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FÉDÉRATION DES SCIENCES NEUROLOGIQUES DU CANADA

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49th Annual Congress of the

Canadian Neurological Sciences Federation

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ABSTRACTS / RÉSUMÉS

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2013 REVIEWER OF THE YEAR - Dylan Blacquiere

We are pleased to present the 2013 CJNS Reviewer of the Year Award to Dr. Dylan Blacquiere from the University of Ottawa, Ottawa, Ontario. Dylan has provided excellent, timely reviews of numerous articles. He has also been a faithful contributor of Journal articles. We hope we can count on him for stellar future contributions. Robert Chen, Editor-in-Chief, CJNS.

Dr. Dylan Blacquiere is a fellow in stroke neurology at the University of Ottawa, and has been a peer reviewer for the Canadian Journal of Neurological Sciences for the past three years. He completed his medical school at Dalhousie University in Halifax, and finished a residency in adult neurology at the University of Ottawa in 2012. His publications and research interests include palliative care and stroke, systems of stroke care, and rural-urban disparity in stroke care, as well as in knowledge translation of stroke care to the community at large. He has recently accepted a position as a stroke neurologist in Saint John, New Brunswick, and will be continuing his work there. In his spare time, he and his wife Mary enjoy camping, hiking and running, as well as being unrepentant science-fiction nerds, not necessarily in that order.

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ABSTRACTS AND PROGRAM

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La Société Canadienne de Neurophysiologie Clinique

The Canadian Association of Child Neurology
L'Association Canadienne de Neurologie Pédiatrique

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Abstracts

Society Prize Presentations

Platform Presentations

Wednesday June 4, 2014

Friday, June 6, 2014

Poster Presentations

Thursday, June 5th and Friday, June 6th, 2014

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CNSF 50th Congress

We will be celebrating the 50th Congress of the Canadian Neurological Sciences Federation June 9 – 12, 2015 at the The Fairmont Royal York Hotel in Toronto Ontario

We hope that you will join us for this special anniversary meeting!

A BRIEF HISTORY - The original Canadian Neurological Association was established in 1948. The founding meeting was held in Montreal and was attended by Wilder Penfield, Allan Waters, Walter Hyland, Jean Saucier, Francis McNaughton and Roma Amyot.

The first annual general meeting of this Association was held at the Royal York Hotel in Toronto and was attended by 38 prospective members from across the country. The association was established to represent neurology, neurosurgery and neurobiology and Dr. Wilder Penfield was named first president. In 1949, the association was renamed the Canadian Neurological Society.

The Canadian Neurological Society was dissolved in 1965 and two new societies were formed representing two distinct disciplines – the new Canadian Neurological Society for neurologists and the Canadian Neurosurgical Society for neurosurgeons. Together, their liaison committees planned the first annual joint meeting held in 1965 – the first Canadian Congress of Neurological Sciences.

In subsequent years, they were joined by the Canadian EEG Society (later named the Canadian Society of Clinical Neurophysiologists) and the Canadian Association of Child Neurology.

The Canadian Congress of Neurological Sciences was formally incorporated in 1990 with a board of directors representing each of the four member societies, and with a permanent secretariat office in Calgary, Alberta. In 2006, we became the Canadian Neurological Sciences Federation. The name was changed to better reflect the fact that the organization had been, for many years, a federation of four professional societies. This also helped to distinguish the organization from its annual meeting, which is the Congress.

Now, in 2015, we are very proud to be hosting our 50th Congress and we are so pleased to be back at the Royal York Hotel in Toronto.

The Congress has seen many changes over 50 years and we are very proud of where we are today. We strive to provide a solid scientific program each year assisted by your input from the evaluations and the hard work of your colleagues on the Continuing Professional Development Committee and the Scientific Program Committee.

Just as the CNSF has grown, the city of Toronto has also grown, surrounding the Fairmont Royal York Hotel. The hotel was built in 1929, and became a notable landmark. The magnificent architecture of this hotel continues to grace the city's skyline, and dominate the city's social scene.

Located in the heart of down-town Toronto, the Fairmont Royal York is just steps away from the best night life, dining, shopping and other attractions that the city has to offer. The hotel features an indoor swimming pool, state-of-the-art exercise equipment, steam bath facilities and exceptional spa treatments. Come for the CNSF 50th anniversary Congress and the Royal York will ensure that your every need will be graciously met.

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2014 Society Prize Papers

Francis McNaughton Memorial Prize

Canadian Neurological Society

B.01

Should blood pressure targets after stroke vary by body size? The SPS3 trial

TS Field (Vancouver) LA McClure (Birmingham) OR Benavente (Vancouver) PE Pergola (San Antonio) RG Hart (Hamilton) M Hill (Calgary)*

Background: It is not known whether blood pressure (BP) has a greater pathophysiological impact on smaller vs. larger patients. We explored relationships between anthropometric measures (body mass index(BMI), body surface area (BSA), height, weight), systolic BP targets and vascular outcomes in the Secondary Prevention of Small Subcortical Strokes Trial. *Methods:* Patients with recent lacunar infarcts were randomized to two BP targets (130-149 mmHg vs. <130 mmHg). We computed rates of stroke, death, and major vascular events by quartiles of each anthropometric measure. Time to outcome was evaluated with Cox proportional hazard models. We examined interactions between anthropometric measures and BP target. *Results:* 3020 subjects were followed over a mean of 3.7 (SD 2.0)y. Mean age was 63 and 63% were male. Mean height was 167cm(SD 11), weight 81(18)kg, BMI of 29(5.9)kg/m2, BSA 1.9(0.25)m2. There were no associations between rates of any vascular outcome or death when assessed by quartiles of BSA, BMI, height or weight, nor was there an association between hazard ratios for lower versus higher BP targets across BMI categories or quartiles of anthropometric measurements. There were no trends with regards to interactions between anthropometrics and BP group for any outcome. *Conclusions:* We found no interaction between anthropometric measurements and higher and lower BP targets groups on the rates of vascular events and death.

André Barbeau Memorial Prize

Canadian Neurological Society

B.02

Abnormal neurons distinguish teratomas in NMDA receptor encephalitis

GS Day (Toronto) S Laiq (Toronto) DF Tang-Wai (Toronto) DG Munoz (Toronto)*

Background: The discovery of neuroglial elements (expressing N-methyl-D-aspartate receptors, NMDAR) within teratomas from patients with NMDAR encephalitis suggests that neuroglial tissue may be integral to autoantibody formation and disease pathogenesis. Neuroglial tissue is observed, however, in teratomas resected from patients without neurological symptoms, suggesting that this alone is insufficient to trigger autoantibody formation. We sought to characterize the organization of neuroglial elements within ovarian teratomas resected from patients with NMDAR encephalitis. *Methods:* The histopathological features of teratomas resected from five consecutively-accrued cases with NMDAR encephalitis were compared with 39 teratomas resected from 38 women without central nervous system dysfunction. *Results:* Central nervous system neuronal elements were identified in teratomas from 4/5 (80%) cases and 20/39 (51.3%) controls (p=0.36). Atypical neurons were detected within teratomas from 4/5 (80%) cases, but not controls (p<0.001). These histological abnormalities would have been diagnosed as gangliocytomas, ganglioneuroblastomas and atypical gangliogliomas if found within tumors resected from the central nervous system. Abnormal neuroglial elements were closely related to immune infiltrates in all cases (4/4). Inflammatory infiltrates were not associated with neuroglial tissue in controls, further differentiating these populations (p<0.001). *Conclusions:* Abnormal neurons distinguished teratomas from cases from controls, and may contribute to the development of autoimmunity in teratoma-associated NMDAR encephalitis.

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The President's Prize

Canadian Association of Child Neurology

A.01

Seizure burden is independently associated with short-term outcome in critically ill children

ET Payne (Toronto) X Zhao (Toronto) H Frndova (Toronto) K McBain (Toronto) R Sharma (Toronto) J Hutchison (Toronto) CD Hahn (Toronto)*

Background: Electrographic seizures are common among critically ill children, but their relationship to outcome remains unclear. *Methods:* We prospectively evaluated 259 patients who underwent clinically ordered continuous video-EEG monitoring in our pediatric intensive care units. Seizure burden was quantified for each subject by calculating the maximum percentage of any hour that was occupied by electrographic seizures. Primary outcome measures included neurological decline, defined as a worsening Pediatric Cerebral Performance Category score between hospital admission and discharge. *Results:* Seizures occurred in 93 subjects (36%) and 23 (9%) had status epilepticus. Neurological decline was observed in 174 subjects (67%), who had a mean maximum seizure burden of 15.7% per hour, compared to 1.8% per hour for those without neurological decline ($P < 0.0001$). After carefully adjusting for diagnosis and illness severity, the odds of neurological decline increased by 1.13 fold (95% CI 1.05-1.21, $P = 0.0016$) for every 1% increase in maximum hourly seizure burden. Above a maximum seizure burden threshold of 20% per hour (12 minutes), both the probability and magnitude of neurological decline rose sharply ($P < 0.0001$) across all diagnostic categories. *Conclusions:* These findings support the hypothesis that seizures among critically ill children independently contribute to brain injury, and suggest that early seizure management in this population is warranted.

K.G. McKenzie Prize for Basic Neuroscience Research 1st Prize

Canadian Neurosurgical Society

C.01

Primate Nucleus Accumbens and Orbitofrontal Cortex mediate decision-making behavior

F Girgis (Calgary) E Eskandar (Boston)*

Background: Understanding the neural circuitry underlying avoidance and reward-seeking behavior in awake-behaving primates is crucial to understanding the physiology of economic behavior theory in humans. Here we investigate two of the principal regions of interest, the nucleus accumbens (NAc) and the lateral orbital frontal cortex (OFC), to determine their contributions to decision-making. *Methods:* Two monkeys were trained in an Aversion-Reward Competition task, designed with the goal of assessing how animals behave when faced with decisions requiring economic valuation. Following training, stimulation chambers were stereotactically implanted atop the monkeys' heads to allow for microelectrode access to the prefrontal cortex and ventral striatum. Different locations within these regions were then systematically targeted for stimulation. *Results:* We demonstrate that OFC stimulation in the pre-decision epoch, and NAc stimulation in the post-decision and post-aversion epochs of the task, increases avoidance behavior, likely through top-down cognitive influence on downstream ventral striatal and prefrontal cortical circuits. In addition, the relation of NAc effects to the directional magnitude of aversive risk was opposite. *Conclusions:* By bridging neural and economic theories of decision-making, these findings may prove important in the honing of neuropsychiatric models dealing with disorders of reward and aversion mechanisms, such as those of addiction and anxiety, leading to novel Deep Brain Stimulation paradigms for the treatments of these diseases.

K.G. McKenzie Prize for Basic Neuroscience Research 2nd Prize

Canadian Neurosurgical Society

C.03

Development of a molecular targeting system for glioblastoma based on surface enhanced Raman scattering nanoparticles

RJ Diaz (Toronto) PZ McVeigh (Toronto) MA O'Reilly (Toronto) K Burrell (Toronto) M Bebenek (Toronto) C Smith (Toronto) AB Etame (Tampa) G Zadeh (Toronto) K Hynynen (Toronto) BC Wilson (Toronto) JT Rutka (Toronto)*

Background: Spectral mapping of nanoparticles with surface enhanced Raman scattering (SERS) capability in the near-infrared range is a novel imaging technique that can be applied with microscope or endoscope systems. We hypothesized that these nanoparticles could be internalized by glioblastoma cells and be delivered to the brain parenchyma across the blood-brain barrier using transcranial focused ultrasound. *Methods:* Multifunctional SERS-capable gold nanoparticles were synthesized and characterized for their potential to be internalized by glioblastoma cells, to act as optical labels, and to be delivered across the blood-brain barrier to tumor margins. Magnetic resonance image-guided transcranial focused ultrasound (TcMRgFUS) was used to reversibly disrupt the blood-brain barrier (BBB) at brain tumor margins in rat brain as the model for nanoparticle delivery. *Results:* Glioblastoma cells were found to internalize SERS-capable nanoparticles of 50 nm or 120 nm physical diameter. Surface coating with anti-epidermal growth factor receptor antibody or non-specific human immunoglobuling G, resulted in enhanced cell uptake of nanoparticles *in-vitro* compared to nanoparticles with polyethylene glycol surface. BBB disruption allowed the delivery of SERS-capable gold nanoparticles at tumor margins. *Conclusions:* Nanoparticles with SERS imaging capability can be delivered across

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the BBB non-invasively using TcMRgFUS and have the potential to be used as optical tracking agents and therapeutic carriers at the invasive front of malignant brain tumors.

K.G. McKenzie Prize for Clinical Neuroscience Research 1st Prize

Canadian Neurosurgical Society

C.05

Impaired development of intrinsic connectivity networks in children with medically-intractable localization-related epilepsy

GM Ibrahim (Toronto) BR Morgan (Toronto) W Lee (Toronto) M Smith (Toronto) EJ Donner (Toronto) F Wang (Toronto) C Beers (Calgary) P Federico (Calgary) MJ Taylor (Toronto) SM Doesburg (Toronto) JT Rutka (Toronto) O Snead (Toronto)*

Background: Typical childhood development is characterized by the emergence of intrinsic connectivity networks (ICNs) via internetwork segregation and intranetwork integration. The impact of childhood epilepsy on the maturation of ICNs is, however, poorly understood. Here, we evaluate the effects of focal, intractable epilepsy on the emergence of ICNs in children. *Methods:* The developmental trajectory of ICNs in 26 children (8-17 years) with focal epilepsy and 28 age-and-sex-matched controls was evaluated using graph theoretical analysis of whole brain connectomes from resting-state fMRI data. *Results:* Children with epilepsy demonstrated impaired development of regional hubs in nodes of the salience and default-mode networks (DMN). Seed-based connectivity and hierarchical clustering analysis revealed significantly decreased intranetwork connections, and greater inter-network connectivity in children with epilepsy compared to controls. Significant interactions were identified between epilepsy duration and the expected developmental trajectory of ICNs. DMN integration in children with epilepsy was associated with better working memory, and internetwork segregation with higher IQ scores. Subgroup analyses revealed the thalamus, hippocampus, caudate were weaker hubs in children with generalized seizures, relative to other patient subgroups. *Conclusions:* Our findings show that epilepsy interferes with the developmental trajectory of large-scale brain networks underlying cognition throughout childhood, providing evidence supporting the early treatment of affected children.

K.G. McKenzie Prize for Clinical Neuroscience Research 2nd Prize

Canadian Neurosurgical Society

C.07

School function in children following traumatic brain injury: developing a new outcome measure

S Vachhrajani (Toronto) AV Kulkarni (Toronto)*

Background: Pediatric traumatic brain injury (TBI) remains common. There is no suitable measure for assessing school function after TBI. Our prototype measure will optimize rehabilitation for this vulnerable population. *Methods:* Focus groups with rehabilitation professionals and special education teachers established the domains of school function, and were used to generate items. Items were reduced using the impact method. Field testing with teachers of injured children was conducted to further reduce items and provide construct validation. *Results:* Four putative domains were cognitive function, psychosocial competence, physical function, and academic competence. 95 items were field tested. Of 602 families approached, questionnaires were received from 58 teachers. Most students (67%) were male, 97% had mild TBI, and 81% had normal function. Teachers rejected 17 items, and two items were unclear. Internal consistency reliability was over 0.94 for all domains. Small sample size precluded robust construct validation. *Conclusions:* We present a prototype instrument that measures school function after pediatric TBI. This instrument will bridge an important assessment gap by screening for deficits in class, providing clinical follow up, and by serving as an outcome in clinical studies. Multicentre testing across the age and severity spectrum will be integral in validating this questionnaire for clinical and educational use.

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PLATFORM PRESENTATIONS

CACN CHAIR'S SELECT ABSTRACT PRESENTATIONS

A01

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ET Payne (Toronto) X Zhao (Toronto) H Frndova (Toronto) K McBain (Toronto) R Sharma (Toronto) J Hutchison (Toronto) CD Hahn (Toronto)*

Background: Electrographic seizures are common among critically ill children, but their relationship to outcome remains unclear. *Methods:* We prospectively evaluated 259 patients who underwent clinically ordered continuous video-EEG monitoring in our pediatric intensive care units. Seizure burden was quantified for each subject by calculating the maximum percentage of any hour that was occupied by electrographic seizures. Primary outcome measures included neurological decline, defined as a worsening Pediatric Cerebral Performance Category score between hospital admission and discharge. *Results:* Seizures occurred in 93 subjects (36%) and 23 (9%) had status epilepticus. Neurological decline was observed in 174 subjects (67%), who had a mean maximum seizure burden of 15.7% per hour, compared to 1.8% per hour for those without neurological decline ($P < 0.0001$). After carefully adjusting for diagnosis and illness severity, the odds of neurological decline increased by 1.13 fold (95% CI 1.05-1.21, $P = 0.0016$) for every 1% increase in maximum hourly seizure burden. Above a maximum seizure burden threshold of 20% per hour (12 minutes), both the probability and magnitude of neurological decline rose sharply ($P < 0.0001$) across all diagnostic categories. *Conclusions:* These findings support the hypothesis that seizures among critically ill children independently contribute to brain injury, and suggest that early seizure management in this population is warranted.

A03

Infraslow electroencephalography changes in infantile spasms

KA Myers (Calgary) L Bello-Espinosa (Calgary) M Scantlebury (Calgary)*

Background: Infantile spasms (IS) are a devastating infantile epileptic encephalopathy. Infraslow EEG activity (ISA) has shown potential in the presurgical evaluation of patients with epilepsy and in differentiating between focal and generalized seizures. To our knowledge there are no published reports describing ISA activity in patients with IS. *Methods:* EEG recordings of all cases of IS in the past 10 years at the Alberta Children's Hospital were reviewed. For each patient, the first 10 confirmed spasms were examined. Spasms were evaluated for changes in ISA which were described as exclusively generalized (g), lateralized (l) or absent (n) ISA. Results were correlated with treatments and clinical data. *Results:* 101 spasms from 13 patients were analyzed and 87% were associated with ISA. All patients with exclusively g-ISA showed at least a partial response to initial therapy, while this was the case in 66.7% with l-ISA, and 50% with n-ISA. Other seizure types developed in 60% of patients with g-ISA versus 83% with l-ISA and all patients with n-ISA. There were no statistically significant differences between the groups. *Conclusions:* Ictal ISA was observed in the majority of infantile spasms. Trends were observed suggesting that the presence of g-ISA changes may be a positive prognostic factor in IS.

