceptive during 6 days of administration of MAXALT® (10-30 mg/day) in healthy female volunteers (n=18), rizatriptan did not affect plasma concentrations of ethinyl estradiol or norethindrone.

### Other 5-$HT_1$ Agonists

The administration of rizatriptan with other 5-$HT_1$ agonists has not been evaluated in migraine patients.

Because their vasospastic effects may be additive, co-administration of rizatriptan and other 5-$HT_1$ agonists within 24 hours of each other is contraindicated (see CONTRAINDICATIONS).

### Propranolol

MAXALT® should be used with caution in patients receiving propranolol, since the pharmacokinetic behavior of rizatriptan during co-administration with propranolol may be unpredictable. In a study of concurrent administration of propranolol 240 mg/day and a single dose of rizatriptan 10 mg in healthy subjects (n=11), mean plasma AUC and $C_{max}$ for rizatriptan were increased by 70% and 75%, respectively, during propranolol administration. In one subject, a 4-fold increase in AUC and 5-fold increase in $C_{max}$ was observed. This subject was not distinguishable from the others based on demographic characteristics. The AUC of the active N-monodesmethyl metabolite of rizatriptan was not affected by propranolol (see DOSAGE AND ADMINISTRATION).

### Selective Serotonin Reuptake Inhibitors / Serotonin Norepinephrine Reuptake Inhibitors and Serotonin Syndrome

Cases of life-threatening serotonin syndrome have been reported in post-marketing experience during combined use of selective serotonin reuptake inhibitors (SSRIs) or serotonin norepinephrine reuptake inhibitors (SNRIs) and triptans (see WARNINGS AND PRECAUTIONS).

In a pharmacokinetic study with paroxetine and rizatriptan, paroxetine had no influence on the plasma levels of rizatriptan.

### Food

Interactions with food have not been studied. Food has no significant effect on the bioavailability of rizatriptan but delays the time to reach peak concentration by an hour. In clinical trials, MAXALT® was administered without regard to food.

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## Administration

### DOSAGE AND ADMINISTRATION

(see Product Monograph for complete information)

#### Dosing Considerations

MAXALT® is recommended only for the acute treatment of migraine attacks. MAXALT® should not be used prophylactically. Controlled trials have not established the effectiveness of a second dose if the initial dose is ineffective.

The safety of treating, on average, more than four headaches in a 30-day period has not been established.

#### Recommended Dose and Dosage Adjustment

#### ADULTS

#### MAXALT® Tablets and MAXALT RPD® Wafers

The recommended single adult dose is 5 mg. The maximum recommended single dose is 10 mg. There is evidence that the 10 mg dose may provide a greater effect than the 5 mg dose (see CLINICAL TRIALS in the Product Monograph). The choice of dose should therefore be made on an individual basis, weighing the possible benefit of the 10 mg dose with the potential risk for increased adverse events.

For MAXALT RPD® Wafers, administration with liquid is not necessary. The wafer is packaged in a blister within an outer aluminum pouch. Patients should be instructed not to remove the blister from the outer pouch until just prior to dosing. The blister pack should then be peeled open with dry hands and the wafer placed on the tongue, where it will dissolve and be swallowed with the saliva.

#### Redosing

Doses should be separated by at least 2 hours; no more than a total of 20 mg (Tablets or Wafers) should be taken in any 24-hour period.

#### Patients receiving propranolol

A single 5 mg dose of MAXALT® should be used. In no instances should the total daily dose exceed 10 mg per day, given in two doses, separated by at least two hours (see DRUG INTERACTIONS).

#### Renal Impairment

In hemodialysis patients with severe renal impairment (creatinine clearance <2 mL/min/1.73 $m^2$), the AUC of rizatriptan was approximately 44% greater than in patients with normal renal function (see ACTION AND CLINICAL PHARMACOLOGY, Special Populations and Conditions in the Product Monograph). Consequently, if treatment is deemed advisable in these patients, the 5 mg MAXALT® Tablet or Wafer should be administered. No more than a total of 10 mg should be taken in any 24-hour period. Repeated dosing in renally impaired patients has not been evaluated.

#### Hepatic Impairment

MAXALT® is contraindicated in patients with severe hepatic impairment (Child-Pugh grade C) due to the absence of safety data. Plasma concentrations of rizatriptan were approximately 30% greater in patients with moderate hepatic insufficiency (see ACTION AND CLINICAL PHARMACOLOGY, Special Populations and Conditions in the Product Monograph). Consequently, if treatment is deemed advisable in the presence of moderate hepatic impairment, the 5 mg MAXALT® Tablet or Wafer should be administered. No more than a total of 10 mg should be taken in any 24-hour period. Repeated dosing in hepatically impaired patients has not been evaluated.