A04

Pattern of brain injury predicts long term epilepsy following neonatal encephalopathy

Q Xu (Vancouver) V Chau (Toronto) SP Miller (Toronto) K Poskitt (Vancouver) A Hill (Vancouver) E Roland (Vancouver) S Belanger (Vancouver) J Rigney (Vancouver)*

Background: Hypoxic-ischemic (HI) encephalopathy is a major cause of neonatal seizures and long-term epilepsy. Extensive brain injury is associated with an increased risk. The objectives were to determine the association between the patterns of HI brain injury and specific anatomical lesion, and the subsequent development of childhood epilepsy. *Methods:* This retrospective study includes newborns (>36 weeks GA) with encephalopathy (n=181) seen between 2004 and 2012 at BC Children's and Women's Hospital, with MRI between 3 and 5 days of life. The predominant pattern of HI brain injury was recorded by a pediatric neuroradiologist blinded to the clinical information. Fisher exact test and Kruskal-Wallis analysis of variance were used for categorical and continuous variables respectively. Logistic regression was performed to examine the relationships between specific brain injury and epilepsy. *Results:* Of 181 newborns, 122 (67%) had long-term followed-up (median 24 months) by pediatric neurologists or pediatricians. Epilepsy diagnosed in 17 children. A significantly higher proportion are found in newborns with Basal Ganglia or Total patterns developed epilepsy ($P<0.001$). Specific injury in the motor cortex and hippocampus ($P<0.001$) was strongly associated with the development of epilepsy. Cooling did not affect these associations.

Pattern of brain injury	Epilepsy (N = 17)	No epilepsy (N = 105)	P-value
Predominant pattern			<0.001
Normal, N (%)	2 (12)	56 (53)	
Watershed, N (%)	2 (12)	12 (11)	
Basal ganglia, N (%)	8 (48)	15 (14)	
Total, N (%)	4 (24)	3 (3)	
Focal-multifocal, N (%)	1 (6)	19 (18)	
Signal abnormalities in specific brain structure			
Hippocampus, N (%)	8 (44)		<0.001
Motor cortex, N (%)	17(65)		<0.001
Occipital cortex, N (%)	8(47)		0.005

Conclusions: In term newborns with HI encephalopathy, injury to the motor cortex and hippocampus on neonatal MRI is reliable predictor of long term epilepsy.

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A05

Feasibility of diagnosing pediatric migraine using a screening questionnaire: a pilot study

RN Whitney (Hamilton) OK Borys (Hamilton)* A Latchman (Hamilton) D Callen (Hamilton)*

Background: Migraine affects approximately 4-11% of elementary school children, yet reaching a diagnosis in this age group can be challenging. This pilot study aimed to develop a screening migraine questionnaire, The McMaster Migraine Tool (MMT), and determine the feasibility of its use in diagnosing migraine in children 5-12 years-old. *Methods:* International Classification of Headache Disorders-II (ICHD-II) criteria for migraine were used to develop the MMT, which was completed by families prior to clinic visit. Feasibility was the primary outcome, as determined by willingness to participate, percentage of completion, and perceived ease of use. Secondary outcomes included sensitivity and specificity of the MMT when compared to assessment by a pediatric neurologist. *Results:* Of 71 families approached, 70 agreed to participate in the study and 69 completed the MMT. On average, families graded its ease of use to be 9/10 (10 being easy to use). The sensitivity and specificity of the MMT were 84% and 69% respectively. *Conclusions:* The MMT may be useful in diagnosing migraine in 5-12 year-old children, as it is readily completed and regarded as easy to use. Application of the MMT could lead to expedited diagnosis and management of migraine. Further validation of the MTT is a topic of further study.

A06

Genetic thrombophilias are uncommon in perinatal stroke

C Curtis (Calgary) P Massicotte (Edmonton) M Leaker (Calgary) A Kirton (Calgary)**

Background: Perinatal stroke diseases cause most hemiparetic cerebral palsy: arterial lesions acquired at term and fetal periventricular venous infarction (PVI). Evidence suggests modest associations between arterial perinatal stroke and thrombophilia but PVI is relatively unstudied. Elucidating the role of thrombophilia in perinatal stroke informs pathogenesis and clinical management. *Methods:* Children with MRI-confirmed perinatal stroke were prospectively enrolled in a population-based registry. Comprehensive thrombophilia evaluation was performed on all patients including factor V Leiden (FVL), factor II G20210A (FII), and MTHFR C677T mutations. Prevalence was compared between stroke types and published population rates. *Results:* We report on 107 patients: 44 PVI (59% male, median 7.5 years (0.8-17.9)) and 63 arterial (58% male, median 5.9 years (0.01-17.9)). FVL was found in 11.3% of PVI and 9.5% of arterial with population rates of 6%. FII mutation was found in 9.1% of PVI and 3.1% of arterial with population rates of 3.8%. Differences were not statistically significant. MTHFR hetero- and homozygosity were common (41%, 12%) but comparable to population rates. *Conclusions:* Genetic thrombophilias are uncommon in perinatal stroke. Perinatal stroke pathophysiology is likely multifactorial and may involve coagulation abnormalities but inherited thrombophilias are not a major factor.

A07

Congenital myopathies: adventures in gene discovery

JJ Dowling (Toronto) AE Davidson (Toronto) K Amburgey (Toronto) M Burmeister (Ann Arbor) J Li (Ann Arbor) S Moore (Iowa City) J Kuwada (Ann Arbor)*

Background: Congenital myopathies are a heterogeneous group of disorders that typically present in infancy or early childhood with hypotonia and weakness. While progress has been made in elucidating the genetic basis and pathogenesis of congenital myopathies, nearly 50% of cases remain genetically unsolved. This presents a major barrier for understanding and developing treatments for these diseases. In this study we describe our efforts in gene discovery for congenital myopathies. *Methods:* We have established a "pipeline" for gene discovery that includes careful clinical phenotypic analysis, whole exome sequencing, and variant validation and modeling using the zebrafish model system. *Results:* We describe the discovery of two new genetic causes of congenital myopathy. These are recessive mutations in STAC3 in Native American myopathy and dominant mutations in CCDC78 in a novel myopathy with cores and central nuclei. We also have identified a common, recurrent mutation in TPM2 as a new cause of distal arthrogryposis and core-rod myopathy. Ongoing discovery projects are aimed at myopathies with malignant hyperthermia. *Conclusions:* Using next generation sequencing and variant modeling in the zebrafish, we have identified new causes of congenital myopathy and expanded the spectrum of knowledge related to the etiologies and pathogenesis of these disorders.

CNS / CSCN Chair's Select Abstract Presentations

B01

Should blood pressure targets after stroke vary by body size? The SPS3 trial

TS Field (Vancouver) LA McClure (Birmingham) OR Benavente (Vancouver) PE Pergola (San Antonio) RG Hart (Hamilton) M Hill (Calgary)*

Background: It is not known whether blood pressure (BP) has a greater pathophysiological impact on smaller vs. larger patients. We explored relationships between anthropometric measures (body mass index(BMI), body surface area(BSA), height, weight), systolic BP targets and vascular outcomes in the Secondary Prevention of Small Subcortical Strokes Trial. *Methods:* Patients with recent lacunar infarcts were randomized to two BP targets (130-149 mmHg vs. <130 mmHg). We computed rates of stroke, death, and major vascular events by quartiles of each anthropometric measure. Time to outcome was evaluated with Cox proportional hazard models. We examined interactions between anthropometric measures and BP target. *Results:* 3020 subjects were followed over a mean of 3.7(SD 2.0)y. Mean age was 63 and 63% were male. Mean height was 167cm(SD 11), weight 81(18)kg, BMI of 29(5.9)kg/m2, BSA 1.9(0.25)m2. There were no associations between rates of any vascular outcome or death when assessed by quartiles of BSA, BMI, height or weight, nor was there an association between hazard ratios

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for lower versus higher BP targets across BMI categories or quartiles of anthropometric measurements. There were no trends with regards to interactions between anthropometrics and BP group for any outcome. *Conclusions:* We found no interaction between anthropometric measurements and higher and lower BP targets groups on the rates of vascular events and death.

B02

Abnormal neurons distinguish teratomas in NMDA receptor encephalitis

GS Day (Toronto) S Laiq (Toronto) DF Tang-Wai (Toronto) DG Munoz (Toronto)*

Background: The discovery of neuroglial elements (expressing N-methyl-D-aspartate receptors, NMDAR) within teratomas from patients with NMDAR encephalitis suggests that neuroglial tissue may be integral to autoantibody formation and disease pathogenesis. Neuroglial tissue is observed, however, in teratomas resected from patients without neurological symptoms, suggesting that this alone is insufficient to trigger autoantibody formation. We sought to characterize the organization of neuroglial elements within ovarian teratomas resected from patients with NMDAR encephalitis. *Methods:* The histopathological features of teratomas resected from five consecutively-accrued cases with NMDAR encephalitis were compared with 39 teratomas resected from 38 women without central nervous system dysfunction. *Results:* Central nervous system neuronal elements were identified in teratomas from 4/5 (80%) cases and 20/39 (51.3%) controls (p=0.36). Atypical neurons were detected within teratomas from 4/5 (80%) cases, but not controls (p<0.001). These histological abnormalities would have been diagnosed as gangliocytomas, ganglioneuroblastomas and atypical gangliogliomas if found within tumors resected from the central nervous system. Abnormal neuroglial elements were closely related to immune infiltrates in all cases (4/4). Inflammatory infiltrates were not associated with neuroglial tissue in controls, further differentiating these populations (p<0.001). *Conclusions:* Abnormal neurons distinguished teratomas from cases from controls, and may contribute to the development of autoimmunity in teratoma-associated NMDAR encephalitis.

B03

Specific clinical, imaging and electrophysiological findings may help with diagnosis, therapy and prognosis in NMDA encephalitis

*J Teitelbaum (Montreal) S Al Jarallah (Montreal)**

Background: NMDA encephalitis is often underdiagnosed. We illustrate common clinical features, MR imaging, EEG, therapy and outcome in order to increase rates of recognition and streamline therapy. *Methods:* Observational study of 10 adult patients (9 females), diagnosed with NMDA-Abs encephalitis at the Montreal Neurological Institute. We present the EEG patterns, clinical picture, EEG, MRI, evolution and outcome. *Results:* No cases had an infectious prodrome, but 50% had significant weight gain prior to neurologic symptoms. All began with psychological changes progressing to psychosis. Eight developed a characteristic movement disorder that will be described (video). Clinical diagnosis of seizures and status were noted in all, but no seizure activity was recorded on continuous EEG and no change in EEG or movements were noted with anticonvulsant treatment or withdrawal. Treatment included teratoma resection (7/10), steroids (3/10), IVIG (7/10), plasmapheresis (8/10) and Rituximab (6/10). Mean time to diagnosis was 27 days. Time from treatment to onset of recovery was 2 months (2 weeks to 3 months). All discharged patients (9/10) achieved functional independence. *Conclusions:* All new onset psychiatric disorders should arouse suspicion and characteristic dyskinesias may be very helpful in recognizing this encephalitis. Anticonvulsants are likely unnecessary. Prolonged illness does not preclude good outcome.

B04

Comorbid movement disorders in autopsied patients

UA Shuaib (Saskatoon) AH Rajput (Saskatoon) AH Rajput (Saskatoon)*

Background: Movement disorders (MD) rank among the most common neurological disorders. Coprevalence of MD in autopsy patients is not well known or fully understood. The prevalence of combined MD disorders is suggested to be 5%, which may be greater than chance alone. We report on comorbid MD in autopsy-confirmed cases. *Methods:* Patients assessed at Movement Disorder Clinic Saskatchewan (MDCS) are offered optional autopsy. Detailed clinical records are kept. Final clinicopathological diagnosis is made by the treating neurologist. *Results:* Of 457 autopsy patients, 23 had more than one MD. Of these, 22 patients had two concomitant conditions, while one had three. These include ET and Parkinson's disease (PD) or Progressive Supranuclear Palsy (PSP) in 11 patients, PD and PSP (3), Corticobasal Degeneration (CBD) and PD (3), ET and CBD (1), ET and SCA (1), CBD and PSP (1), Incidental Lewy bodies and CBD (1), Drug-induced parkinsonism (DIP) and ET (1), and ET with DIP and MSA (1). The most commonly overdiagnosed disease was PD with 4 cases, and the most commonly undiagnosed pathology was PSP with 8. *Conclusions:* This represents the first large study of MD comorbidity in autopsy-confirmed cases. Further genetic and pathological studies are needed to elucidate whether this observation is incidental or there is a combined genetic risk.

B05

Very mild hypothermia (35°C) reduces infarct volume and blood brain barrier breakdown following tPA treatment during ischemia reperfusion in the mouse

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Background: We hypothesized targeting a core temperature of 35C following 30-minutes of middle cerebral artery occlusion (MCAO) would reduce both infarct-volume and blood-brain-barrier (BBB) breakdown, improving clinical/logistical problems related to hypothermic induction. *Methods:* Post-MCAO, mice were randomly assigned i.v. tPA (10mg/kg) or normal saline, and core temperature maintained at normothermia (36.5C) or hypothermia (35C). Hypothermia was maintained 48-hours, followed by gradual re-warming, and all animals sacrificed at 72-hours. BBB-breakdown was determined by IgG extravasation, and total stroke-volumes via Haematoxylin and Eosin corrected for edema. Histology was assessed blind to treatment group. Data were analyzed by 1-way-ANOVA applying Bonferroni correction, significance considered at

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P<0.05. *Results:* The ipsi-contralateral differences in Optical-Density for IgG extravasation in animals treated with hypothermia+tPA showed a mean reduction of 19.4% (P<0.001) compared to the normothermia+tPA group. In saline-treated animals hypothermia did not reduce IgG extravasation compared to normothermic or sham controls. In hypothermia+tPA treated animals, stroke-volume was significantly reduced by 28.8% (P<0.001) when compared to normothermic+tPA animals. Hypothermia reduced mean infarct volume by 26.86% (P<0.01) in saline-treated animals. *Conclusions:* Our results show that very-mild hypothermia reduces BBB-breakdown and infarct-volume post ischemia reperfusion. Major implications include simplification of hypothermia induction and improvements of generalisability, and reduced BBB-breakdown improving safety of tPA treatment.

B06

Mutations in SPG7 cause chronic progressive external ophthalmoplegia through disordered mtDNA maintenance

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Background: Despite being a canonical presenting feature of mitochondrial disease, the genetic basis of progressive external ophthalmoplegia (PEO) remains unknown in a large proportion of patients. Here we show that mutations in SPG7 are a novel cause of PEO associated with multiple mitochondrial DNA (mtDNA) deletions. *Methods:* Whole exome sequencing, targeted Sanger sequencing and MLPA analysis were used to study 68 adult patients with PEO. Functional studies included transcript analysis (using RT-qPCR), proteomics (using Western blot), mitochondrial network analysis (using confocal microscopy to image the mitochondria of patient fibroblasts), single fibre muscle mtDNA analysis, and deep resequencing of mtDNA. *Results:* Nine patients (eight probands) were found to carry compound heterozygous SPG7 mutations, including three novel mutations. We identified a further six patients with single heterozygous mutations in SPG7. The functional studies indicated increased mitochondrial biogenesis on the level of transcript expression, mitochondrial protein levels, and mitochondrial morphology. Deep sequencing suggested clonal expansion of mtDNA mutations. *Conclusions:* SPG7 should be screened in patients in whom a disorder of mitochondrial DNA maintenance is suspected when spastic ataxia is prominent. The complex neurological phenotype is likely due to the clonal expansion of secondary mtDNA mutations modulating the phenotype, driven by compensatory mitochondrial biogenesis.

CNSS Chair's Select Abstract Presentations

C01

Primate Nucleus Accumbens and Orbitofrontal Cortex mediate decision-making behavior

F Girgis (Calgary) E Eskandar (Boston)*

Background: Understanding the neural circuitry underlying avoidance and reward-seeking behavior in awake-behaving primates is crucial to understanding the physiology of economic behavior theory in humans. Here we investigate two of the principal regions of interest, the nucleus accumbens (NAc) and the lateral orbital frontal cortex (OFC), to determine their contributions to decision-making. *Methods:* Two monkeys were trained in an Aversion-Reward Competition task, designed with the goal of assessing how animals behave when faced with decisions requiring economic valuation. Following training, stimulation chambers were stereotactically implanted atop the monkeys' heads to allow for microelectrode access to the prefrontal cortex and ventral striatum. Different locations within these regions were then systematically targeted for stimulation. *Results:* We demonstrate that OFC stimulation in the pre-decision epoch, and NAc stimulation in the post-decision and post-aversion epochs of the task, increases avoidance behavior, likely through top-down cognitive influence on downstream ventral striatal and prefrontal cortical circuits. In addition, the relation of NAc effects to the directional magnitude of aversive risk was opposite. *Conclusions:* By bridging neural and economic theories of decision-making, these findings may prove important in the honing of neuropsychiatric models dealing with disorders of reward and aversion mechanisms, such as those of addiction and anxiety, leading to novel Deep Brain Stimulation paradigms for the treatments of these diseases.

C02

Correlation of concussion symptoms and BOLD MRI CO2 challenge

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Background: To investigate the relationship between cerebrovascular reactivity (CVR) to CO2 measured with BOLD MRI and post-concussion symptoms (PSC). *Methods:* 25 patients with recent mTBI were submitted to CVR testing using BOLD MRI (μ 63 days post-injury) and CO2 manipulation in 2 occasions. PSC was assessed using SCAT2 questionnaire. Mean CVR indexes and volumes were calculated for brain (GCVR), grey (GMCVR) and white (WMCVR) matter. Spearman coefficient was used to evaluate the correlation between CVR indexes and compartment volumes and SCAT2 on both occasions. *Results:* CVR indexes were significantly lower in the WM, as expected. At first visit, GMCVR ($r = 0.4$, $p = 0.04$) and GM volume ($r = 0.45$, $p = 0.02$) were correlated with SCAT2 performance, with a trend for GCVR ($r = 0.38$, $p = 0.06$). In follow up, only GMCVR was correlated ($r = 0.4$, $p = 0.023$). There was no correlation with WMCVR or WMvol values. *Conclusions:* Severity of PSC correlates with impairment of CVR seen on BOLD MRI. Regional variations in CVR impairment

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can be detected by the technique. Lower CVR indexes suggest a state of vasoparalysis in response to CO2) and correlate with lower SCAT2 scores. BOLD CVR needs to be investigated longitudinally as an imaging indicator of severity in mTBI.

C03

Development of a molecular targeting system for glioblastoma based on surface enhanced Raman scattering nanoparticles

RJ Diaz (Toronto) PZ McVeigh (Toronto) MA O'Reilly (Toronto) K Burrell (Toronto) M Bebenek (Toronto) C Smith (Toronto) AB Etame (Tampa) G Zadeh (Toronto) K Hynynen (Toronto) BC Wilson (Toronto) JT Rutka (Toronto)*

Background: Spectral mapping of nanoparticles with surface enhanced Raman scattering (SERS) capability in the near-infrared range is a novel imaging technique that can be applied with microscope or endoscope systems. We hypothesized that these nanoparticles could be internalized by glioblastoma cells and be delivered to the brain parenchyma across the blood-brain barrier using transcranial focused ultrasound. *Methods:* Multifunctional SERS-capable gold nanoparticles were synthesized and characterized for their potential to be internalized by glioblastoma cells, to act as optical labels, and to be delivered across the blood-brain barrier to tumor margins. Magnetic resonance image-guided transcranial focused ultrasound (TcMRgFUS) was used to reversibly disrupt the blood-brain barrier (BBB) at brain tumor margins in rat brain as the model for nanoparticle delivery. *Results:* Glioblastoma cells were found to internalize SERS-capable nanoparticles of 50 nm or 120 nm physical diameter. Surface coating with anti-epidermal growth factor receptor antibody or non-specific human immunoglobuling G, resulted in enhanced cell uptake of nanoparticles in-vitro compared to nanoparticles with polyethylene glycol surface. BBB disruption allowed the delivery of SERS-capable gold nanoparticles at tumor margins. *Conclusions:* Nanoparticles with SERS imaging capability can be delivered across the BBB non-invasively using TcMRgFUS and have the potential to be used as optical tracking agents and therapeutic carriers at the invasive front of malignant brain tumors.

C04

Measuring cost of the neurosurgical episode of care: a key step to optimize value-based neurosurgery

N Mclaughlin (Los Angeles) P Upadhyaya (Los Angeles) F Buxey (Los Angeles) NA Martin (Los Angeles)*

Background: Scarce data exists regarding cost measurement and containment for episodes of neurosurgical care. We assessed how cost measurement and strategic containment could be used to optimize the value of delivered care, after implementation and maturation of pre-, intra-, and post-operative quality improvement (QI) initiatives. *Methods:* Retrospective study of consecutive patients undergoing a microvascular decompression: Group 1 prior to the implementation of QI interventions; Group 2 after implementation and maturation of QI processes. Group 3 represents a contemporary group, after implementation of cost containment interventions targeting the 3 most expensive activities: length of OR time, intra-operative neuromonitoring (IOM), and bed assignment. *Results:* Forty-four patients are included. Average OR time and average OR cost was 434min/$8,513, 348min/$7,592, and 403min/$8,333 respectively in groups 1, 2, and 3. Average cost for IOM was $1,557, $1,585, and $1,263 respectively in groups 1, 2, and 3. Average cost for bed assignment was $5,747, $5,198, and $4,535 respectively in groups 1, 2, and 3. Complete relief or significant decrease of pre-operative symptomatology was achieved in 42/44 patients. Overall, average cost of surgical care episode decreased 25% between groups 1 and 3. *Conclusions:* Linking cost containment and reduction strategies to ongoing outcome improvement strategies is an important step towards optimization of value-based delivery of care.

C05

Impaired development of intrinsic connectivity networks in children with medically-intractable localization-related epilepsy

GM Ibrahim (Toronto) BR Morgan (Toronto) W Lee (Toronto) M Smith (Toronto) EJ Donner (Toronto) F Wang (Toronto) C Beers (Calgary) P Federico (Calgary) MJ Taylor (Toronto) SM Doesburg (Toronto) JT Rutka (Toronto) O Snead (Toronto)*

Background: Typical childhood development is characterized by the emergence of intrinsic connectivity networks (ICNs) via internetwork segregation and intranetwork integration. The impact of childhood epilepsy on the maturation of ICNs is, however, poorly understood. Here, we evaluate the effects of focal, intractable epilepsy on the emergence of ICNs in children. *Methods:* The developmental trajectory of ICNs in 26 children (8-17 years) with focal epilepsy and 28 age-and-sex-matched controls was evaluated using graph theoretical analysis of whole brain connectomes from resting-state fMRI data. *Results:* Children with epilepsy demonstrated impaired development of regional hubs in nodes of the salience and default-mode networks (DMN). Seed-based connectivity and hierarchical clustering analysis revealed significantly decreased intranetwork connections, and greater inter-network connectivity in children with epilepsy compared to controls. Significant interactions were identified between epilepsy duration and the expected developmental trajectory of ICNs. DMN integration in children with epilepsy was associated with better working memory, and internetwork segregation with higher IQ scores. Subgroup analyses revealed the thalamus, hippocampus, caudate were weaker hubs in children with generalized seizures, relative to other patient subgroups. *Conclusions:* Our findings show that epilepsy interferes with the developmental trajectory of large-scale brain networks underlying cognition throughout childhood, providing evidence supporting the early treatment of affected children.

C06

Discrepancy between CT and conventional angiography in determining degree of carotid artery stenosis

E McFadden (Saskatoon) S Ahmed (Saskatoon) L Peeling (Saskatoon) P Szkup (Saskatoon) M Kelly (Saskatoon)*

Background: Computerized tomography angiography (CTA) is commonly used to define the degree of carotid stenosis prior to carotid endarterectomy or stenting; however, digital subtraction angiography (DSA) is considered the gold standard for assessing carotid stenosis. We analyzed the discrepancy rates between CTA

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and DSA in patients undergoing carotid stenting with only a baseline CTA. *Methods:* We retrospectively reviewed our carotid stenting patient database from 09/2008 to 06/2013. 49 patients were identified. The criteria for carotid stenting were symptomatic disease, multidisciplinary decision regarding treatment modality and greater than 69% stenosis on CTA. *Results:* There was no statistically significant difference between the degree of stenosis on CTA and DSA (P >0.05). However, 5/58 patients (8.6%) had stenosis greater than 70% on initial CTA, but showed < 70% stenosis on angiography. *Conclusions:* In this study, there was some discrepancy between CTA and DSA and 5 patients had a carotid stenting procedure aborted because of mild or moderate stenosis on DSA. One must ensure that patients undergoing carotid endarterectomy or stenting do not have an overestimation of the degree of stenosis, and subsequently undergo unnecessary treatment. A second imaging modality, such as duplex ultrasound, may reduce the likelihood of this occurring.

C07

School function in children following traumatic brain injury: developing a new outcome measure

S Vachhrajani (Toronto) AV Kulkarni (Toronto)*

Background: Pediatric traumatic brain injury (TBI) remains common. There is no suitable measure for assessing school function after TBI. Our prototype measure will optimize rehabilitation for this vulnerable population. *Methods:* Focus groups with rehabilitation professionals and special education teachers established the domains of school function, and were used to generate items. Items were reduced using the impact method. Field testing with teachers of injured children was conducted to further reduce items and provide construct validation. *Results:* Four putative domains were cognitive function, psychosocial competence, physical function, and academic competence. 95 items were field tested. Of 602 families approached, questionnaires were received from 58 teachers. Most students (67%) were male, 97% had mild TBI, and 81% had normal function. Teachers rejected 17 items, and two items were unclear. Internal consistency reliability was over 0.94 for all domains. Small sample size precluded robust construct validation. *Conclusions:* We present a prototype instrument that measures school function after pediatric TBI. This instrument will bridge an important assessment gap by screening for deficits in class, providing clinical follow up, and by serving as an outcome in clinical studies. Multicentre testing across the age and severity spectrum will be integral in validating this questionnaire for clinical and educational use.

CACN
Platform Presentations

D01

Pediatric intracranial arachnoid cysts: insights into clinical management

M Ali (Hamilton) MR Bennardo (Hamilton) S Almenawer (Hamilton) N Zagzoog (Hamilton) A Smith (Hamilton) D Dao (Hamilton) F Farrokhyar (Hamilton) S Singh (Hamilton)*

Background: To identify predictors of the need for surgery among children with intracranial arachnoid cysts managed at a single neurosurgical center. *Methods:* We conducted a retrospective chart review at McMaster Children's Hospital in Hamilton, Canada, to identify radiologically confirmed cases of intracranial arachnoid cysts. Data on baseline characteristics and need for surgery were extracted. In univariable and multivariable analyses was conducted using SPSS v. 20. *Results:* 83 patients with arachnoid cysts were reviewed, 27 (33%) of whom underwent surgery. The most common cyst-related symptoms among children who had surgery were headache/irritability (44%), macrocephaly (37%) and cyst growth (37%). Univariable analysis comparing cysts managed operatively versus conservatively, age (months) at first presentation (mean±SD: 41.2±50.7 vs. 87.5±61.7; p=0.002), cyst size (in cm3) at diagnosis (mean±SD: 253.2±283.4 vs. 67.2±111.0; p<0.001), and number of cyst-related symptoms (median±IQR: 2±1 vs. 0±0; p<0.001) predicted need for surgery; sex (% males: 77% vs. 70.4%; p=0.594) and cyst location (p=0.117) did not. Multivariate analysis and ROC forthcoming. *Conclusions:* This case series complements previous studies showing that younger age at presentation is a predictor of need for surgery. We made the novel observation that cyst size at diagnosis and number of cyst-related symptoms were also significant predictors. Our study can thus inform pediatricians' decision-making regarding neurosurgical referral for children with intracranial arachnoid cysts.

D02

Temporal trends of intraventricular hemorrhage and post hemorrhagic hydrocephalus in a population based cohort of very-preterm infants born to residents of Nova Scotia from 1993 to 2012

JA Radic (Halifax) M Vincer (Halifax) PD McNeely (Halifax)*

Background: Intraventicular hemorrhage (IVH) and post hemorrhagic hydrocephalus (PHH) are common in premature newborns. Here, we describe temporal trends in incidence of IVH, PHH and shunt surgery in a population based cohort of very-preterm infants (gestational age > 19 and < 31 weeks) with minimal selection bias. *Methods:* A perinatal database that includes all very-preterm infants born from 1993 onwards to residents of Nova Scotia was screened for infants born from January 1, 1993 to December 31, 2012. Incidences of IVH, PHH and shunt placement were calculated. Chi-square test for trend was used to assess for trends over time. *Results:* Out of 1349 successfully resuscitated very-preterm infants, 406 (30.1%) and 148 (10.9%) were diagnosed with IVH, any Papile grade and grades 3/4 respectively. No patients with IVH grades 1/2 developed PHH. The incidence of IVH has significantly increased

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over time (p=0.020), as has the incidence of PHH and shunt surgery (p=0.001, p=0.010) in patients with IVH grades 3/4. The proportion of patients with PHH receiving a shunt has not changed over time (p=0.813). *Conclusions:* The increasing incidence of IVH, PHH and shunt surgery in infants with IVH over time is poorly understood, though worrisome. Further research to identify preventable and treatable causal factors is warranted.

D03

Papilledema in children with an CSF opening pressure below 28 cm H_2O. Is it pseudotumor cerebri though?

D Tibussek (Toronto) F Distelmaier (Duesseldorf)*

Background: A CSF opening pressure (OP) of >28 cm H_2O is now required as a diagnostic criteria for Pseudotumor cerebri syndrome in children. We here report a group of 11 children with an OP between 21 and 27 cm H_2O and clinical signs and symptoms of PTCS. *Methods:* We present a detailed analysis of a subgroup (n=11) of PTCS patients identified during an active hospital-based surveillance on paediatric PTCS in the German population in 2008 (Tibussek et al. 2013). *Results:* All patients had papilledema. Five children had an additional abducens nerve palsy. Three patients had a relapse as indicated by recurrence of papilledema or abducens palsy. Two children required escalation of medical treatment because of persistent abducens palsy. In two children a second LP documented an opening pressure of 34 and 35 cm H_2O. All but two patients received medical treatment in addition to pressure release during LP. *Conclusions:* We believe that the majority of these 11 patients with a "normal" opening pressure are very likely to suffer from a pseudotumor cerebri syndrome or should at least be considered "probable PTCS". A single lumbar puncture is neither diagnostic nor exclusive in suspected cases of PTCS. Results of OP measurement need to be correlated with the clinical history, clinical signs and symptoms.

D04

Agenesis of corpus callosum: clinical and neuroradiological evaluation

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Background: To study the clinical findings of patients with corpus callosum abnormalities and the neuroradiological features, with the use of new functional corpus callosum subtyping for correlation with the clinical presentation. *Methods:* A retrospective review included patients with abnormalities of the corpus callosum from 1999-2012. 125 patients were included. The study included clinical features, genetic etiology and microarray results. We used a new functional classification for callosal abnormalities, with four classes: complete agenesis, anterior agenesis (rostrum, genu, body), posterior agenesis (isthmus, splenium), and complete hypoplasia (thinning). We studied the presence of extra callosal abnormalities. *Results:* There were a significant proportion of patients with developmental delay, 76% had fine motor developmental delay, 74% had speech delay and 49% had behavioral issues. 43% of our cohorts had identifiable causes. Microarray testing was positive in 35.8%. The presence of extra callosal brain abnormalities was 46% and this were associated with higher risk of epilepsy, gross motor delay, and speech delay. *Conclusions:* Developmental anomalies of the corpus callosum appeared to be a common end phenotype. The functional classification system without clinical data cannot predict the functional outcome. The underlying neurogenetic cause has the major effect on clinical outcome.

D05

Regenerating axons: new translational avenues

DW Zochodne (Calgary) K Christie (Calgary) A Krishnan (Calgary) B Singh (Calgary) C Cheng (Calgary) JA Martinez (Calgary)*

Background: Assumptions that peripheral neurons regenerate adequately are incorrect. Peripheral axon regrowth is constrained, frequently misdirected and requires new supportive approaches. *Methods:* Review of published and unpublished models, approaches and results. *Results:* Exposing injured nerves to exogenous growth factors has been complicated by limited receptor expression, access and endogenous competition. We have explored knockdown of intrinsic neuronal barriers to growth, or 'brakes' as new directions to enhance axon regeneration: RHO-ROK that inhibits growth cone extension, PTEN (phosphatase and tensin homolog deleted on chromosome 10) a tumour suppressor and others, for example oncogenic proteins expressed in neurons. PTEN inhibition or knockdown is associated with dramatic rises in axon outgrowth beyond the impact of 'preconditioning'. In experimental diabetes, PTEN is upregulated and its knockdown using siRNA restores attenuated regeneration (Singh et al, Brain, in press). Exogenous electrical stimulation (ES) is an empiric approach that enhances both *in vitro* and *in vivo* growth with early benefits in human trials (Gordon, Chan, Verge and others). *Conclusions:* New strategies that demonstrate proof of principle *in vitro* or in early *in vivo* models including RHO-ROK inhibition, PTEN knockdown and ES are candidates for translation to human trials. [Supported by CIHR, CDA, NIH and AIHS]

D06

Predicting motor outcome using DTI quantification of corticospinal tract integrity after perinatal stroke

JA Hodge (Calgary) H Carlson (Calgary) X Wei (Calgary) B Goodyear (Calgary) A Kirton (Calgary)*

Background: Perinatal stroke causes most hemiparetic cerebral palsy (CP). Preterm venous and term arterial lesions injure the corticospinal tract (CST). Diffusion tensor imaging (DTI) of CST informs adult stroke models but perinatal stroke studies are limited with large lesions creating additional complexity. *Methods:* Alberta Perinatal Stroke Project children had unilateral motor perinatal stroke, quantified symptomatic hemiparesis, and DTI MRI [6 directions, 6 averages, 2x2x3mm voxels]. Fifteen children (8 arterial, 7 venous) were studied (median 11, range 7-17 years). Anatomically-guided regions-of-interest (ROI, cerebral peduncles, internal capsule) and tractography defined CST. Four tract lengths were created: full, partial, mini, and upper. Variables of fractional anisotropy (FA), radial (RD), axial (AD), and mean diffusivity (MD) were expressed as asymmetry indices. Motor outcomes were the Assisting Hand Assessment (AHA) and Melbourne. *Results:* Full tract was most predictive of AHA and Melbourne. Partial tracts were

also correlated with motor outcome. For the full tract, AD was most predictive of AHA ($p<0.001$) while FA was most predictive of Melbourne ($p<0.001$). *Conclusions:* DTI parameters correlate with motor outcome in perinatal stroke. The more tract available the better but subsections are useful when not available. FA and AD variables demonstrate the strongest associations.

D07

Health-related quality of life in children with Duchenne Muscular Dystrophy

S Wei (London) C Campbell (London) K Speechley (London)*

Background: Duchenne Muscular Dystrophy (DMD) impacts multiple aspects of an affected child's health. Health-related quality of life (HRQOL) in DMD patients has not been well studied. This study describes HRQOL in Canadian children with DMD and examines disease progression and HRQOL. *Methods:* Through the Canadian Neuromuscular Disease Registry, 176 children with DMD received child and parent proxy HRQOL questionnaires. The Pediatric Quality of Life 4.0 General Core Scale, and additional scales, were used. *Results:* To date, the response rate is 55%. Child and parent reports indicated HRQOL scores are lower than published scores of healthy children ($p<0.0001$). The youngest age group (4-7 years) reported higher overall ($p=0.0094$) and physical ($p<0.0001$) HRQOL than the older ages (8-12 and 13-17), but there was no difference among three groups in psychosocial HRQOL ($p=0.2644$). Parents of the youngest children reported higher physical ($p=0.02$), psychosocial ($p=0.0106$) and overall ($p=0.0053$) HRQOL than parents of older children. Parents of ambulant children reported higher physical ($p=0.0073$), psychosocial ($p=0.0166$) and overall ($p=0.0046$) HRQOL scores than non-ambulant children. *Conclusions:* This study describes HRQOL from a nationally representative sample of DMD children, improving upon existing studies in its comprehensiveness and sample size. HRQOL is compromised in DMD children and there is an association between disease progression and lower HRQOL.

D08

Stacking exercises aid the decline in FVC and sick time (STEADFAST) in Duchenne muscular dystrophy: a pilot study

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Background: Lung volume recruitment (LVR) is a technique to achieve maximal lung insufflation capacity. The benefits of LVR have not been formally evaluated in boys with Duchenne muscular dystrophy (DMD). *Methods:* The study is a single-blind RCT for DMD boys age 6-16 years. Participants are randomized to conventional treatment +/- LVR. Pulmonary function tests, respiratory symptoms, adherence, and satisfaction with LVR are recorded. This one-year pilot aimed to determine feasibility of study enrolment. *Results:* Twenty-three boys were screened; 19 (82.6%) were enrolled, with mean age of 11.7 years. Five (26%) subjects were wheelchair-dependent and four (21%) had scoliosis. The mean baseline predicted FVC, FEV1, and FEF25-75 were 85.3%, 81.1%, and 80.2% respectively. Initial challenges included use of LVR adherence monitoring device and frequency of surveys. To reduce caregivers' burden, visits were changed to every six months and questionnaires were simplified to a quarterly basis. *Conclusions:* The estimated sample size for the multi-site STEADFAST trial is 110 subjects. Given the pilot enrolment rate, the target sample size should be achievable with 254 eligible participants across Canada. However, other concurrent clinical trials may compete for enrolment. On-going collaboration within the Canadian Paediatric Neuromuscular and Respiratory Group is essential to ensure success of this important DMD study.