#### Patients with Hypertension

MAXALT® should not be used in patients with uncontrolled or severe hypertension. In patients with mild to moderate controlled hypertension, patients should be treated cautiously at the lowest effective dose.

### OVERDOSAGE

No overdoses of MAXALT® were reported during clinical trials.

Rizatriptan 40 mg (administered as either a single dose or as two doses with a 2-hour interdose interval) was generally well tolerated in over 300 patients; dizziness and somnolence were the most common drug-related adverse effects.

In a clinical pharmacology study in which 12 subjects received rizatriptan, at total cumulative doses of 80 mg (given within four hours), two subjects experienced syncope and/or bradycardia. One subject, a female aged 29 years, developed vomiting, bradycardia, and dizziness beginning three hours after receiving a total of 80 mg rizatriptan (administered over two hours); a third degree AV block, responsive to atropine, was observed an hour after the onset of the other symptoms. The second subject, a 25-year-old male, experienced transient dizziness, syncope, incontinence, and a 5-second systolic pause (on ECG monitor) immediately after a painful venipuncture. The venipuncture occurred two hours after the subject had received a total of 80 mg rizatriptan (administered over four hours).

In addition, based on the pharmacology of rizatriptan, hypertension or other more serious cardiovascular symptoms could occur after overdosage. Gastrointestinal decontamination (i.e., gastric lavage followed by activated charcoal) should be considered in patients suspected of an overdose with MAXALT®. The elimination half-life of rizatriptan is 2 to 3 hours (see ACTION AND CLINICAL PHARMACOLOGY in the Product Monograph). Clinical and electrocardiographic monitoring should be continued for at least 12 hours, even if clinical symptoms are not observed.

There is no specific antidote to rizatriptan. In cases of severe intoxication, intensive care procedures are recommended, including establishing and maintaining a patent airway, ensuring adequate oxygenation and ventilation, and monitoring and support of the cardiovascular system.

The effects of hemo- or peritoneal dialysis on serum concentrations of rizatriptan are unknown.

## Supplemental Product Information

### WARNINGS AND PRECAUTIONS

#### Special Populations and Conditions

**Pregnant Women:** In a reproduction study in rats, birth weights and pre- and post-weaning weight gain were reduced in the offspring of females treated prior to and during mating and throughout gestation and lactation. These effects occurred in the absence of any apparent maternal toxicity (maternal plasma drug exposures were 22 and 337 times, respectively, the exposure in humans receiving the maximum recommended daily dose (MRDD) of 20 mg). The developmental no-effect dose was equivalent to 2.25 times human exposure at the MRDD.

In embryofetal development studies, no teratogenic effects were observed when pregnant rats and rabbits were administered doses at the equivalent of 337 times and 168 times, respectively, the human MRDD, during organogenesis. However, fetal weights were decreased in conjunction with decreased maternal weight gain at these same doses. The developmental no-effect dose in both rats and rabbits was 22 times the human MRDD. Toxicokinetic studies demonstrated placental transfer of drug in both species.

There are no adequate and well-controlled studies in pregnant women; therefore, rizatriptan should be used during pregnancy only if the potential benefit justifies the potential risk to the fetus.

#### Impairment of Fertility

In a fertility study in rats, altered estrus cyclicity and delays in time to mating were observed in females treated orally with an equivalent of 337 times the maximum recommended daily dose (MRDD) of 20 mg in humans. The no-effect dose was 22 times the MRDD. There was no impairment of fertility or reproductive performance in male rats treated with up to 825 times the MRDD.

**Nursing Women:** It is not known whether this drug is excreted in human milk. Because many drugs are excreted in human milk, caution should be exercised when MAXALT® is administered to women who are breast-feeding. Rizatriptan is extensively excreted in rat milk, at a level of 5-fold or greater than maternal plasma levels.

**Pediatrics (< 18 years of age):** MAXALT® is not recommended for use in patients under 18 years of age. In a randomized placebo-controlled trial of 291 adolescent migraineurs, aged 12-17 years, the efficacy of MAXALT® Tablets (5 mg) was not different from that of placebo (see ACTION AND CLINICAL PHARMACOLOGY, Special Populations and Conditions in the product monograph).

**Geriatrics (> 65 years of age):** The safety and effectiveness of MAXALT® has not been adequately studied in individuals over 65 years of age. The risk of adverse reactions to this drug may be greater in elderly patients, as they are more likely to have decreased hepatic function, be at higher risk for CAD, and experience blood pressure increases that may be more pronounced. Clinical studies with MAXALT® did not include a substantial number of patients over 65 years of age (n=17). Its use in this age group is, therefore, not recommended.