D09

Neuroimaging findings in children with chronic ataxia in Manitoba

MS Salman (Winnipeg) B Chodirker (Winnipeg) M Bunge (Winnipeg)*

Background: Pediatric ataxia is caused by diverse disorders. Our aim was to review the neuroimaging features in pediatric chronic ataxia to ascertain their contribution in the diagnosis. *Methods:* A retrospective charts/ neuroimaging reports review was undertaken in 177 children with chronic ataxia. Neuroimaging in 130 patients was also reviewed. *Results:* Nineteen patients had brain CT only, 103 brain MRI only, and 55 had both. Abnormalities in the cerebellum or other brain regions were associated with ataxia. Neuroimaging was helpful in 74 patients with 31 diseases: It was diagnostic in 9 diseases, narrowed down the diagnostic possibilities in 14 diseases, and revealed important but non-diagnostic abnormalities in 8 diseases. In 5 of 31 diseases where neuroimaging was helpful, there were 13 patients where neuroimaging was either normal or showed an abnormality not contributing to diagnosis. Having a normal MRI was mostly seen in genetic diseases or in the early course of disorders of impaired DNA repair. Repeat neuroimaging was sometimes helpful in monitoring disease evolution. Neuroimaging was not directly helpful in 35 patients with 9 diseases or (by definition) the 55 patients with unknown disease etiology. *Conclusions:* Neuroimaging is an essential investigation in the assessment of pediatric chronic ataxia.

CNS / CSCN
Platform Presentations

E02

Occult anterograde flow: an under-recognized but crucial predictor of early recanalization with IV tPA using CT perfusion T0 maps

S Ahn (Gwang Ju) C d'Esterre (Calgary) E Qazi (Calgary) S Patil (Calgary) M Almekhlafi (Calgary) C Casault (Calgary) T Lee (London) M Goyal (Calgary) A Demchuk (Calgary) B Menon (Calgary)*

Background: Clot lysis is dependent on the ability of blood and lytics to permeate clot. We devise a novel technique to quantify occult anterograde flow (OAF) through intracranial clot and determine if OAF predicts early recanalization with IV tPA. *Methods:* From the Prove-IT stroke-imaging database, IV tPA treated patients were analyzed. Using a CT perfusion T0 map generated from delay in arrival time of contrast within the intracranial arterial tree, a "positive sloped" regression line of T0

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values from distal clot interface along the artery profile indicated presence of OAF. T0 values in the distal and proximal clot interface were also measured. Early recanalization was assessed on subsequent conventional angiography or on 4hr CTA after tPA injection. *Results:* Of 50 patients analyzed, early recanalization rate was higher in patients with OAF (12/17 versus 10/33, p<0.01). Mean T0 value difference was significantly less in recanalizers (0.6 versus 3.8, p<0.01). Those with OAF and maximum T0 difference < 4.5s were most likely to achieve recanalization (n=16, 75%) versus those with only one parameter (n=24, 37.5%) or those with neither parameters (n=10, 10%). *Conclusions:* Occult Anterograde Flow can be measured by CT perfusion T0 maps and is a robust predictor of early recanalization with IV tPA.

E04

Long-term outcomes of pallidal DBS for cervical dystonia

YB Bezchlibnyk (Calgary) KC Gomes (Calgary) K Hunka (Calgary) P Lawrence (Calgary) R Ranawaya (Calgary) S Kraft (Calgary) S Furtado (Calgary) ZH Kiss (Calgary)*

Background: Cervical dystonia (CD) can be disabling and often fails medical therapy in the long-term. Pallidal deep brain stimulation (DBS) is an effective option for selected patients. Here, we assess its efficacy over 10 years. *Methods:* All patients undergoing DBS for CD in Calgary were assessed using the Toronto Western Spasmodic Torticollis Rating Scale (TWSTRS) at baseline, 6 months and 1 year post-op, and bi-annually thereafter. Primary outcome was severity (range 0-30, higher scores indicating greater impairment). *Results:* Seventeen patients underwent surgery with at least 2 year follow-up. Mean baseline TWSTRS severity score was 16.9+/-3.4 (+/-SD, n=17). Follow-up ranged from 2 to 10 yrs. Outcomes at each follow-up were significantly different from baseline (p<0.001 in all cases, one-way ANOVA plus Holm-Sidak tests for multiple comparisons to baseline): 6 months – 6.5+/-4.2 (n=14); 1 year – 4.9+/-4.2 (n=15); 2 years – 4.8+/-3.3 (n=15); 3 years – 3.0+/-3.2 (n=9); 4 years –5.3+/-5.6 (n=7); 5 years – 5.2+/-4.1 (n=6); 6 years – 5.0+/-4.2 (n=4); 7 years – 3.0+/-2.7 (n=3); 8 years – 3.0+/-1.4 (n=2); 10 years – 1.00 (n=1). Adverse effects included mild speech dysarthria in 3 and balance disturbance with bradykinesia in 4 older patients. *Conclusions:* Pallidal DBS is an effective and durable therapy for CD persisting up to 10 years.

E05

GABA transport and neuroinflammation are coupled in multiple sclerosis: regulation of the GABA transporter-2 by ganaxolone

*AM Paul (Edmonton) WG Branton (Edmonton) J Walsh (Edmonton) MJ Polyak (Edmonton) J Lu (Edmonton) GB Baker (Edmonton) C Power (Edmonton)**

Background: Gamma-aminobutyric acid (GABA) is the chief inhibitory neurotransmitter but its actions on immune pathways in the brain are unclear. In the present study, we investigated GABAergic transport in conjunction with neuroinflammation in models of multiple sclerosis (MS). *Methods:* Gene expression was examined in white matter from MS and control (Non-MS) patients, in cultured human macrophages, microglia and astrocytes, and in spinal cords from mice with and without experimental autoimmune encephalomyelitis (EAE) that were treated with ganaxolone. *Results:* The GABA transporter (GAT)-2's expression was increased in multiple sclerosis (MS) patients' white matter, particularly in myeloid cells, compared to Non-MS patients (p<0.05). Interferon-gamma (IFN-γ) stimulation of human myeloid cells induced GAT-2 expression and reduced extracellular GABA levels (p<0.05). The synthetic allopregnanolone analogue, ganaxolone (GNX), repressed GAT-2, JAK-1 and STAT-1 expression in activated macrophages (p<0.05). *In vivo* GNX treatment reduced Gat-2, Cd3e, MhcII, and Xbp-1/s expression in spinal cords following EAE induction (p<0.05), which was correlated with improved neurobehavioral outcomes and reduced neuroinflammation, demyelination and axonal injury. *Conclusions:* These findings highlight altered GABAergic transport through GAT-2 induction during neuroinflammation. GABA transport and neuroinflammation are closely coupled but regulated by GNX, pointing to GABAergic pathways as therapeutic targets in neuroinflammatory diseases.

E06

Does blood pressure at presentation and fluctuations in the hyper-acute phase of ischemic stroke affect clinical outcome?

A Trivedi (Calgary) E Qazi (Calgary) P Wee (Calgary) C d'Esterre (Calgary) M Goyal (Calgary) AM Demchuk (Calgary) B Menon (Calgary)*

Background: Blood pressure fluctuations are presumed to be markers of compromised hemodynamics and therefore poor clinical outcome in acute ischemic stroke. We sought to understand the effect of BP at presentation and subsequent fluctuations on clinical outcome. *Methods:* Data is from a study of patients with acute ischemic stroke within 12 hrs of onset. Patients with proximal occlusions were included. Systolic (SBP) and diastolic BP (DBP) was recorded at 3 time points, within 60 minutes of each other. BP fluctuation was estimated using multiple measures of statistical dispersion. Clinical outcomes were NIHSS at presentation and change in NIHSS from baseline to 24 hrs (δNIHSS). *Results:* 83 patients were included for analysis. Mean SBP and DBP at arrival were 158 and 84.3 mmHg respectively. No significant correlation found between baseline NIHSS and SBP or DBP at baseline. A modest negative correlation was noted between δNIHSS and SBP at arrival (p=0.01). No correlation was noted between δNIHSS and DBP at arrival or between δNIHSS and any measure of BP fluctuation. *Conclusions:* Increased SBP at arrival correlates with reduced probability of clinical recovery at 24 hours in acute ischemic stroke with proximal occlusions. Hyperacute BP fluctuations are not associated with poor clinical outcomes.

E07

Rebooting the immune system: a 13 years' experience with autologous stem cell transplant in the treatment of immune-mediated neuromuscular disease

CE Pringle (Ottawa) HL Atkins (Ottawa) LB Huebsch (Ottawa) PR Bourque (Ottawa) CN Bredeson (Ottawa)*

Background: Although most immune-mediated neuromuscular diseases respond well to standard treatments, occasional patients require more aggressive therapy. We report our experience with these rare cases, utilizing iimmunoablation followed by autologous stem cell "rescue". *Methods:* 14 patients (7 myasthenia, 3 stiff person syndrome and 4 CIDP) underwent autologous peripheral

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blood hematopoietic stem cell (HSC) collection and cryopreservation. Following stem cell collection, patients received chemotherapy-based condition regimen to ablate the immune system or to treat concurrent malignancy. Some patients received total body irradiation or anti-thymocyte globulin. Patients were then re-infused with thawed HSC and followed for 1-13 years. *Results:* 3 patients underwent autologous HSC transplant for concurrent malignancy. 11 underwent HSC transplant for refractory immune-mediated neuromuscular disease. All MG patients maintained medication-free remission for the length of follow-up (ie no relapses in any patients). 1 patient died of a pre-existing lymphoma but was myasthenia-free at the time of death. Two SPS patients achieved medication-free remission. The 3rd patient is early in her course at time of submission. All CIDP patients had improvement. Two achieved remission (with residual axonal damage) and the third showed a decrease in his requirement for immunomodulartory therapy. *Conclusions:* Autologous stem cell transplant results in sustained disease-free responses without further immunosuppression in those rare patients with neuromuscular disease inadequately treated with standard agents.

E08

EEG reactivity in coma: comparing stimuli

B Young (London) M SarkelA (Helsinki) A Tolonen (Helsinki)*

Background: EEG reactivity has prognostic utility in coma. However, the relative effectiveness of various stimuli has not been systematically explored. *Methods:* We chose 200 adult patients with in coma in ICU and excluded patients who were brain dead or on anesthetic doses of sedative medication. EEGs were recorded while applying stimuli randomly: Vocal stimulus (VS): calling of the patient's first name; "noisy stimulus" (NS): tone of 120 dB into both ears; nasal stimulus (NaS): tissue paper inserted into the nares; nailbed stimulus (NBS): pressure on the nailbed of index finger. *Results:* The percentage in which reactivity to one stimulus was associated with reactivity to another stimulus is shown in Table:

Response/ % Response	VS	NS	NaS	NBS
VS	100.00	20.00	80.00	50.00
NS	100.00	100.00	100.00	50.00
NaS	66.67	37.5	100.00	62.5
NBS	40.00	14.29	83.30	100.00

Conclusions: It is best to apply more than one stimulus modality when assessing EEG reactivity. With respect to associations, NS is the least effective stimulus.

E09

Predicting drug-resistance in generalized epilepsy in an adult population: a case-control study

AR Voll (Saskatoon) S Buckley (Saskatoon) L Hernandez Ronquillo (Saskatoon) JF Tellez-Zenteno (Saskatoon)*

Background: To identify risk factors for development of drug resistant epilepsy (DRE) in an adult cohort of patients with generalized epilepsy. This would allow patients to receive earlier and more specifically individualized treatment plans. *Methods:* Nested case-control study. 118 patients with generalized epilepsy (GE) between the ages of 18 and 75 were identified. We used the definition of DRE (2010) and the guidelines to classify syndromes and seizure types by the ILAE (1989). Odds ratios and confidence intervals were calculated.

Prognostic Factor	No DRE(%) n=74	DRE (%) n=44	OR	95% Confidence Interval	p value
Prior to 12 y at age of epilepsy onset	18(24)	35(80)	12.1	4.8-29.9	<0.001
Presence of Developmental Delay	9(12)	28(64)	12.6	4.99-32.0	<0.001
Autism	2(3)	6(14)	5.7	1.09-29.5	0.02
Symptomatic	2(3)	8(18)	8.5	1.6-39.6	0.004
Cryptogenic	7(9.5)	23(52)	10.5	3.9-27.8	<0.001
Frequent spike waves on 1st EEG	18(28)	22(56)	3.38	1.47-7.8	0.004
More than 1 seizure type	19(26)	40(91)	28.4	8.9-90	<0.001
Status Epilepticus	2(3)	13(29.5)	15.1	3.2-70.9	<0.001
Lennox Gastaut Syndrome	1(1)	15(34)	37.7	4.7-299	<0.001
Any Epileptic Syndrome	9(12)	25(57)	9.5	3.7-23.7	<0.001
More than 1 seizure per month	5(18)	29(71)	11	3.4-36	<0.001

Results: Cases of DRE were significantly younger than controls at the onset of epilepsy (6.5 vs. 18.8 p= <0.001). Presence of developmental delay and more than one seizure profile remained statistically significant in a logistic regression multivariate analysis. *Conclusions:* Presence of more than one seizure profile and the presence of developmental delay are significantly associated with DRE. Some risk factors identified in our study are similar to pediatric cohorts, however our study is specifically tailored to adult patients with generalized epilepsy.

CNSS
Platform Presentations

F01

Microvascular decompression surgery for hemifacial spasm: a 10-year prospective population based analysis

A Prior (Winnipeg) AM Kaufmann (Winnipeg)*

Background: Hemifacial spasm (HFS) is relatively rare with an estimated incidence of 0.8/100,000/year. We set out to determine the utilization rate and outcomes of MVD for HFS in our province. *Methods:* Clinical data regarding local HFS patients assessed in 2001-2010 were prospectively recorded at our centre that provides the exclusive neurosurgical services for a relatively constant provincial population of 1.26 million. Among those naive to prior surgical interventions for TN, date and type of first surgery were recorded. Postoperative outcomes were determined by review of hospital records and telephone interviews after a minimum 3 year follow-up period. *Results:* First neurosurgical intervention for HFS was performed for 69 patients, a rate of 0.55/100,00/year. Before electing MVD, 77% had tried serial botulinum toxin injections. At 7 +/- 4 years follow-up, postoperative spasm relief was excellent in 86% and good (>75% relief) in another 6%; this included the 9 of the 69 patients (13%) who required a repeat MVD. No patients suffered permanent or severe complications of death, stroke, new deafness or facial paralysis. *Conclusions:* We found approximately two-thirds of HFS sufferers elected surgical treatment, even after the

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majority had tried serial botulinum injections. Our success and safety results appear to support this rate of MVD utilization for HFS.

F02

Gamma knife radiosurgery in the treatment of brain metastases from lung cancers: results of a single center

PA Szelemej (Winnipeg) FA Zeiler (Winnipeg) AM Kaufmann (Winnipeg) PJ McDonald (Winnipeg) D Fewer (Winnipeg) J Butler (Winnipeg) G Schroeder (Winnipeg) M West (Winnipeg)*

Background: Gamma Knife (GK) for brain metastases offers a means of tumour control and mortality benefit with an acceptable risk profile. We conducted this study to evaluate GK treatment for brain metastases from lung cancer at our center. *Methods:* We conducted a retrospective review of patients treated with GK for brain metastases from lung cancer at our institution from November 2003 to July 2012. Demographic data, treatment parameters, and outcomes were analyzed. *Results:* A total of 157 patients were identified, 149 had sufficient data, 16 were lost to follow-up. 11.4% of metastases were small cell, 87.3% non-small cell, and 1.3% mesothelioma. The mean age was 62; 57% of patients were female. Patients received an average of 1.51 GK sessions, with 401 individual lesions treated; average dose of 17.0 Gy at the 50% isodose line. Local control rate was 91.2%, for those with follow-up at 3-4 months, with 81.4% experiencing local tumour regression. No major complications occurred. Median survival time from diagnosis was 11 months. Probability of survival at 30 and 67 months were 25% and 3%, respectively. *Conclusions:* GK is a safe and effective means of treating lung cancer metastases to the brain, achieving acceptable tumour growth control with mortality benefit.

F03

The utility of paraneoplastic serology in the Saskatoon Health Region

I Poliakov (Saskatoon) G Hunter (Saskatoon)*

Background: Neurological paraneoplastic disorders (PNDs) are syndromes of protean presentation, which can be associated with numerous antibodies. Hence, PNDs are difficult to diagnose. There are no clear guidelines of when they should be worked up, and to what extent. *Methods:* We reviewed the paraneoplastic serology of all patients admitted under, or consulted to, the Saskatoon Health Region neurology service between Jan 1, 2012 and May 1, 2013. We applied a data collection instrument to assess the serology ordered, serology processed, results and the clinical characteristics of the presentation. *Results:* 32 patients were screened for paraneoplastic serology, of which 2 (6.25%) had positive results. 278 serological tests were ordered, of which 2 (0.72%) were positive. 17/32 (53%) cases had either errors of omission or commission, in terms of tests ordered. 3/32 (9.4%) patients had an alternative diagnosis for their symptoms, of the remainder, 3/29 (10.3%) had evidence of a distal cancer. *Conclusions:* The positive result rate per patient for any PND workup was about 6.25%; or about 0.72% per individual test. Of patients with a proven distal malignancy, the positive result rate per patient was 33%. There was a discrepancy between the serology ordered and processed in 53% of the cases.

F04

The effect of selective hypothermia on focal cerebral ischemia in swine

T Mattingly (Washington) L Denning (London) K Siroen (London) P Lopez-Ojeda (London) D Pelz (London) S Das (London) L Ang (London) D Lee (London) S Lownie (London)*

Background: Total body hypothermia is an established neuroprotectant in global cerebral ischemia. Selective application of hypothermia to a region of focal ischemia may provide similar protection with more rapid cooling and elimination of systemic side effects. We studied the effect of selective endovascular cooling in a focal stroke model in adult domestic swine. *Methods:* After craniotomy under general anesthesia, a proximal middle cerebral artery branch was occluded for 3 hours, followed by 3 hours of reperfusion. In half the animals, selective hypothermia was induced during reperfusion using a dual-lumen balloon occlusion catheter placed in the common carotid artery. Following reperfusion, the animals were sacrificed. Brain MRI and histology were evaluated by experts who were blinded to the intervention. *Results:* In this series of 25 animals, the hemicranial temperature was successfully cooled to a mean of 26.5°C in the intervention arm. Average time from start of perfusion to attainment of moderate hypothermia (< 30°C) was 25 minutes. Mean MRI stroke volumes were significantly reduced by selective cooling 5.0+/-6.6 control, 0.5+/- 0.3 hypothermia, (stroke % of hemisphere) (p=0.042). Total stroke pathology volumes were reduced by 42% compared with controls (p=0.251). *Conclusions:* Selective moderate hypothermia was rapidly induced using endovascular techniques in a clinically realistic swine stroke model. A significant reduction in stroke volume was observed.