**Special Disease Conditions:**
MAXALT® should be administered with caution to patients with diseases that may alter the absorption, metabolism, or excretion of drugs (see ACTION AND CLINICAL PHARMACOLOGY, Special Populations and Conditions in the product monograph).

#### Monitoring and Laboratory Tests

No specific laboratory tests are recommended for monitoring patients prior to and/or after treatment with MAXALT®.

### ADVERSE REACTIONS

#### Clinical Trial Adverse Drug Reactions

*Because clinical trials are conducted under very specific conditions the adverse reaction rates observed in the clinical trials may not reflect the rates observed in practice and should not be compared to the rates in the clinical trials of another drug. Adverse drug reaction information from clinical trials is useful for identifying drug-related adverse events and for approximating rates.*

#### Experience in Controlled Clinical Trials with MAXALT®

#### Typical 5-$HT_1$ Agonist Adverse Reactions

As with other 5-$HT_1$ agonists, MAXALT® has been associated with sensations of heaviness, pressure, tightness or pain which may be intense. These may occur in any part of the body including the chest, throat, neck, jaw and upper limb.

#### Acute Safety

Adverse experiences to rizatriptan were assessed in controlled clinical trials that included over 3700 patients who received single or multiple doses of MAXALT® Tablets. The most common adverse events during treatment with MAXALT® were asthenia/fatigue, somnolence, pain/pressure sensation and dizziness. These events appeared to be dose-related. In long-term extension studies where patients were allowed to treat multiple attacks for up to 1 year, 4% (59 out of 1525 patients) withdrew because of adverse experiences.

Tables 1 and 2 list the adverse events regardless of drug relationship (incidence ≥ 1% and greater than placebo) after a single dose of MAXALT® Tablets and MAXALT RPD® Wafers, respectively. Most of the adverse events appear to be dose-related. The events cited reflect experience gained under closely monitored conditions of clinical trials in a highly selected patient population. In actual clinical practice or in other clinical trials, these frequency estimates may not apply, as the conditions of use, reporting behavior, and the kinds of patients treated may differ.

**Table 1**
**Incidence (≥ 1% and Greater than Placebo) of Adverse Experiences After a Single Dose of MAXALT® Tablets or Placebo (Prior to Subsequent Dose) in Phase III Controlled Clinical Trials†**

| | % of Patients | | |
|---|---|---|---|
| | Placebo | MAXALT® 5 mg | MAXALT® 10 mg |
| **Number of Patients** | 627 | 977 | 1167 |
| **Symptoms of Potentially Cardiac Origin** | | | |
| Upper Limb Sensations* | 1.3 | 1.7 | 1.8 |
| Chest Sensations* | 1.0 | 1.6 | 3.1 |
| Neck/Throat/Jaw Sensations* | 0.6 | 1.4 | 2.5 |
| Palpitations | 0.2 | 0.9 | 1.0 |
| **Body as a Whole** | | | |
| Asthenia/Fatigue | 2.1 | 4.2 | 6.9 |
| Abdominal Pain | 1.0 | 1.7 | 2.2 |
| **Digestive System** | | | |
| Nausea | 3.5 | 4.1 | 5.7 |
| Dry Mouth | 1.3 | 2.6 | 3.0 |
| Vomiting | 2.1 | 1.6 | 2.3 |
| **Nervous System** | | | |
| Dizziness | 4.5 | 4.2 | 8.9 |
| Somnolence | 3.5 | 4.2 | 8.4 |
| Headache | 0.8 | 1.8 | 2.1 |
| Paresthesia | 1.0 | 1.5 | 2.9 |
| Tremor | 1.0 | 1.3 | 0.3 |
| Insomnia | 0.3 | 1.0 | 0.3 |
| **Skin and Skin Appendage** | | | |
| Flushing | 1.0 | 0.6 | 1.1 |

*The term "sensations" encompasses adverse events described as pain, discomfort, pressure, heaviness, constriction, tightness, heat/burning sensation, paresthesia, numbness, tingling, weakness and strange sensations.

†Data from Studies 022, 025, 029 and 030.