F05

Leveraging optimal care delivery in neurosurgery – going beyond the value equation

N Mclaughlin (Los Angeles) JL Klohn (Los Angeles) SK Foss (Los Angeles) N Kyulo (Los Angeles) T Padilla (Los Angeles) S Skootsky (Los Angeles) L So (Los Angeles) NA Martin (Los Angeles)*

Background: Strategies aiming to improve value of delivered care most commonly benchmark resolution of symptoms, disease control, complication rates, readmission/reoperation, and mortality as the numerator of the value equation. However additional information such as safety events, patient satisfaction, and risk liability, may be valuable in redesign strategies to assure optimal care in a patient population. *Methods:* Retrospective study of safety events, patient satisfaction, and claim data specifically for the Department of Neurosurgery between 2008 and 2012. For safety events, data was extracted from the event reporting system. Patient satisfaction was extracted from multiple sources including patient-reported survey data. Claims data and related contributing factors was extracted from a comprehensive risk intelligence tool database. *Results:* Regarding patient safety, the top five event categories include medication-related events, skin issues, falls/injury other than falls, patient flow, surgical issues. Concerning patient satisfaction, patient access, coordination of care, communication, and discharge information were the lowest composites of the patient reported survey data. The top five contributing factors in terms of number of claims include clinical judgment, technical skills, non-insured issues, communication, and administration related issues.

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Conclusions: Review of these complementary data of current state of care delivery enabled aligning patient affairs, risk management, and patient safety department priorities with the neurosurgical care redesign initiatives to achieve optimal global care.

F06

The association between length of time to urgent spine surgery and length of postoperative hospital stay and cost

*YH Khormi (Edmonton)**

Background: In Canada, surgical resources in a given hospital are typically shared between all surgical services and as a result many emergency cases are not performed within 24 hours. Longer waiting time for patients requiring urgent surgery, such as surgery for spine fracture increase length of post-operative hospitalization and overall cost. If this were demonstrated conclusively, there may be significant budgetary implication within the Canadian healthcare system. *Methods:* This retrospective cohort study examines patients who underwent emergency surgery in last 5 years at the University of Alberta Hospital. Linear regression analysis was used to determine the relationship between mean time to surgery from admission and mean postoperative length of hospitalization and cost, adjusting for potential confounders. We did subgroup analyses by speciality and by disease. *Results:* Data analysis of 12000 patients is in progress. A subgroup analysis of 108 patients showed that a delay in lumbar burst fracture surgery by > 48 hours was associated with statistically significant longer mean post-surgical hospital stay and higher overall costs of care. *Conclusions:* Subgroup analysis of patients undergoing emergency spine surgery for burst fracture showed increase length of time to surgery was associated with increased length of postoperative hospital stay and overall cost.

F07

Door to knife in trauma craniotomies: room for improvement

J Marcoux (Montreal) D Bracco (Montreal)*

Background: "Time is brain" in neurotrauma and a timely decompression of mass expanding lesions may decrease the incidence and severity of secondary lesions. We aim to evaluate our ER door to knife delay for patients requiring urgent craniotomies. *Methods:* All priority 1 cranial neurotrauma procedures transferred to OR from ER over 5 years were included. The primary outcome was to describe our door to knife times. Patients were subcategorized in ultra urgent (E0) versus urgent (E1) based on CT and clinical presentation. *Results:* 162 patients were included. The median ER door to CT was 50 minutes for E0 versus 59 minutes for E1. The median ER door to OR door time was 85 versus 127 minutes ($p<0.001$), and a median OR door to knife of 27 versus 39 ($p<0.001$), yielding a median door to knife time of 150 minutes (131 vs 180). Determinants of a shorter door to knife time were lower GCS, higher ISS and E0 status. *Conclusions:* Our results show that more pressing emergencies were indeed treated faster. However, the median ER to OR door in a level 1 trauma center with 24h access to CT, OR and a trauma team leader in house could be improved. Strategies for improvement are proposed.

F08

Wait-times in spinal cord stimulation: trends, sources of delay, and impact on patient outcomes

SA Rizvi (Saskatoon) K Kumar (Regina) M Abbas (Edmonton)*

Background: Long-term spinal cord stimulation (SCS) success rates hover around 48-74%. SCS wait-times are inversely proportional to therapeutic success of this modality. This study analyzes sources of delay in the pathway for SCS treatment and offers suggestions for improvement. *Methods:* A retrospective analysis of 437 patients who received SCS. Delays to implantation at various time points from initial diagnosis, family physician and various specialist treatments, to implantation are examined. Analysis of variance and multiple regression analysis were performed to assess effect of demographic factors and treating specialty on implantation delay. *Results:* From time of onset of chronic pain to implantation, patients endured a mean delay of 65.4 months. Initial physician contact occurred at a mean of 3.4 months after development of pain syndrome. Family physicians managed cases for 11.9 months and various specialists for an additional 39.8 months. Neurosurgeons were quickest to refer to an implant physician while orthopedic surgeons and non-implanting anesthesiologists took the longest, contributing to wait-times of 51.60 months and 58.08 months, respectively. Once the decision for implantation was made, the implanting physician required 3.31 months to organize implantation. SCS wait-times have gradually declined since the 1980s. *Conclusions:* Current wait-times are detrimental to SCS outcomes. Timely institution of SCS should be incorporated into pain-management pathways.

F09

Novel outcome prediction models in aneurysmal subarachnoid hemorrhage derived from large cohorts of international patients

BN Jaja (Toronto) H Lingsma (Rotterdam) E Steyerberg (Rotterdam) RL Macdonald (Toronto)*

Background: Aneurysmal subarachnoid hemorrhage (SAH) is a cerebrovascular emergency. Currently, clinicians have limited tools to estimate outcomes early after hospitalization. We aimed to develop prediction models for clinical outcomes in patients with SAH using large cohorts of patients reflecting different settings. *Methods:* Prediction models were developed for mortality and unfavorable outcome according to 3-month Glasgow outcome score after SAH using readily obtained parameters at hospital admission. The development sample was derived from 10 prospective studies involving 10936 patients. Model performance was assessed by bootstrap internal validation and by cross validation by omission of each of the 10 studies using R2 statistic, AUC, and calibration plots. *Results:* Predictor variable with the strongest prognostic value was neurologic status (partial R2 = 12.03%), followed by age (1.91%), treatment modality (1.25%), Fisher grade of CT clot burden (0.65%), history of hypertension (0.37%), aneurysm size (0.12%) and aneurysm location (0.06%). These parameters were combined to develop 3 sets of hierarchical models. The AUC at bootstrap validation was 0.79-0.80, and at cross validation was 0.64-0.85. Calibration varied with case mix but was satisfactory in unselected hospital cohorts. *Conclusions:* Novel clinical prediction models in SAH showed adequate predictive ability. The models may require recalibration for clinical application in a different setting

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CANADIAN NEUROLOGICAL SCIENCES FEDERATION
FÉDÉRATION DES SCIENCES NEUROLOGIQUES DU CANADA

Congress Agenda as of April 30, 2014

TUESDAY, JUNE 3, 2014

8:30 AM to 4:30 PM	Resident Review	Neurosurgery - Spine
9:00 AM to 4:30 PM	Co-Developed Institute	MS Co-developed CNS and Biogen
9:00 AM to 12:00 PM	Courses	Chronic Migraine: OnabotulinumtoxinA Injection Workshop
1:30 PM to 4:30 PM	Courses	Headache
		Hot Topics in Epilepsy
6:00 PM to 8:00 PM	Special Interest Groups (SIGs)	Epilepsy Videos
		Neuromuscular
		Neurocritical Care
		An Evening of Movement Disorders – a Case Based Workshop
		Headache
		Neurosurgery SIG: Neuropathic Pain

WEDNESDAY, JUNE 4, 2014

8:00 AM to 10:30 AM	Grand Plenary	CNS - Richardson Lecture - *Lesley Fellow*s
		CACN - Tibbles Lecture - *Madeleine Grigg-Damberger*
		CSCN - Gloor Lecture - *Daniel H. Lowenstein*
		CNSS - Penfield Lecture - *Julian Bailes*
10:45 AM to 12:30 PM	SPC Chair's Select Abstracts	CACN, CNSS, CNS/ CSCN Abstract Presentations
12:30 PM to 2:00 PM	Learning Activities with Lunch	Lunch 'n Learn
		Concepts and Controversies in Parkinson's Disease Mngmt
		Lunch 'n Learn
		Understanding Alternate Therapeutic Approaches in MS
2:15 PM to 5:15 PM	Courses	Genetics of Neurologic and Neurodegenerative Syndromes
		Update on Sports-related Concussion
		Neurovascular & Interventional Neuroradiology
		Neuro Ophthalmology
		Neuromuscular
5:15 PM to 7:15 PM	Exhibitor's Reception	
7:30 PM to 9:30 PM	Residents' Social	

THURSDAY, JUNE 5, 2014

8:30 AM to 4:30 PM	Resident Review	Neurology - Neuro Ophthalmology
8:30 AM to 4:30 PM	Child Neurology (CACN) Day	Sleep Morning Session (8:30 am - 11:45 am)
		Sleep Afternoon Session Continued (1:30 pm - 4:30 pm)
	Neurophysiology (CSCN) Day	EEG (8:30 am - 11:30 am)
		Clinical functional MRI applications in epilepsy (1:30 pm - 4:30 pm)
	Neurology (CNS) Day	Stroke (8:30 am - 11:30 am)
		MS (1:30 pm - 4:30 pm)
	Neurosurgery (CNSS) Day	Endoscopy (8:30 am - 11:30 am)
		Difficult Cases & Controversies in Neuro-Oncology (1:30 pm - 4:30 pm)
11:45 AM to 1:15 PM	Lunch Time Activities	Lunch 'n Learn: Practical Financial Advice for Residents
4:45 PM to 6:00 PM	Digital Poster Author Standby Sessions	
7:00 PM to 11:00 PM	Networking BBQ	

FRIDAY, JUNE 6, 2014

9:00 AM to 11:30 AM	Concurrent Courses & Society Platforms	Understanding and Surviving the Treatment of Chronic Pain in your Neurologic Patients
		Dementia
		Brain Tumour Biology
		CNS/ CSCN Abstract Platform Presentations
		CNSS Abstract Platform Presentations
		CACN Abstract Platform Presentations
11:30 AM to 1:00 PM	Lunch Time Activities	Lunch in the Exhibit Hall
		Digital Poster Author Standby Sessions
1:00 PM to 3:00 PM	Grand Rounds	

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Poster Presentations

Child Neurology (Epilepsy and EEG)

P.001

Thalamic volume in focal malformations of cortical development

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Background: Malformations of cortical development (MCD) are seen in 20-25% of patients with focal epilepsy. There is considerable variability in the age of onset of epilepsy, intractability and cognitive outcome in children with malformations of cortical development. We examined the relationship between thalamic volumes, clinical and EEG findings in patients with focal MCDs. *Methods:* Patients with unilateral MCD, seizures, and available 1mm volumetric images were included. Images were reviewed by a neuroradiologist for confirmation and classification of MCD. Subcortical and cortical segmentation was performed using Freesurfer software. Thalamic volume differences between the affected and contralateral hemispheres were calculated. Clinical and EEG data were collected through a chart review. *Results:* 14 patients were included. Four had continuous spike and wave during sleep (CSWS). Multilobar MCDs were associated with thalamic volume asymmetry. There was no association between age of onset of epilepsy and thalamic asymmetry, however ipsilateral thalamic volume decreased as the sleep spike-wave index increased. This was not statistically significant. *Conclusions:* In this group of patients with unilateral MCD, age of seizure onset was not associated with thalamic asymmetry. Ipsilateral thalamic volume decreased as the sleep spike-wave index increased.

P.002

The clinical spectrum of treatment resistant epilepsy in children with SCN2A mutations: report of 4 additional cases

C Sanguansermsri (Vancouver) M Demos (Vancouver) C Van Karnebeek (Vancouver) M Patel (Vancouver) A Singh (Vancouver) W Wasswrman (Vancouver) C Shyr (Vancouver) E Roland (Vancouver) M Connolly (Vancouver)*

Background: SCN2A mutations are classically associated with benign familial neonatal infantile seizures (BFNIS) but there are rare reports of severe epilepsy syndromes. The purpose of this report is to describe 4 children with treatment resistant epilepsy and *de novo* SCN2A mutations. *Methods:* Patients were identified from the Epilepsy/Neurophysiology databases. The medical records, EEG and neuroimaging were reviewed. *Results:* 4 patients were identified. Age at seizure onset was in the neonatal period (n= 2), 8 months (n=1) and 3 years (n=1). All had focal seizures (3 multifocal) and focal EEG abnormalities. The neonatal onset group had the syndrome of migratory partial epilepsy of infancy (MPEI). They failed a median of 6 AEDs (5-10) and the ketogenic diet in one. One patient died at the age of 11 months, 2 have developmental delay/autism and one infant is developmentally normal at 3 months of age. MRI was normal at seizure onset in all. One developed cerebral atrophy and one cerebellar atrophy. Extensive metabolic investigations were negative. *De novo* SCN2A mutations were identified using whole exome sequencing or Epilepsy Gene Panel. *Conclusions:* SCN2A mutations can be associated with treatment resistant epilepsy including MPEI in the neonatal period. This report expands the electroclinical phenotype of SCN2A mutations and the importance of genetic testing in treatment resistant epilepsy.

P.003

SHANK3 deletion and hyaline astrocytic inclusions in a patient with intractable epilepsy and global developmental delay

SE Buerki (Vancouver) C Sanguansermsri (Vancouver) C Dunham (Vancouver) P Steinbok (Vancouver) M Connolly (Vancouver) M Demos (Vancouver)*

Background: Pediatric epilepsy with 'hyaline astrocytic inclusions' (HAI) is a clinicopathologic entity characterized by epilepsy and developmental delay. The cause is unknown. Patients with 22q13.3 deletion syndrome involving SHANK3 gene are characterized by variable dysmorphic features, global developmental delay/intellectual disability, absent to severely delayed speech, autism and epilepsy. To date, no association has been noted in the literature between SHANK 3 mutation and HAI. *Methods:* A boy with a SHANK3 deletion and hyaline astrocytic inclusions in brain resected for epilepsy surgery is described. *Results:* This 2-year-old boy presented with frontal lobe seizures and global delay at 6 months. Extensive investigations, including head MRI and metabolic testing, were negative. Chromosome microarray revealed a *de novo* 22q13.3 deletion including SHANK3 gene. Epilepsy surgery and invasive EEG monitoring were performed at age of 21 months for treatment resistant frontal lobe epilepsy. Neuropathological analysis of resected tissue revealed HAI. *Conclusions:* To our knowledge this is the first time an association between SHANK3 mutation and HAI has been noted. The clinicopathologic significance of HAI and any possible association with SHANK3 mutation is unclear, but may suggest a putative genetic underpinning of HAI.

Child Neurology (General Pediatric Neurology)

P.004

Effect of melatonin in neuro-developmentally disabled children with sleep disorders

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Background: The aim of the study is to assess the impact on sleep pattern of melatonin in neuro-developmentally disabled children and the safety of it. *Methods:* This cross-sectional study used a designed questionnaire about sleep pattern of the patients before and after melatonin use. Children with neuro-developmental disability who

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are taken melatonin in our center were included. *Results:* Total number of patients enrolled were 23 with mean age 5.83 ± 3.07 years. They consisted of 15 (65.22%) males and 8 (34.78%) females. The dose of melatonin was as following; 9 (39.93%) received 1 mg, 8 (34.78%) received 2 mg, 2 (8.70%) received over 3 mg. Seven (30.43%) received melatonin for 0-6 months, 7 (30.43%) received it for 7-12 months while 5 (21.7%) received it for over a year. Significant differences were seen in time taken to fall asleep (p-value = 0.046), number of times child woke up at night (p-value = 0.071), total sleep time within 24 hours (p-value = 0.011) and time taken to be wakeful (p-value = 0.007), while no significant difference was observed in number of naps during day time (p-value = 0.801). No major side effects were reported. *Conclusions:* Melatonin showed significant difference in total sleep time and the quality of sleep. The use of melatonin was safe and acceptable by the caregivers.

P.005

Neuro-ophthalmological features in children and adolescents with chronic ataxia

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Background: Chronic ataxia is caused by a multitude of disorders that may initially have similar or non-specific phenotype. Some of these disorders have associated neuro-ophthalmological signs (N-OS). Our aims were to describe the N-OS and their frequencies in general and by etiology in pediatric chronic ataxia. *Methods:* We identified 184 patients <17y with chronic ataxia (>2 months duration or recurrent) during 1991-2008 from multiple sources. Patients with tumors, isolated vestibular or peripheral nerve diseases were excluded. Diagnoses and N-OS were ascertained following charts review. *Results:* Mean age (SD) was 15(7.7)y. Median duration of follow-up was 6.4y. There were 214 N-OS in 115 patients (median=2, range=1-5 N-OS/patient). Strabismus was present in 29.3% of patients, nystagmus 27.7%, impaired smooth pursuit 23.4%, hypometric saccades 10.3%, decreased visual acuity 9.2%, and abnormal optic discs in 8.7% of patients. N-OS were reported commonly among patients with the following (commonest N-OS): Hypoxic-ischemic encephalopathy (strabismus), episodic ataxia (nystagmus), neuronal ceroid lipofuscinosis (abnormal optic discs), neuronal migration disorder (strabismus), ischemic stroke (nystagmus), Joubert syndrome (strabismus), Friedreich ataxia (hypometric saccades/impaired smooth pursuit/nystagmus), and mitochondrial disease (strabismus/nystagmus). *Conclusions:* N-OS occur commonly in pediatric chronic ataxia. Although non-specific, they vary with etiology thus potentially prioritizing the list of differential diagnoses.

P.006

Do the clinical features in infantile-onset saccade initiation delay (congenital ocular motor apraxia) correlate with brain MRI findings?

MS Salman (Winnipeg) KM Ikeda (London)*

Background: Infantile-onset saccade initiation delay (ISID) is a defect of saccade initiation. Brain MRI can be normal, show supra- or infratentorial abnormalities. Our aim was to correlate the clinical features of ISID with brain MRI findings. *Methods:* Detailed review of the English medical literature (1952-2012) revealed 67 studies with possible ISID. Patients without adequate information, brain MRI, and typical features of ISID were excluded. The remaining patients were divided into three MRI groups: Normal MRI (N=55), supratentorial abnormalities (N=17) and infratentorial abnormalities (N=19). The patients' clinical features including head thrusts' direction, smooth ocular pursuit, optokinetic response (OKR), tone, development, and coordination were compared and analyzed using Chi-Square test. *Results:* Horizontal head thrusts were significantly more common in patients with infratentorial abnormalities or normal MRI, while vertical head thrusts occurred mostly among patients with supratentorial abnormalities (p<0.0001). The OKR slow phases were significantly more likely to be impaired in patients with supra- or infratentorial abnormalities than patients with a normal brain MRI (p=0.011). Other clinical features were similar among the three MRI groups. *Conclusions:* The direction of head thrusts and the integrity of the OKR slow phases are useful clinical indicators of possible sites of abnormality on brain MRI in patients with ISID.