**Table 2**
**Incidence (≥ 1% and Greater than Placebo) of Adverse Experiences After a Single Dose of MAXALT RPD® Wafers or Placebo (Prior to Subsequent Dose) in Phase III Controlled Clinical Trials†**

| | % of Patients | | |
|---|---|---|---|
| | Placebo | MAXALT RPD® 5 mg | MAXALT RPD® 10 mg |
| **Number of Patients** | 283 | 282 | 302 |
| **Symptoms of Potentially Cardiac Origin** | | | |
| Chest Sensations* | 0.4 | 1.4 | 1.7 |
| Neck/throat/Jaw Sensations* | 0.4 | 1.4 | 2.0 |
| Tachycardia | 1.1 | 1.4 | 0.3 |
| Upper Limb Sensations* | 0.4 | 0.7 | 2.0 |
| Palpitations | 0.4 | 0.4 | 1.0 |
| **Body as a Whole** | | | |
| Asthenia/Fatigue | 0.4 | 2.1 | 3.6 |
| **Digestive System** | | | |
| Dry Mouth | 2.1 | 6.4 | 6.0 |
| Nausea | 5.7 | 6.4 | 7.0 |
| Dyspepsia | 0.7 | 1.1 | 2.0 |
| Acid Regurgitation | 0 | 1.1 | 0.7 |
| Salivation Increase | 0 | 0 | 1.3 |
| **Musculoskeletal System** | | | |
| Regional Heaviness | 0 | 0 | 1.0 |
| **Nervous System** | | | |
| Dizziness | 3.9 | 6.4 | 8.6 |
| Somnolence | 2.8 | 4.3 | 5.3 |
| Headache | 0.7 | 1.8 | 2.0 |
| Insomnia | 0 | 1.4 | 0.7 |
| Paresthesia | 0.4 | 1.4 | 3.0 |
| Hypesthesia | 0 | 1.4 | 0.7 |
| Mental Acuity Decreased | 0 | 1.1 | 0.3 |
| Tremor | 0.7 | 1.1 | 0 |
| Nervousness | 0.4 | 1.1 | 0.7 |
| **Respiratory System** | | | |
| Pharyngeal Discomfort | 0 | 1.1 | 0.7 |
| **Skin and Skin Appendage** | | | |
| Sweating | 0.7 | 1.1 | 1.0 |
| **Special Senses** | | | |
| Taste Perversion | 1.1 | 1.4 | 2.3 |
| Blurred Vision | 0 | 0.4 | 1.3 |

*The term "sensations" encompasses adverse events described as pain, discomfort, pressure, heaviness, constriction, tightness, heat/burning sensation, paresthesia, numbness, tingling, weakness and strange sensations.

†Data from Studies 039 and 049.

MAXALT® was generally well-tolerated. Adverse experiences were typically mild in intensity and were transient. The frequencies of adverse experiences in clinical trials did not increase when up to three doses were taken within 24 hours. The incidences of adverse experiences were not affected by age, gender or use of prophylactic medications. There were insufficient data to assess the impact of race on the incidence of adverse events.

#### Other Events Observed in Association with the Administration of MAXALT®

In the section that follows, the frequencies of less commonly reported adverse clinical events are presented. Because the reports include events observed in open studies, the role of MAXALT® in their causation cannot be reliably determined. Furthermore, variability associated with adverse event reporting, the terminology used to describe adverse events, etc. limit the value of the quantitative frequency estimates provided. Event frequencies are calculated as the number of patients who used MAXALT® 5 mg and 10 mg tablets in Phase II and III studies (n=3716) and reported an event divided by the total number of patients exposed to MAXALT®. All reported events are included, except those

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already listed in the previous table, those too general to be informative, and those not reasonably associated with the use of the drug. Events are further classified within body system categories and enumerated in order of decreasing frequency using the following definitions: frequent adverse events are those defined as those occurring in at least 1/100 patients; infrequent adverse experiences are those occurring in 1/100 to 1/1000 patients; and rare adverse experiences are those occurring in fewer than 1/1000 patients.

**Body as a Whole**
Frequent were warm sensations, chest pain and chills/cold sensations. Infrequent were heat sensitivity, facial edema, hangover effect, abdominal distention, edema/swelling and malaise. Rare were fever, orthostatic effects, and syncope.

**Cardiovascular**
Frequent was palpitation. Infrequent were tachycardia, cold extremities, hypertension, arrhythmia, and bradycardia. Rare were angina pectoris and blood pressure increased.

**Digestive**
Frequent was diarrhea. Infrequent were dyspepsia, thirst, acid regurgitation, dysphagia, constipation, flatulence, and tongue edema. Rare were anorexia, appetite increase, gastritis, paralysis (tongue), eructation and glosodynia.

**Metabolic**
Infrequent was dehydration.

**Musculoskeletal**
Infrequent were muscle weakness, stiffness, myalgia, muscle cramp, musculoskeletal pain, and arthralgia.