P.007

No cases of pediatric autoimmune neuropsychiatric disorder associated with streptococcal infection (PANDAS) on prospective follow-up of patients referred to a pediatric movement disorders clinic (2005-2012)

S Kilbertus (Ottawa) R Brannan (Ottawa) A Doja (Ottawa)*

Background: PANDAS is a controversial diagnosis in the medical literature and it is unclear how frequently it is encountered in clinical practice. *Methods:* This was a prospective study of 39 children who presented to a movement disorders clinic with acute onset tics or OCD that examined how many actually met criteria for PANDAS. *Results:* None of the 39 children who presented to us acutely met full criteria for PANDAS. 38% had no association between their symptoms and a group A beta-hemolytic streptococcal (GABHS) infection, while 54% had prior inconclusive laboratory testing done and no prospective exacerbations during the course of the study. Only 8% of patients prospectively had acute exacerbations, however prospective testing for GABHS in these patients was negative. *Conclusions:* Our results support the notion that PANDAS, if it exists, is an exceedingly rare diagnosis encountered in a pediatric movement disorder clinic.

P.008

Effect of rTMS and speech therapy on naming abilities in a dysphasic patient after childhood stroke

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Background: Childhood stroke causes expressive dysphasia, often after left inferior frontal gyrus (IFG) injury. Contralesional IFG repetitive transcranial magnetic stimulation (rTMS) with speech language therapy (SLT) may improve dysphasia in adult stroke but is untested in children. *Methods:* A 17-year-old, right-handed male sustained complete left MCA infarction 30 months prior with severe expressive dysphasia. He completed 10 days (20 hours) of intensive SLT. Inhibitory rTMS (1Hz, 1200 stimulations) was applied to contralesional IFG during the initial 20 minutes. Daily pre- and post-intervention Snodgrass Picture Naming (SPN) included novel and repeated words. Baseline and follow-up language fMRI, Boston

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Diagnostic Aphasia Examination (BDAE) and SPN were performed. *Results:* Initial IFG rTMS was uncomfortable but improved. Interventions were tolerated with no serious adverse events. A consistent increase in naming accuracy was observed from baseline (55%) to 1st week (58%) to post-treatment week (72%; r=0.63, p=<0.01). No correlation was seen between picture naming speed and treatment day (r=-.265, p=.234). BDAE scores also improved. Language fMRI suggested a shift in activations from right IFG to left perilesional frontal areas. *Conclusions:* Contralesional rTMS paired with SLT appears feasible in childhood stroke-induced dysphasia.

P.009

A case of pediatric spinal high-grade astrocytoma presenting as transverse myelitis

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Background: Transverse myelitis (TM) is an inflammatory lesion of the spinal cord. The diagnostic criteria, as defined by the 2002 AAN Transverse Myelitis Consortium working group, include evidence of spinal cord inflammation by an enhancing spinal cord lesion or of inflammation in the cerebrospinal fluid. TM may share some radiological features with spinal cord tumours, which may lead to misdiagnosis. *Methods:* Case report. *Results:* A 15-year-old boy presented progressive paraplegia and paresthesias with a defined sensory level, and sphincter dysfunction. Initial MRI suggested TM with a mildly enhancing lesion from levels C7 to D8. Lumbar puncture was not performed due to the presence of peri-lesional oedema. Methylprednisone was initially administered. Cyclophosphamide, pheresis, and rituximab were subsequently tried because of a clinical deterioration without change on the control MRI. A third MRI, done two months after the onset of symptoms, showed a net progression of the lesion without enhancement. This lesion was then suggestive of an astrocytoma and this etiology was confirmed histopathologically. The patient passed away 3 months after the onset of symptoms. *Conclusions:* This case shows the importance of reconsidering a diagnosis of TM when there is an unfavourable evolution, even if the initial presentation and imaging are strongly suggestive of this pathology.

P.010

CSF neurotransmitter metabolites in pediatric neurology patients; a ten year review

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Background: With the prospect of employing Cerebrospinal Fluid investigations to delineate neurometabolic disorders, we sought to record phenotypic descriptors and incidence rate of patients presenting with abnormal neurotransmitter levels. *Methods:* Retrospective data collection from patients with abnormal neurotransmitter metabolite levels, assayed via CSF, seen at this facility over a 10 year period. *Results:* Of 607 CSF assays performed, 124 patients reviewed displayed abnormal neurotransmitter metabolite levels. 76 with low HVA, 60 with low 5-HIAA, and 20 patients with low 5-MTHF. Low individual metabolites: HVA only n=65, HIAA only n=31, MTHF only n=28. All assayed metabolites low n=5. Patients with an etiologic diagnosis n=32, with a semiotic diagnosis n=61. Seizures were reported in n=70. Abnormal MRi results reported in n=65. *Conclusions:* The results of our data show that the incidence of primary neurotransmitter disorders was n=7 (5.6%), however frequency of secondary neurotransmitter changes is much higher. In a number of these secondary cases we applied neurotransmitter supplementation with positive outcome. Overall, we suggest that at least a trial of NT replacement therapy is valuable for symptom management in patients with known or unknown primary diagnoses and secondary NT deficiencies. Additionally, the expansion of criteria for NT investigation may increase predictive value of the investigation.

P.011

Placental pathology and arterial perinatal stroke

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Background: Perinatal stroke causes most hemiparetic cerebral palsy (CP) but pathophysiology is mostly unknown. Placental disease leading to cerebral embolism is a suspected cause but pathological proof is limited. *Methods:* The population-based Canadian CP registry (CCPR) enrolls pre-school aged children across 13 Canadian centres. Over 150 variables include imaging and placental pathology reports. Data current to June 2013 was extracted. Imaging classified definitive and probable stroke cases with subclassification as arterial or venous. Placental pathology was described in accordance with standard classifications *Results:* Of 1168 children (57% male, median 42±23mos), 28% had hemiparetic CP. Definitive perinatal stroke was common (158, 49%) compared to non-stroke (109, 34%) and 67% were arterial (33% venous). A total of 24 strokes had placental pathology results available (20 arterial). Abnormal placental pathology was present in 22 cases (91%) of definite strokes and 4 cases (80%) of presumed strokes. Within the 18 arterial cases, 17(94%) were abnormal. The most common abnormality was placental infarct or thrombosis (10, 34%). Another 8 cases (31%) described villitis, chorioamnionitis, fibrin deposition or calcification. *Conclusions:* Placental pathology is common in arterial perinatal stroke. Prospective tissue banking and biomarker studies are required to improve understanding if prevention strategies are to be developed.

P.012

The old argument: should we biopsy? New insights in pediatric CNS vasculitis

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Background: Determining the etiology of encephalopathy in children is often challenging and early identification of treatable disorders is important. This study explores the diagnostic utility of brain biopsy in children with encephalopathy. *Methods:* All children who underwent a brain biopsy with a diagnosis of encephalopathy between 1997 and 2013 at BC Children's Hospital were included. The pathology of all biopsies was reviewed by a Pediatric Neuropathologist. *Results:* 16 children underwent brain biopsy. On initial pathological examination, 4/13 (31%) of biopsies demonstrated findings consistent with small vessel childhood

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primary angiitis of the central nervous system (SVcPACNS). After pathologic criteria-driven review, 9/13 (70%) of biopsy specimens demonstrated findings consistent with SVcPACNS. Children with small vessel vasculitis were significantly more likely to present with focal neurological findings. 56% of brain biopsies resulting in SVcPACNS diagnosis had no corresponding imaging abnormalities. Overall, children with SVcPACNS had better outcomes. *Conclusions:* Brain biopsies in children with encephalopathy were useful in establishing the diagnosis of SVcPACNS. Pathologic criteria that arrive at this diagnosis will be highlighted. Brain biopsy remains an important diagnostic tool in children with encephalopathy of unclear etiology. If the clinical history is suggestive of SVcPACNS, brain biopsy might be indicated regardless of lack of imaging abnormalities.

NEUROLOGY (EPILEPSY AND EEG)

P.013

A systematic review of NMDA antagonists for refractory seizures

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Background: Refractory status epilepticus has recently been treated using NMDA receptor antagonists. Our goal was to perform a systematic review of the use of these medication in seizure patients. *Methods:* Articles from MEDLINE, Biosis, EMBASE, Global Health, HealthStar, Scopus, Cochrane Library, the International Clinical Trials Registry Platform (inception to September 2013), reference lists of relevant articles, and gray literature were included. Two reviewers identified all manuscripts on the administration of NMDA receptor antagonists in refractory seizures. Two reviewers independently extracted data. The strength of evidence was adjudicated using the Oxford and GRADE methodology. *Results:* Our search strategy produced a total 759 citations. Twenty-three articles, 16 manuscripts and 7 meeting proceedings, were considered for the review with all utilizing ketamine for seizure control. Only three studies were prospective studies. Fifteen and 9 studies pertained to adults and pediatrics respectively. Across all studies, of the 110 adult patients described, ketamine was attributed to electroencephalogram (EEG) seizure response in 56.5%, with a 63.5% response in the 52 pediatric patients described. Adverse events related to ketamine were rare and outcomes were poorly documented. *Conclusions:* There exists Oxford level 4, GRADE C evidence to support the use of ketamine for refractory seizures in the adult and pediatric populations. Further prospective study of early ketamine administration is warranted.

P.014

Hippocampal changes in refractory status epilepticus

KM Ikeda (London) L Ang (London) G Young (London)*

Background: While the hippocampus shows selective vulnerability in refractory status epilepticus (RSE), the pathological spectrum of changes has not been fully addressed. *Methods:* Review of 5 autopsied cases of RSE included clinical features, EEG and MRI findings. Hippocampi were stained with H&E, GFAP and HLA-DR. *Results:* Four cases had new onset RSE (NORSE) without obvious clinical etiology in any of the cases. Prominent astrogliosis was found in CA4 and granule layer in 3/5 cases. Two other cases showed prominent astrogliosis in CA1: one with early hippocampal sclerosis, the other acute neuronal necrosis. Clasmatodendrosis was evident in all cases. There was increased staining with HLA-DR in areas most prominently affected with astrogliosis. *Conclusions:* This study demonstrates prominent involvement of CA4 and granule layer of the hippocampus. This differs from previous findings of seizure-related damage occurring primarily in CA1. Clasmatodendrosis, reported in rat models of status epilepticus, was found in all cases. This suggests hippocampal damage in RSE may be due to factors other than ischemia. The increased staining of HLA-DR may represent an inflammatory response, but whether this is primary and potentially etiological, or secondary is unknown.

P.015

A validation of the new definition of drug resistant epilepsy by the International League Against Epilepsy

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Background: Our objective was to validate the 2010 International League Against Epilepsy's (ILAE) definition of Drug Resistant Epilepsy (DRE) *Methods:* The validation of the definition of DRE by the ILAE was performed in two phases. The first phase we assessed the reliability and validity of the definition. In the second phase the definition was applied to a large cohort of patients from an epilepsy center. We used three definitions to validate the definition of the ILAE (Berg, Kwan and Brodie and Camfield and Camfield definitions) *Results:* The inter-observer agreement of the definitions was as follows: Berg (0.56), Kwan and Brodie (0.58), Camfield and Camfield's (0.69) and for the definition of the ILAE was 0.77. The intra observer agreement of the four definitions was as follows: Berg (0.81), Kwan and Brodie (0.82), Camfield and Camfield (0.72), for the definition of the ILAE was 0.82. The prevalence of DRE with the Berg's definition was 28.4%, Kwan and Brodie 34%, Camfield and Camfield 37%, and with the definition of ILAE was 33%. *Conclusions:* This is the first study that shows that the definition of DRE released by the ILAE is valid and reliable. Future studies are required using the definition in other settings and other methodologies.

P.016

The hippocampus participates in a pharmacological rat model of absence seizures

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Background: Spike-and-wave discharges (SWDs) in absence epilepsy are generated within the thalamocortical network. We hypothesized that the neural activity of the hippocampus becomes entrained in SWDs in a model of absence seizures. *Methods:* Absence seizures in rats were induced by injection of 200mg/kg (i.p.) gamma butyrolactone (GBL). Local field potentials were recorded by chronically implanted depth electrodes in the neocortex (frontal, parietal, visual), ventrolateral thalamus and dorsal hippocampal CA1 area. In a separate experiment, multiple unit recordings were made at the hippocampal CA1 pyramidal cell layer.

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Results: As SWDs developed following GBL injection, there was a statistically significant increase in coherence at 4 to 6 Hz in pairs of electrodes that involved the hippocampus. Multiple unit recordings at the CA1 cell layer indicated that the probability of neuronal firing was significantly increased at 60 to 200 ms prior to the negative peak of thalamic SWDs. *Conclusions:* During SWDs, the local field potential of the hippocampus was shown to be synchronous with the thalamus and neocortex. Hippocampal CA1 spiking preceded thalamic SWDs by 60 to 200 ms, which may further influence thalamocortical SWDs. Involvement of the hippocampus in absence seizures may have implications in the variability of cognitive and memory deficits in patients with absence seizures and absence status epilepticus.

P.017

Health related behaviors and comorbidity in people with epilepsy: changes in the past decade

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Background: Epilepsy is associated with negative health-related behaviors (HRBs), including smoking and poor participation in physical activity compared to the general population. It is unknown whether these HRBs have improved over time, and if potential changes in HRBs have impacted the prevalence of comorbidities. We aimed to explore estimates of HRBs and comorbidities in persons with epilepsy (PWE) over time. *Methods:* We used five cycles (2001-2011) of the Canadian Community Health Survey to estimate the proportions and odds ratios for HRBs and comorbidities in PWE over the 10-year period. Precision was assessed using 95% confidence intervals. *Results:* The study included 522,722 participants (3,220 PWE). The proportion of PWE who did not participate in physical activity decreased linearly over time (2001=17.2%, 2010/2011=8.5%), as did the proportion of PWE who smoked cigarettes (2001=32.3%, 2010/2011=18.0%). An apparent reduction in the prevalence of heart disease occurred in PWE (2001=11.7%, 2010/2011=4.0%), but not in those without epilepsy; however a similar trend was not noted for other cardiovascular risk factors or comorbidities in PWE. *Conclusions:* Apparent improvements in smoking cessation and physical activity occurred in PWE. Further exploration into the reasons for the apparent decrease in the prevalence of heart disease in PWE is warranted.

P.018

Is rapid withdrawal of anti-epileptic drug therapy during video EEG monitoring safe and efficacious?

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Background: Video electroencephalographic monitoring (VEM) is used to record ictal and interictal epileptiform activity and to ascertain the level of concordance between the two. Often, taper or discontinuation of antiepileptic (AED) therapy is needed to facilitate seizure occurrence. The safety of this practice is unclear and long-term sequelae have yet to be elucidated. *Methods:* A prospective study of 158 patients subjected to combined sleep-deprived VEM with rapid AED withdrawal for evaluation of seizure-like episodes over 24 months under the care of an epileptologist with direct nursing observation and EEG technician support in our telemetry unit. In most cases, AEDs were discontinued within 24 hours of admission. We assessed diagnostic yield and safety of VEM as well as epilepsy surgery outcomes. *Results:* VEM answered the study question in 90.5% of cases but failed to record ictal events in 9.5%. This diagnostic yield was achieved over a mean VEM duration of 4.53±1.44 days, with no benefit of longer monitoring. Overall, 32.9% of the cohort received epilepsy surgery. The complication rate was 5.06%, characterized largely by musculoskeletal pain secondary to clinical seizure activity, with no mortality observed. *Conclusions:* VEM with protocolized rapid AED withdrawal is safe and effective. It is a reliable strategy for therapeutic planning and can be used to determine candidacy for surgical treatment.

P.019

How canonical is canonical? Examining the BOLD response to interictal discharges at the epileptogenic site using intracranial EEG-fMRI

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Background: Simultaneous EEG-functional MRI (EEG-fMRI) is a well-established technique for imaging the Blood-Oxygen-Level Dependent (BOLD) response associated with interictal epileptiform discharges (IEDs). Essential to this analysis is application of the hemodynamic response function (HRF), which quantifies BOLD signal changes in response to neural events. The standard HRF was originally derived from an auditory response task performed on healthy subjects. However, it is not know if the HRF is truly generalizable to all tasks. Therefore, we quantified the BOLD signal changes associated with intracranial EEG-fMRI (iEEG-fMRI) IEDs recorded directly from the epileptogenic source. *Methods:* Nine subjects undergoing intracranial video-EEG monitoring underwent simultaneous iEEG-fMRI at 3T. Epileptiform discharges that were isolated 3s prior, and 10s post-spike were identified. Regions of interest encompassing 50 voxels nearest to the active electrode were created. BOLD signal changes for isolated spikes were averaged to generate HRFs characteristic of each subject. *Results:* Seven to 23 IEDs were identified for each subject. BOLD responses recorded from the epileptogenic tissue showed a later time-to-peak, ranging from 7.5-10s, compared to 4-6s for the standard HRF. *Conclusions:* The HRF associated with IEDs recorded intracranially has a longer time-to-peak than the canonical HRF. These results imply that epileptic discharges may generate BOLD signal changes unique from other neural events.

P.021

Co-localization of interictal discharges and BOLD signal examined with simultaneous intracranial EEG-fMRI

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Background: Electroencephalography (EEG) is the key tool used to localize seizure foci prior to epilepsy surgery. Advances in functional neuroimaging provide an opportunity to improve this. Functional MRI (fMRI) has been successfully combined with EEG to localize changes in brain activity associated with epileptiform discharges. Intracranial EEG (iEEG) can accurately record activity

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too small or too deep to be seen on scalp EEG. This project was designed to assess the co-localization of the fMRI Blood-Oxygen-Level-Dependent (BOLD) signal to focal iEEG discharges. *Methods:* Twelve patients undergoing intracranial video-EEG monitoring underwent simultaneous iEEG-fMRI at 3T. Epileptiform discharges were identified and used to generate parametric maps of BOLD signal changes. The location of the maximal BOLD response and interictal discharge location were then compared. *Results:* Twelve patients completed the iEEG-fMRI studies without incident. Three studies were excluded due to excessive artefacts, and one patient had independent bitemporal discharges, leaving 10 studies for analysis. The BOLD responses co-localized with spike location in 9/10 analyses (90%). *Conclusions:* This study showed that iEEG-fMRI could be safely performed at our centre with high (90%) concordance between epileptic spikes and BOLD responses. This opens a new avenue for better understanding of the hemodynamics of epileptogenic activity, and may provide a technique for improved seizure focus localization.