**Neurological/Psychiatric**
Frequent were hypesthesia and mental acuity decreased. Infrequent were nervousness, vertigo, insomnia, anxiety, depression, euphoria, disorientation, ataxia, dysarthria, confusion, dream abnormality, gait abnormality, irritability, memory impairment, agitation, hyperesthesia, sleep disorder, speech disorder, migraine and spasm. Rare were dysesthesia, depersonalization, akinesia/bradykinesia, apprehension, hyperkinesia, hypersomnia, and hyporeflexia.

**Respiratory**
Frequent were dyspnea and pharyngeal discomfort. Infrequent were pharyngitis, irritation (nasal), congestion (nasal), dry throat, upper respiratory infection, yawning, respiratory congestion, dry nose, epistaxis, and sinus disorder. Rare were cough, hiccups, hoarseness, rhinorrhea, sneezing, tachypnea, and pharyngeal edema.

**Special Senses**
Frequent was taste perversion. Infrequent were blurred vision, tinnitus, dry eyes, burning eye, eye pain, eye irritation, ear pain, and tearing. Rare were hyperacusis, smell perversion, photophobia, photopsia, itching eye, and eye swelling.

**Skin and Skin Appendage**
Infrequent were sweating, pruritus, rash, and urticaria. Rare were erythema, acne, and photosensitivity.

**Urogenital System**
Frequent was hot flashes. Infrequent were urinary frequency, polyuria, and menstruation disorder. Rare was dysuria.

The adverse experience profile seen with MAXALT RPD® Wafers was similar to that seen with MAXALT® Tablets.

**Post-Market Adverse Drug Reactions**
The following additional adverse reactions have been reported very rarely and most have been reported in patients with risk factors predictive of CAD: Myocardial ischemia or infarction, cerebrovascular accident.

The following adverse reactions have also been reported:

**Hypersensitivity:** Hypersensitivity reaction, anaphylaxis/anaphylactoid reaction, angioedema (e.g., facial edema, tongue swelling, pharyngeal edema), wheezing, urticaria, rash, toxic epidermal necrolysis.

**Nervous System:** serotonin syndrome.

**Seizures:** There have been very rare reports of seizures following administration of MAXALT® in patients with or without risk factors or previous history of seizures (see WARNINGS AND PRECAUTIONS).

**Musculoskeletal:** facial pain.

**Special Senses:** Dysgeusia.

**Vascular disorders:** Peripheral vascular ischemia

**Drug Abuse and Dependence**
Although the abuse potential of MAXALT® has not been specifically assessed, no abuse of, tolerance to, withdrawal from, or drug-seeking behavior was observed in patients who received MAXALT® in clinical trials or their extensions. The $5\text{-HT}_{1B/1D}$ agonists, as a class, have not been associated with drug abuse.

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Product Monograph available at
**www.merckfrosst.com**
or upon request at 1-800-567-2594

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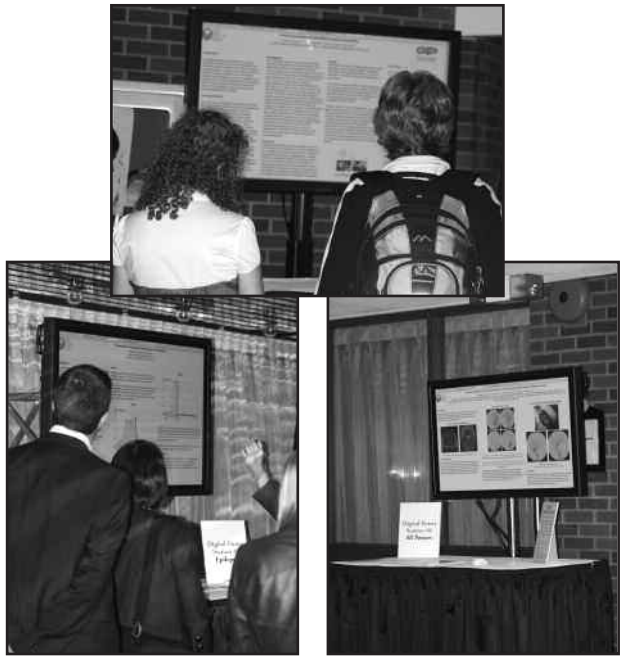

Thursday, June 7th, 2012
5:30 pm to 7:00 pm

Friday, June 8, 2012
1:15 pm to 2:45 pm

*See a poster during the week that you have questions about?*

*Want to encourage research in the neurosciences?*

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CANADIAN NEUROLOGICAL SCIENCES FEDERATION
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*Congress Agenda*
*as of February 1, 2012*

# *2012 Canadian Neurological Sciences Federation Annual Congress, June 6-8, 2012*

*Pre-Congress SIGs* evening of June 5 *Special Interest Groups*

## Tuesday, June 5/12

| | |
|---|---|
| 18:00 - 20:00 | **Movement Disorders SIG** *David Grimes, Oksana Suchowersky* |
| 18:00 - 20:00 | **Headache SIG** *Suzanne Christie* |
| 18:00 - 20:00 | **Epilepsy Video SIG** *Seyed Mirsattari* |
| 18:00 - 20:00 | **Neuromuscular Diseases SIG** *Mike Nicolle* |

## Wednesday, June 6/12

| | |
|---|---|
| 07:00 - 08:45 | **Delegate Continental Breakfast** |
| 09:00 - 16:45 | **Neurology Resident Review – Neuromuscular Diseases** *Kristine Chapman, Laine Greene* |
| 09:00 - 16:45 | **Neurosurgery Resident Review – Neuro-oncology** *David Eisenstat, Joe Megyesi, Roberto Diaz* |
| 09:00 - 12:00 | **Hydrocephalus Management in the Child and Adult** *Mark Hamilton* |
| 09:00 - 12:00 | **A Practical Update in Stroke Neurology Course** *Dariush Dowlatshahi* |
| 09:00 - 12:00 | **Hot Topics in Child Neurology** *Asif Doja* |
| 12:00 - 13:45 | **Lunch & Poster Viewing** |
| 12:15 - 13:30 | **Co-developed Industry Symposium (Stroke)** |
| 12:15 - 13:30 | **Co-developed Industry Symposium (Headache)** |
| 13:45 - 16:45 | **Dementia** *Andrew Frank* |
| 13:45 - 16:45 | **Headache** *Jonathan Gladstone* |
| 13:45 - 16:45 | **Neurocritical Care** *Draga Jichici, Jeanne Teitelbaum* |
| 16:45 – 19:30 | **Exhibitors Reception** |

## Thursday, June 7/12

| | |
|---|---|
| 07:00 - 08:15 | **Delegate Continental Breakfast** |
| 08:30 - 10:45 | **Grand Plenary – Gloor Lecture:** *Lawrence Hirsch,* **Tibbles Lecture:** *Marjo van der Knaap,* **Penfield Lecture:** *Hunt Batjer,* **Richardson Lecture:** *Alain Dagher* |
| 11:00 - 17:00 | **Child Neurology Day** *Michelle Demos, Cecil Hahn* |
| 11:00 - 12:30 | **CNS / CSCN Chair's Select Abstracts** |
| 11:00 - 12:30 | **CNSS Chair's Select Abstracts** |
| 12:30 - 14:15 | **Lunch, Exhibit & Poster Viewing** |
| 12:45 - 14:00 | **Co-developed Industry Symposium (Epilepsy)** |
| 12:45 - 14:00 | **Co-developed Industry Symposium (Neuropathic Pain)** |
| 14:15 - 17:15 | **Multiple Sclerosis** *Mark Freedman* |
| 14:15 - 17:15 | **EEG** *Seyed Mirsattari* |
| 14:15 - 17:15 | **Neurosurgical Education and Workforce in Canada** *Chris Wallace* |
| 14:15 - 17:15 | **Evidence Based Neurosurgery** *Brian Toyota, Ramesh Sahjpaul* |
| 17:30 – 19:00 | **Poster Author Stand-by Tour #1** |
| 19:00 | **Dine-Around** |

## Friday, June 8/12

| | |
|---|---|
| 07:00 - 07:45 | **Delegate Continental Breakfast** |
| 08:00 - 11:00 | **Platform Sessions** |
| 11:15 - 13:00 | **Grand Rounds** |
| 13:15 - 14:45 | **Lunch, Exhibition & Poster Author Stand-by Tour #2** |
| 14:45 - 17:45 | **Status Epilepticus & Sudden Unexplained Death in Epilepsy** *Sharon Whiting* |
| 14:45 - 17:45 | **Genetics of Neurodegenerative Syndromes** *Matthew Farrer* |
| 14:45 - 17:45 | **Neuro-ophthalmology** *Jason Barton* |
| 14:45 - 17:45 | **Spinal Neurosurgery: Complication Avoidance & Management** *Eric Massicotte* |
| 14:45 - 17:45 | **Neurovascular & Interventional Neuroradiology** *Gary Redekop* |

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CANADIAN NEUROLOGICAL SCIENCES FEDERATION
FÉDÉRATION DES SCIENCES NEUROLOGIQUES DU CANADA