P.022

Correlates of suicidal ideation in persons with epilepsy

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Background: Epilepsy is associated with suicide. Understanding correlates of suicidal ideation (SI) could help clinicians prevent suicide in persons with epilepsy (PWE). We explore correlates of SI in PWE. *Methods:* 300 consecutive PWE were approached to complete a questionnaire including socio-demographics, the Patient Health Questionnaire-brief (PHQ-9), and a quality-of-life scale (12-item Short Form Survey; SF-12). Participants completed the Structured Clinical Interview for DSM-IV (SCID, psychiatric interview) within 2 weeks of enrolment. Univariate analyses are presented below (significance = $p<0.05$). *Results:* Of the 268 PWE who participated in the study, 185 completed the SCID. SI (PHQ-9) was endorsed by 12.4% of participants for at least "several" days during the preceding 2 weeks. Factors associated with SI included: older age of seizure onset, currently smoking, and having clinically significant symptoms of anxiety. SI was not associated with employment status, medication use, or alcohol consumption. PWE with SI had greater odds of being currently depressed, reporting severe epilepsy, and having lower scores on the mental component of the quality-of-life scale compared to PWE without SI. *Conclusions:* We found correlates of SI in PWE which may assist clinicians in identifying those at elevated risk of suicide, thereby facilitating prevention.

P.023

Interictal localization of the seizure onset zone using high frequency oscillations and visibility graphs

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Background: High frequency oscillations (HFOs, 80-250Hz) are hypothesized to reflect increases in neural synchrony. In focal epilepsies, this increase is pathological, and localized to the seizure onset zone (SOZ). Interictal HFOs have been proposed as a surrogate marker for SOZ identification. Recently, the graph index complexity (GIC) of visibility graphs (VG) has been introduced as a measure of HFOs, and has been shown to increase ictally at the SOZ. However, the properties of the GIC have yet to be investigated interictally. *Methods:* Interictal intracranial electroencephalograms of 5 patients with focal epilepsy were analyzed during slow-wave sleep. Bipolar data were filtered (80-250Hz), normalized, and labelled for HFOs. VGs were constructed from 1 second epochs of the original data, and quantified as a time-series of GIC values. The electrodes within the SOZ were identified clinically. The GIC standard deviation (SD) and ripples/minute (RM) for all electrodes within and without the SOZ were calculated for each patient. *Results:* The RM and GIC-SD values were significantly greater for channels within the SOZ than without, in all patients ($p = 0.0312$; Wilcoxon signed-rank test). *Conclusions:* Both markers of high-frequency oscillatory activity convey information that may be useful in the localization of the seizure onset zone in patients with focal epilepsy.

P.024

Epileptic coprolalia

*A Massot Tarrus (London) C Dove (London) D Diosy (London) R McLachlan (London) JG Burneo (London) SM Mirsattari (London)**

Background: Several hypotheses attempted to implicate striatum and limbic system in effective motor behaviour including coprolalia in Tourette Syndrome. However, only three English language case reports of epilepsy with ictal coprolalia have been published with inconclusive localization. *Methods:* A retrospective chart review of seven patients with ictal coprolalia was done. Patients were compared with regards to demographics, etiology, seizure semiology, video-EEG findings, neuroimaging, and response to treatment. *Results:* 4 women and 3 men were analyzed. Mean age at seizure onset was 19.2 years (range 14-27). All had medically refractory focal epilepsy and complex partial seizures. 6/7 also had secondary generalized seizures. Continuous scalp video-EEG was available for all and subdural/depths EEG recordings for 6/7 patients. Seizures were orbito-frontal or temporal in origin without consistent lateralization. Coprolalia was never the first manifestation of seizure and was associated with local or bilateral spreading of the activity mainly from the right hemisphere. Three patients had an underlying ganglioglioma, one meningioma, one mesial sclerosis, and three had normal cranial MRI. Four underwent lesionectomy or left anterior temporal lobectomy, all them with Engle class I outcome. *Conclusions:* We hypothesize that ictal coprolalia is indicative of seizure propagation to the limbic system without lateralizing value.

P.025

Intravenous versus non-intravenous benzodiazepines for the abortion of seizures: a systematic review and meta-analysis of randomized controlled trials

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Background: Status epilepticus is a neurological emergency. Delays in treatment cause increased pharmacoresistance and worse outcomes. Difficulties in intravenous (IV) access are a frequent cause of delayed treatment. We assess whether the delay imposed by

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IV access is justified by improved outcomes. We compared IV vs Non-IV benzodiazepine(BDZ) efficacy with regards to failure rates (primary outcome), interval to seizure control and observed complications (secondary outcomes). *Methods:* We conducted a systematic review using MEDLINE, Embase and the Cochrane Library. Only randomized and quasi-randomized controlled trials were included. *Results:* Upon review of 2542 citations, 10 studies were deemed suitable for qualitative synthesis and 9 for quantitative analysis. For treatment failure, non-IV BDZ was non-inferior to IV BDZ (Odd ratio [OR] = 0.76; 95% confidence interval [CI] = 0.55 to 1.05). Non-IV BDZ was administered faster and therefore controlled seizures faster (mean difference = 3.44 minutes; 95% CI = 1.55 to 5.32 minutes) despite a delayed onset of action (mean difference = 0.65 minutes; 95% CI = 0.42-0.89 minutes. Respiratory complications requiring intervention were similar regardless of administration route. *Conclusions:* This is the first Meta-analysis to show that non-IV BDZ, compared to IV BDZ, abort seizures faster with a similar efficacy and side effect profile. Higher quality studies and further evaluation in adults are warranted.

P.027

Contralateral hippocampal atrophy following temporal lobe surgery for epilepsy

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Background: Medically refractory Mesial Temporal Lobe Epilepsy (MTLE) with hippocampal sclerosis can be treated with anterior temporal lobectomy (ATL) or selective amygdalo-hippocampectomy (SAH). We hypothesized that MTLE surgery leads to contralateral hippocampal atrophy due to loss of hippocampal-hippocampal connections. *Methods:* Serial, 1.5T, T1-weighted MRI scans were acquired in six MTLE patients treated with ATL (n=2) or SAH (n=4), and three controls. Patients were imaged preoperatively and on post-operative day (POD) #1, 2, 3, 6, 30, and 60; controls were scanned at identical intervals. Hippocampal body volume (HBV) was measured at all time points by a blinded observer by manual segmentation using an in-house protocol. *Results:* In the surgery group, repeated measures ANOVA revealed a statistically significant decrease ($p<0.05$, Bonferroni post hoc) in mean HBV from baseline (1262.1 mm3 +/- 131) to POD 6 (937.2 mm3 +/- 106) and POD 60 (955.1 mm3 +/- 171), but no statistically significant interval atrophy between POD 6 and 60. By contrast, in the control group, there was no significant change from baseline (1229.5 mm3 +/- 152) at either day 6 (1241.8 mm3 +/- 167) or day 60 (1248.8 mm3 +/- 159). *Conclusions:* MTLE patients treated with ATL or SAH experience a significant decrease in contralateral HBV within the first post-operative week which persists at 2 months after surgery.

P.028

Treatment choice and outcome in elderly patients with epilepsy: a retrospective cohort study

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Background: Few studies are available to guide the clinician treating elderly patients with epilepsy. There are concerns regarding the side effects and interactions of phenobarbital and phenytoin in this population. A significant increase in the use of newer antiepileptic drugs has been documented for Veterans Health Administration patients between 2002 and 2006. *Methods:* We conducted a retrospective cohort study at our tertiary care center to assess the treatment of patients aged 65 and older with new-onset epilepsy. Patients started on antiepileptic drugs considered suboptimal (phenytoin, phenobarbital, and primidone) and optimal were compared regarding treatment failure (change in medication or recurrence of seizures). *Results:* There was a significant reduction in the proportion of patients (n=322) started on a suboptimal drug between years 2001-2005 (78.1%) and 2006-2010 (47.3%), mainly explained by a reduction in phenytoin use and a rise in levetiracetam use. The two categories of antiepileptic drugs were not different in terms of treatment failure. However, a post-hoc analysis of individual drugs revealed a significant difference between lamotrigine and carbamazepine. *Conclusions:* Medications received by elderly patients with new-onset epilepsy were more appropriate in view of expert recommendations in the second half of the 2001-2010 decade. However, an association between optimal drugs and a better outcome was not found.

P.029

Seizure prognosis in Angelman (Happy Puppet) syndrome in adulthood

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Background: Angelman syndrome is a neurogenetic disorder caused by lack of UBE3A gene expression due to 15q11-q13 abnormalities in maternally inherited chromosome 15. Along with developmental delay and a specific “happy” demeanour, 90% have early-childhood onset epilepsy. Prognosis into adult life has rarely been reported. *Methods:* We searched our adult epilepsy database for patients with genetically confirmed Angelman syndrome. Clinical features were analyzed. *Results:* Two patients met inclusion criteria. Both reside in group homes, are nonverbal and have unsteady gait but are always smiling. A 50-year-old woman had convulsive febrile and afebrile status epilepticus at age 2 and 3 years, respectively. She is seizure free on low dose phenobarbital since childhood. EEG is normal. A 57-year-old woman has refractory epilepsy since age 3 years. She has had febrile and afebrile generalized tonic-clonic seizures, drop attacks and recurrent prolonged atypical absence status; the latter requires frequent hospital treatment. EEG shows diffuse slowing with multifocal and generalized spikes and waves. *Conclusions:* Epilepsy outcome in adults with Angelman syndrome is quite variable. To our knowledge, the second patient is the oldest with Angelman syndrome and epilepsy in the literature.

P.030

Benign temporal lobe epilepsy

AA AlQassmi (London) S Mirsattari (London) R Maclachlan (London)*

Background: Benign mesial temporal lobe epilepsy (bTLE) is often not well recognized. It requires at least 24 months of seizure freedom with or without antiepileptic medication. Seizure onset tends to be in adolescence or adulthood, and 40% show evidence of hippocampal sclerosis in long standing bTLE. *Methods:* We describe

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the clinical features of a benign form of temporal lobe epilepsy of 27 patients (8 Males). The mean age was 32.2 years (range 28-80), and the follow-up period exceeded 2 years. Neurological examinations were performed at every follow-up visit (4-12 months). All patients had at least 2 EEGs and a MRI. *Results:* All patients had a mild epileptic disorder and achieved seizure freedom at onset of treatment, which persisted for at least 24 months. Sixteen patients (59%) had MTS, 79% had significantly older age at onset, and two patients (8%) had early onset, age of 15 and 19 years and one of them presented with focal febrile seizure earlier, then had dyscogntive seizure later was control with tegretol. In three patients, we attempted discontinuation of AEDs after a long period of remission (5-8 years), but all had recurrence of seizure within 2 to 4 weeks. *Conclusions:* Not all temporal lobe epilepsy, even with MTS, is refractory to medication. Lifelong treatment is advocated.

NEUROLOGY (GENERAL NEUROLOGY)

P.032

Vitamin D and healthcare utilization during long-term treatment with fingolimod in relapsing-remitting multiple sclerosis: PASSAGE world-wide Post-Approval Safety program

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Background: PASSAGE is a prospective, multinational study to evaluate long-term (>5 years) safety in relapsing MS patients newly started with fingolimod or receiving another disease-modifying therapy (DMT) in routine medical practice. *Methods:* The parallel-cohort study will compare patients treated with fingolimod or another DMT. Canadian sub-studies will assess the relationship between serum 25(OH)D levels (including dosage) and disease activity in both treated cohorts, and the effect of fingolimod on healthcare resource utilization (e.g. steroid use, hospitalizations). Patient-reported outcomes will include disability, health-related quality of life and productivity. *Results:* At last data cut-off, 470 MS patients (mean age 41.5 years) on fingolimod and 133 patients on another DMT were enrolled in 8 countries. For the fingolimod cohort, mean duration of MS was 12.3 years. Mean of 1.0 relapse in the year prior to study entry. Mean baseline EDSS score was 3.2. SAEs were reported in 4.1% and bradycardia in 2.3% of patients. *Conclusions:* PASSAGE is the first and only prospective, long-term, post-approval study of a large patient cohort that will provide longitudinal data on clinical outcomes, concurrently obtained, for all approved medications used to treat relapsing MS. Results will provide important insights on the use of fingolimod in real-world clinical practice.

P.033

Real-life patient adherence and follow-up monitoring with fingolimod

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Background: Fingolimod is approved to treat RRMS in Canada. The Gilenya* Go Program(TM) provides patient support services and coordination of follow-up monitoring, including an eye exam 3-4 months post first dose (PFD). *Methods:* Data were analyzed for Gilenya* Go Program(TM) participants from March 2011 to October 2013 to determine the patient continuation rate and adherence to monitoring requirements. *Results:* 1700 patients (mean age 43 years) were being actively treated and 289 had withdrawn at data cut-off. Overall continuation was 85.5%. There were 12 discontinuations at first dose (0.6%); reasons were AV block (n=5; 0.25%), bradycardia (n=3), unspecified cardiac (n=1), migraine (n=1), itchiness (n=1) and drug interaction (n=1). The most common AEs associated with discontinuation PFD were low serum lymphocyte count (n=21), worsening MS symptoms (n=13), and headache/migraine (n=12). A total of 96.6% of patients had the required eye exam within 135 days PFD; 3.5% completed the exam thereafter. The incidence of macular edema was 0.35% (n=7). *Conclusions:* • Oral fingolimod is very well tolerated • >85% of patients continue on fingolimod • With the Gilenya* Go Program(TM), we observe a high rate of adherence to monitoring requirements for fingolimod. *Gilenya is a registered trademark.

P.034

Perfusion MRI characteristics of tumefactive demyelinating lesions

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Background: Tumefactive demyelinating lesions (TDLs) are demyelinating plaques >20 mm that may be associated with mass effect and/or gadolinium enhancement. Solitary TDLs present a diagnostic challenge as conventional MRI appearance is similar to a neoplastic lesion. Perfusion MRI may provide a non-invasive means of differentiating TDLs from neoplasms. *Methods:* A retrospective chart review was performed of all patients between July 2010 and July 2013 with a TDL or high grade glioma (HGG) imaged using perfusion MRI at the Halifax Infirmary. Lesion relative cerebral blood flow (rCBF) and relative cerebral blood volume (rCBV) were calculated as a ratio to contralateral normal appearing white matter. Student's t-test was used to compare perfusion characteristics. *Results:* Perfusion MRI was performed for three patients with a TDL (male:female-2:1; mean 40.3 years) and six patients with a HGG (male:female-5:1; mean 57.2 years). Maximum lesion diameter was similar between TDLs and HGG (mean 43.3 ± 38.5 mm versus 69.0 ± 31.5 mm; t=-1.1, p=0.3). TDLs had significantly lower rCBF (t=-3.2, p<0.02) and rCBV (t=-3.9, p<0.01) compared to HGG. *Conclusions:* TDLs have significantly lower rCBF and rCBV than HGG on perfusion MRI. Perfusion MRI may be a useful tool in differentiating TDLs from neoplasms.

P.035

Predictors of cognitive decline in a rural and remote Saskatchewan population with Alzheimer's Disease

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Background: To investigate predictors of cognitive decline, we examined the association between cognitive change over one year and socio-demographic, clinical, and functional data at diagnosis in a rural and remote Saskatchewan population with Alzheimer's disease. *Methods:* Independent variables included socio-demographic, clinical, and functional information collected through questionnaires and assessments administered at diagnosis. The

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dependent variable was the difference between MMSE score at one year follow-up visit and MMSE score at initial visit. Variables underwent bivariate linear regression analysis. All associated variables then underwent multiple regression analysis to determine predictors of cognitive decline. *Results:* Our sample included 72 (66.7% female) patients with AD. Mean age at clinic day appointment was 75.3 (SD=7.44). We found that female gender, poor Bristol Activities of Daily Living score, and history of hypertension were significantly associated with a greater decline in MMSE score at one year. *Conclusions:* Female gender, decreased ability to carry out activities of daily living, and history of hypertension predicted greater cognitive decline at one year. Many previously suggested predictors of cognitive decline were not found to be predictors in this study suggesting that predictors may vary between populations. Additional research is required in this field to identify clinically useful predictors of decline and interactions between them.

P.036

Progressive multifocal leukoencephalopathy mimicking ALS in an immunocompetent patient

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Background: Progressive Multifocal Leukoencephalopathy (PML) is a rare CNS demyelinating disease caused by the JC virus and almost exclusively seen in immunocompromised patients. *Methods:* Case report of PML in an immunocompetent individual. *Results:* An 83-year-old, right-handed female with no immunocompromise presented with progressive weakness of both legs and left arm. Examination demonstrated triplegia involving the left arm and both legs with spastic tone, brisk reflexes and upgoing toes. Extensive laboratory investigations revealed a positive ANA and isolated lymphopenia. Brain MRI demonstrated T2 hyperintensities with gadolinium enhancement involving both frontoparietal lobes. EMG/NCS showed decreased motor amplitudes. Brain biopsy was consistent with PML. The patient developed focal seizures that were easily treated. Her PML was treated with mefloquine and mirtazapine. At 4-month follow-up, she made slight clinical and radiological improvements. *Conclusions:* PML is rarely seen in immunocompetent individuals. However, there are reports of PML in elderly patients whose only risk factor is age. Isolated lymphopenia is non-specific and although reported with PML, is of unclear significance. Mefloquine and mirtazapine have been reported with varying success in treating PML. Contrast enhancement, as seen here, may indicate an inflammatory variant and denotes favourable prognosis. This case demonstrates PML in an elderly, otherwise immunocompetent patient, in whom mefloquine and mirtazapine provided disease stabilization.

P.037

The prescription patterns and adherence of disease-modifying drugs for Multiple Sclerosis in Saskatchewan 1997-2013

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Background: The disease modifying drugs (DMDs) for Multiple Sclerosis were approved as a benefit by the Provincial Drug Plan under Exception Drug Status, Department of Health, Saskatchewan, in November 1997. It is estimated that thirty to forty percent discontinue treatment within two years. The objective is to compare the prescription patterns and adherence of four approved DMD's. *Methods:* A prospective database and cohort analysis of all applications eligible for drug prescriptions was maintained 16 years. Descriptive analysis was performed after November 15th 2013 using SPSS v21. *Results:* There were 1565 eligible prescriptions, including Avonex 168 (10.7%), Betaseron 355 (22.7%), Copaxone 723 (46.2%), and Rebif 318 (20.3%). 1409 (90%) started a drug. Currently 546 (34.9%) remain on the initial prescription including Avonex 52 (30.9%), Betaseron 83 (23.4%), Copaxone 293 (40.5%), and Rebif 118 (37.1%), the latter two drugs showing a higher adherence rate. 863 discontinued and 156 never started. 565 persons were prescribed 2-5 drugs. 796 (50.9%) continue treatment including 250 persons who switched. *Conclusions:* The adherence on DMD treatments is low, even after changing treatments. Further study is warranted to understand the factors which impact drug utilization in Multiple Sclerosis.