*Congrès ordre du jour comme de 1 Février 2012*

# *Congrès annuel de la Fédération canadienne des sciences neurologiques 2012, du 6 au 8 juin 2012*

*Soirée de GIS* précongrès le 5 juin *Groupes d'intérêt spéciaux*

## Mardi 5 juin 2012

| | |
|---|---|
| **18 h à 20 h** | **GIS sur les désordres du mouvement** *David Grimes, Oksana Suchowersky* |
| **18 h à 20 h** | **GIS sur le mal de tête** *Suzanne Christie* |
| **18 h à 20 h** | **GIS sur l'épilepsie (vidéo)** *Seyed Mirsattari* |
| **18 h à 20 h** | **GIS sur les maladies neuromusculaires** *Mike Nicolle* |

## Mercredi 6 juin 2012

| | |
|---|---|
| **7 h à 8 h 45** | **Petit déjeuner continental des participants** |
| **9 h à 16 h 45** | **Cours de révision pour résidents en neurologie – Maladies neuromusculaires** *Kristine Chapman, Laine Greene* |
| **9 h à 16 h 45** | **Cours de révision pour résidents en neurochirurgie – Neuro-oncologie** *David Eisenstat, Joe Megyesi, Roberto Diaz* |
| **9 h à 12 h** | **Gestion de l'hydrocéphalie chez l'enfant et l'adulte** *Mark Hamilton* |
| **9 h à 12 h** | **Accidents vasculaires cérébraux** *Dariush Dowlatshahi* |
| **9 h à 12 h** | **Sujets chauds en neurologie infantile** *Asif Doja* |
| **12 h à 13 h 45** | **Dîner et présentation d'affiche** |
| **12 h 15 à 13 h 30** | **Symposium développé conjointement avec l'industrie (AVC)** |
| **12 h 15 à 13 h 30** | **Symposium développé conjointement avec l'industrie (Mal de tête)** |
| **13 h 45 à 16 h 45** | **Démence** *Andrew Frank* |
| **13 h 45 à 16 h 45** | **Mal de tête** *Jonathan Gladstone* |
| **13 h 45 à 16 h 45** | **Soins neurocritiques** *Draga Jichici, Jeanne Teitelbaum* |
| **16 h 45 à 19 h 30** | **Réception des exposants** |

## Jeudi 7 juin 2012

| | |
|---|---|
| **7 h à 8 h 15** | **Petit déjeuner continental des participants** |
| **8 h 30 à 10 h 45** | **Assemblée plénière – Conférence Gloor :** *Lawrence Hirsch*, **Conférence Tibbles :** *Marjo van der Knaap*, **Conférence Penfield :** *Hunt Batjer*, **Conférence Richardson :** *Alain Dagher* |
| **11 h à 17 h** | **Journée neurologie infantile** *Michelle Demos, Cecil Hahn* |
| **11 h à 12 h 30** | **Résumés choisis par le président de la SNC/SNCC** |
| **11 h à 12 h 30** | **Résumés choisis par le président de la SNCC** |
| **12 h 30 à 14 h 15** | **Dîner, expositions et présentation d'affiche** |
| **12 h 45 à 14 h** | **Symposium développé conjointement avec l'industrie (Épilepsie)** |
| **12 h 45 à 14 h** | **Symposium développé conjointement avec l'industrie (Douleur neuropathique)** |
| **14 h 15 à 17 h 15** | **Sclérose en plaques** *Mark Freedman* |
| **14 h 15 à 17 h 15** | **EEG** *Seyed Mirsattari* |
| **14 h 15 à 17 h 15** | **Formation et travailleurs en neurochirurgie au Canada** *Chris Wallace* |
| **14 h 15 à 17 h 15** | **Neurochirurgie factuelle** *Brian Toyota, Ramesh Sahjpaul* |
| **17 h 30 à 19 h** | **Affiche avec auteur présent, tour no 1** |
| **19 h** | **Autour de dîner** |

## Vendredi 8 juin 2012

| | |
|---|---|
| **7 h à 7 h 45** | **Petit déjeuner continental des participants** |
| **8 h à 11 h** | **Présentations plates-formes** |
| **11 h 15 à 13 h** | **Séance scientifique** |
| **13 h 15 à 14 h 45** | **Dîner, expositions et affiche avec auteur présent, tour no 2** |
| **14 h 45 à 17 h 45** | **État de mal épileptique et décès soudain inexpliqué en épilepsie** *Sharon Whiting* |
| **14 h 45 à 17 h 45** | **Composante génétique des syndromes neurodégénératifs** *Matthew Farrer* |
| **14 h 45 à 17 h 45** | **Neuro-ophthalmologie** *Jason Barton* |
| **14 h 45 à 17 h 45** | **Colonne vertébrale** *Éric Massicotte* |
| **14 h 45 à 17 h 45** | **Neuroradiologie neurovasculaire et interventionnelle** *Gary Redekop* |

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# NOTES



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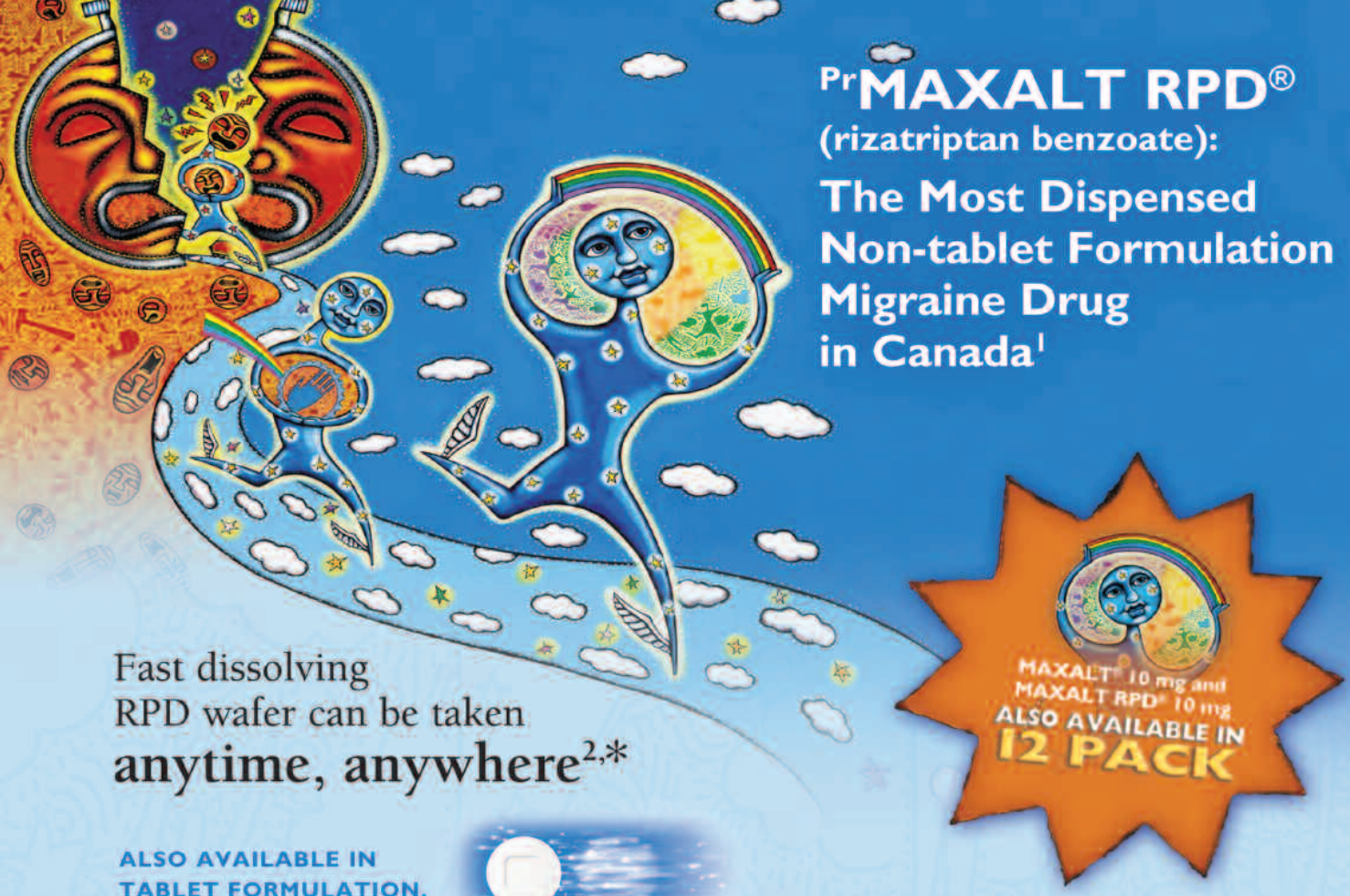

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MAXALT® is also contraindicated in patients with uncontrolled or severe hypertension.

MAXALT® is contraindicated in co-administration with monoamine oxidase (MAO) inhibitors within 2 weeks after discontinuation of treatment, and within 24 hours of administration of 5-HT$_1$ agonists or ergot-type medications. For a complete list of contraindications, please consult the Product Monograph.

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**References:**

1. Brogan Inc. Geographic Prescription Monitor (GPM®) September 2008 to August 2009.
2. Data on file. Merck Frosst Canada Ltd.: Product Monograph, MAXALT®, 2009.


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*See prescribing summary on page S58-S61*