P.038

An unusually rapid progression to familial Creutzfeldt-Jakob disease

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Background: We report a case of familial Creutzfeldt-Jakob disease (fCJD) presenting with severe cognitive decline leading to rapid death within only 4 week of symptom onset. *Methods:* Case Report *Results:* A previously healthy 49-year-old Chilean woman, with two first-degree relatives suspected to have died from CJD in Chile, presented with a 2 week history of progressive emotional lability and visual hallucinations. She also reported intermittent diplopia, deterioration in gait, and rapid cognitive decline. Physical examination identified slow scanning speech and motor impersistence. Reflexes were diffusely brisk and she had postural tremors of the upper limbs. Basic metabolic panel and autoimmune testing was unremarkable. Lumbar puncture revealed normal cells and chemistry, with positive 14-3-3 protein and elevated hyperphosphorylated-tau. EEG showed triphasic waves and diffuse slowing. MRI showed diffusion restriction in the caudate and putamen bilaterally, consistent with the"hockey-stick" sign. Genetic testing demonstrated a codon 200 mutation in prion protein gene (PRNP). The patient died 2 weeks after admission. *Conclusions:* Approximately 15% of CJD cases show a familial pattern of autosomal dominant inheritance. Familial CJD typically follows a fairly gradual course resulting in dementia, loss of motor function, and death within 5 years of disease onset. This case reveals an unusually rapid progression of symptoms with death within only 4 weeks of presentation.

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P.039

Thiamine prescribing practices within Canadian university-affiliated hospitals: does familiarity breed contempt?

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Background: Patients with suspected thiamine deficiency should receive treatment with parenteral thiamine to achieve the high serum-thiamine levels necessary to reverse the effects of deficiency and to circumvent problems with absorption common in the medically ill. We sought to quantify rates of parenteral administration of thiamine and to identify factors associated with higher rates of parenteral prescribing across Canadian university-affiliated hospitals. *Methods:* Fourteen university-affiliated Canadian hospitals were included in this observational study. 48,806 prescriptions for thiamine were captured from computerized pharmacy information systems, specifying the dose, route, frequency and duration of treatment prescribed to 32,213 hospitalized patients over two years. Factors associated with higher rates of parenteral prescribing were investigated using comparative statistics. *Results:* Parenteral thiamine accounted for 55.1±13.3% of prescriptions, on average. No significant difference was observed in the proportion of thiamine prescribed via the parenteral versus oral routes across centers (p=0.19). Protocols prioritizing parenteral administration were associated with higher rates of parenteral prescribing (61.7% with protocol, 44.6% without protocol; p=0.016). Patients admitted under psychiatric services were significantly more likely to be prescribed oral thiamine (p<0.001). *Conclusions:* Oral thiamine continues to be prescribed across university-affiliated hospitals. Strategies are needed to promote parenteral thiamine prescribing in patients with suspected deficiency.

P.040

Fat embolism syndrome secondary to a tibiofibular fracture: a case report

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Background: Fat embolism syndrome is characterized by a constellation of neurologic, respiratory, and cutaneous signs and symptoms. It can complicate a variety of clinical conditions, but is usually seen after long bone and pelvic fractures. Isolated tibiofibular fractures, however, are an infrequent and often overlooked cause. Pathogenesis is not completely understood, but thought to be secondary to mechanical blockage of blood vessels by fat emboli. Treatment is supportive. *Methods:* Case report. *Results:* We report a case of a 55-year-old male who presented with acute confusion and agitation. The day prior he sustained a right closed tibiofibular fracture, which was reduced and casted. The following day he was found to be markedly confused and agitated. Physical examination revealed a temperature at 380C and a reduced oxygen saturation of 94%. There were no focal or lateralizing signs on neurological exam. There were no skin changes. MRI brain revealed multiple bilateral punctate regions of diffusion restriction throughout both cerebral hemispheres. CSF examination was normal and HSV PCR was negative. CT chest showed ground-glass opacities and interstitial thickening in both lower lobes. *Conclusions:* Fat embolism syndrome is a diagnostic consideration in any patient presenting with altered mental status after sustaining a fracture.

P.041

Cognitive evolution in tysabri treated multiple sclerosis patients

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Background: Cognitive dysfunction affects 40-60% of MS patients and progresses over time. Natalizumab has shown to be superior to placebo in preserving cognitive function for the first two years of therapy. The objectives are to understand the impact of natalizumab on cognition beyond two years of therapy and to investigate whether baseline characteristics are predictive of clinical response. *Methods:* This is a single-center, 24-month, observational study. Sixty-three patients treated with natalizumab were assessed prior to monthly infusions using the CogState battery and the SDMT. Patient demographics, MS treatment history, EDSS, MSSS, and natalizumab treatment duration were collected at baseline. A linear mixed model was conducted with time on natalizumab (4 years, n=12) as a between-subjects factor, time point as a within-subjects factor, and age, EDSS, type of MS as covariates. The current data are from the 12-month interim analysis. *Results:* Irrespective of time on natalizumab, significant improvements were observed at the group level in executive function (p<.0001), verbal memory (p<.0001), and working memory (p<.0001), whereas processing speed (p=.19) and attention (p=.15) remained unchanged. *Conclusions:* Interim analysis suggests that natalizumab can preserve cognitive function and the ability to learn beyond two years of continuous therapy.

P.042

Mild cognitive impairment in a case of Brugada syndrome as a result of hypothyroidism

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Background: Brugada Syndrome is a genetic heart rhythm disorder that is characterized by a specific abnormality on an electrocardiogram test. Hypothyroidism has been anecdotally associated with Brugada syndrome in a small number of case studies. *Methods:* A case study. *Results:* A highly functioning 57 year old male presented with complaints of cognitive impairment. He recently had experienced cardiac arrest and was diagnosed with Brugada syndrome (type I Brugada ECG pattern and genetic testing). Neurological exam revealed frontal lobe release signs, a Montreal Cognitive test score of 24 (points lost on delayed recall, language and orientation) but normal head CT. Cognitive impairment was consistent with Hashimoto thyroiditis/ encephalopathy based on TSH levels over 20 IU/ml and anti-TPO over 1000 IU/ml. *Conclusions:* This case study is the first of its kind reported in Canada and reflects the potential relationship between hypothyroidism and Brugada syndrome. Further research in this area may lend to future reduction of sudden cardiac arrest and symptoms of Brugada syndrome. Additional testing is needed to assess ECG

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pattern following normalization of thyroid function. This study emphasizes the importance of testing thyroid function of neurology patients to determine causation of underlying health issues and pre-emptively treat potentially life threatening syndromes.

P.043

Case report of Weston Hurst Syndrome

R Magun (Hamilton) J Provias (Hamilton)*

Background: Acute Hemorrhagic leukoencephalopathy (AHLE) or Weston Hurst Syndrome is a rare, acute disorder characterized diffuse hemorrhagic necrosis of arterioles and/or by perivascular demyelination in the CNS. The cause for AHLE is unclear. *Methods:* Here we report full autopsy results of a 27-year-old male who initially developed an acute respiratory infection and subsequently developed hemorrhagic necrosis and edema in the right hemisphere of his brain secondary to acute hemorrhagic leukoencephalopathy. *Results:* We present brain histology results which showed punctate, ring shaped foci of perivascular hemorrhage and edema, localized to the white matter on H&E stain. There was multicentric fibrinoid necrosis within smaller arteriolar type vessels with surrounding edema noted in the right hemisphere. Cold Agglutinins were positive. Autopsy revealed active multifocal myocarditis, and a left lower lobe lung infection. *Conclusions:* The results thoroughly illustrate a severe post-infectious autoimmune reaction of a yet to be identified antigenic trigger leading to immune-complex deposition in walls of arterioles and venules which activates complements and leads to vessel wall necrosis. The associated perivascular edema and/or demyelination cause brain swelling, hemorrhage, and herniation which led to death of this patient. The autopsy results confirmed lung infection and myocarditis. Cold agglutinins were positive. For this reason, mycoplasma pneumoniae is strongly suggested as the infectious cause in this case.

P.044

A case of Miller-Fisher Syndrome presenting as Parinaud's Syndrome

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Background: Parinaud's Syndrome, also known as dorsal midbrain syndrome is a group of abnormalities of eye movement and pupil dysfunction. It is caused by lesions of the upper brain stem. It is a cluster of abnormalities of eye movement and pupil dysfunction, characterized by: Paralysis of upgaze, Pseudo-Argyll Robertson pupils, Convergence-Retraction nystagmus, and Eyelid retraction (Collier's sign). Miller Fisher Syndrome (MFS) presents with ataxia, areflexia, and ophthalmoplegia. Anti-GQ1b antibodies are prominent in MFS, and have a relatively high specificity and sensitivity for the disease. *Methods:* Here we present a 29-year-old male with Parinaud's Syndrome whose was tested for Anti-GQ1b antibody which is highly specific for Miller Fisher Syndrome. Brain Imaging was also performed. *Results:* This patient presented with a sudden change in vision and examination revealed Parinaud's Syndrome. Anti-GQ1b antibodies were positive confirming the suspected diagnosis of Miller Fisher Syndrome. An MRI brain showed no lesion or hydrocephalus as cause for patients symptoms. He responded to intravenous immunoglobulins with full resolution of his symptoms and signs. *Conclusions:* We present a 29-year-old male with sudden onset Parinaud's Syndrome in the context of ataxia and areflexia. Anti-GQ1b antibody titres were positive which is highly specific for Miller Fisher Syndrome.

P.045

Duodenal perforation as a rare complication of methylprednisolone pulse therapy in extensive myelomeningitis

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Background: A case of para-infectious myelomengitis with duodenal perforation while on pulse steroids. *Methods:* Case Report & Review of Literature. *Results:* A 36-year-old Caucasian female presented with 2 day history of severe headache, fever & meningmus. Complete resolution after 2 days of admission. She returned to hospital 5 days later with fever, headache, encephalopathy, reduced lower extremity strength and upgoing plantar reflexes. Initial CSF: WBC 0, protein 1.38, glucose 2.6. Repeat CSF: WBC 242 (69% lymphs), protein 3.95, glucose 2.8. Initial MRI Brain/C-Spine w/ Gad unremarkable. Repeat MRI Brain/Cord w/ Gad: new, predominantly central, patchy T2 hyperintense lesions from C2 to level of conus with associated diffuse cord swelling & faint leptomeningeal enhancement within medulla & pons. Pulse steroids initiated with solumedrol. Despite interval improvement in exam & imaging, the patient developed acute septic shock on Day 4 of pulse steroid therapy. CT-C/A/P demonstrated free air under diaphragm & duodenal perforation. The patient received emergent corrective surgery. She had no further relapses of myelomeningitis during four month recovery. *Conclusions:* This case is notable for presenting as a simple viral meningitis with complete resolution, followed by para-infectious myelomeningitis with encephalopathy similar to ADEM. It highlights the possibility of GI perforation in pulse methylprednisolone therapy due to disrupted autonomic input from extensive myelitis.

P.046

Prevelence of primitive reflexes in MS patients

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Background: Primitive reflexes are commonly observed in early development and can reappear in adulthood with possible associated pathology. This pilot study examines the prevalence of primitive reflexes in multiple sclerosis patients and explores the possible association with cognitive impairment in these patients. *Methods:* 115 Patients were recruited from the Sunnybrook MS clinic between May to August, 2013. 79 of these patients were female (69%) and 31% were male. Diagnosed MS were enrolled if they were able to complete the testing. Primitive reflexes tested included the grasp, palmomental, glabellar, snouting and rooting reflex. Cognitive testing included the Folstein mini-mental status, the validated Sunnybrook Sunscreen cognitive test. *Results:* 57.4% of participants had at least one of the primitive reflexes and 19% had more than one reflex. There was an increased prevalence of reflexes with age. 19% of subjects with two or more reflexes, had lower cognitive test scores. Confounding variables (MS subtype), EDSS, level of education, depression and frontal lobe function were controlled for. *Conclusions:* MS patients in this pilot study had a higher prevalence of primitive reflexes compared to the normal population. The presence of more than two primitive reflexes were associated with

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lower cognitive scores and suggest that the yield of formal cognitive screening may be higher with MS patients with multiple primitive reflexes.

P.047

Enhancing training in affective, behavioural, and cognitive disorders of the brain through the creation of a new Royal College diploma programme

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Background: Disorders of the brain and mind causing aberrations in Affect, Behaviour, and Cognition ('ABC') constitute a growing and resource-intensive health issue in Canada. However, they do not fit into traditional disciplinary boundaries. Specialists from different disciplines who treat and diagnose these have either "learned on the job" or taken non-accredited additional training. A comprehensive training program for these disorders could ensure quality of care and attract more physicians to this practice area. *Methods:* A "grass-roots" interdisciplinary group of specialists from across Canada has explored the creation of a Royal College of Physicians and Surgeons of Canada (RCPSC) Diploma programme. Teleconferences and meetings with key stakeholders have further defined this Diploma. *Results:* Names proposed include "Brain Medicine" and "Cognitive and Behavioural Medicine". A consensus definition has been agreed upon, with a "core" Diploma program complemented by specific "streams" including: dementia; neuropsychiatry & behavioural neurology; and neuromodulation. *Conclusions:* An interdisciplinary team, with support of RCPSC, is developing a Diploma programme for training in disorders of 'ABC', which will: 1) formalize current informal training; 2) build capacity, attracting more physicians to an underserved, growing area of medicine; 3) allow for the creation of a community of practice in these disorders; and 4) support the emergence of novel inter-disciplinary and trans-disciplinary competencies for treatment of these disorders.

P.048

Giant arachnoid granulation causing headache

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Background: We report a case of secondary headache with a rare aetiology. Giant arachnoid granulations are not uncommon (0.3-24% as reported in the literature). However, some case reports support this as an aetiology for secondary headache. *Methods:* Case report. *Results:* A 31-year-old female had a 5 month history of constant headache with retro-orbital pressure not relieved by analgesia. No previous history of headache. On exam, she had bilateral disc edema with decreased visual acuity and no other visual disturbance. The rest of the neurological exam was normal. Initial MRI imaging revealed empty delta sign and a hypointense filling defect in the superior sagittal sinus concerning for venous thrombosis. Additionally, the superior ophthalmic veins were prominent. Follow-up CT venogram showed hypodensities consistent with giant arachnoid granulations in the superior sagittal sinus (8 mm x 8 mm x 9 mm) and right transverse sinus (5mm x 4mm x 3mm). The Hounsfield units of the hypodensities were consistent with CSF. They were of sufficient size to cause a filling defect, local dilation. and adjacent bony erosion in the superior sagittal sinus. Thrombophilia work-up was negative. *Conclusions:* Although rare, giant arachnoid granulations are an important cause of secondary headache that must be differentiated from venous thrombosis, as there are important differences in prognosis and treatment.

P.049

A case of disseminated mycobacterium bovis infection with meningoencephalitis

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Background: Infliximab is a TNF alpha inhibitor used to treat many auto-immune conditions spanning many specialties. *Methods:* We present a case of Mycobacterium Bovis Meningoencephalitis acquired during Infliximab treatment. *Results:* The patient is a 34-year-old female of who travelled extensively for work. Her past medical history was only significant for Crohn's disease for which she was treated with Infliximab. She presented to our center, complaining of pleuritic chest pain and recurrent fevers for 6 months. Her symptoms began while working in Lebanon, and most of her investigations were done in the Middle East. She had recurrent ascites and right pleural effusions as well as bilateral adnexal masses. Since all investigations thus far were inconclusive, an omental biopsy was performed. Pathologic analysis was consistent with granulomatous peritonitis. A few weeks later, she developed a severe frontal headache with vomiting. A lumbar puncture was performed and CSF analysis revealed tuberculous meningitis with Mycobacterium bovis. Brain MRI showed a left pontine hyperintensity compatible with a tuberculoma. The patient was treated with standard anti-tuberculous therapy and has sustained no neurologic deficits. *Conclusions:* Neurologists need to be aware of potential neurologic complications associated with TNF-alpha treatment, as they can become key players in establishing a diagnosis.

NEUROLOGY (MOVEMENT)

P.050

Drug-induced Parkinsonism clinical pathological studies

UA Shuaib (Saskatoon) AH Rajput (Saskatoon) AH Rajput (Saskatoon)*

Background: Drug-induced parkinsonism (DIP) is a well-known complication of neuroleptics and other drugs, and is possibly the second-most common cause of parkinsonism. Despite this, very few autopsies have been reported. *Methods:* Patients assessed at Movement Disorder Clinic Saskatchewan (MDCS) are offered optional autopsy. Detailed clinical records are kept. Brains were obtained from patients with parkinsonian symptom onset coinciding with use of known DIP producing drugs. *Results:* Five DIP cases seen at MDCS were autopsied. Four were on typical antipsychotics (chlorpromazine, haloperidol), and one was on metoclopramide. In two cases, parkinsonian features reversed after stopping the offending agent. Autopsy showed findings consistent with preclinical PD. In the remaining three, offending drugs were continued until death. Two cases were treated with levodopa. In two

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of the three, brain was normal but one had mild loss of SN without Lewy bodies. *Conclusions:* Our data shows:

1. Neuroleptics can unmask preclinical PD

2. Reversal of parkinsonism after discontinuing offending drugs does not indicate absence of underlying pathology

3. Neuroleptics can produce parkinsonism in otherwise healthy brain

4. Dopamine receptor block does not lead to retrograde SN neuronal degeneration

5. The mechanism of sustained parkinsonian features after discontinuing neuroleptics remains to be established

6. Levodopa is not toxic to SN

P.051

Deep brain stimulation of Globus Pallidus internus modulates the depotentiation of motor cortical circuits in patients with cervical dystonia

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Background: Internal globus pallidus (GPi) deep brain stimulation (DBS) is an effective treatment for advanced generalized dystonia and cervical dystonia, but its mechanisms of action are not fully understood. We hypothesized that depotentiation is impaired in dystonia and it may be improved by GPi-DBS. *Methods:* We studied two cervical dystonia patients preoperatively, and at one and six months after GPi-DBS in the ON and OFF stimulation states in random order. Motor-evoked potential (MEP) amplitude was measured at baseline before TBS and up to 30 min after depotentiation protocol. Intermittent (i) TBS with 80% of motor threshold and 600 pulses was used to induce long-term potentiation and was followed by depotentiation protocol consisting of continuous (c) TBS with 150 pulses. *Results:* MEP size increased after iTBS and but failed to decrease after cTBS in patients before DBS surgery, suggesting a lack of depotentiation. At 6 months after surgery, there was a trend towards restoration of depotentiation in the ON stimulation but not in the OFF stimulation condition. This is ongoing study with more patients are being recruited. *Conclusions:* Our preliminary findings suggest that depotentiation plasticity is deficient in motor cortex in dystonia patients and is restored by GPi-DBS. Restoration of cortical plasticity may be one of the mechanisms of how GPi-DBS produces clinical benefit.

P.053

The impact on sleep quality in Parkinson's disease patients with or without Restless Legs Syndrome – a case-control study

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Background: The Objective of the study was to explore the impact of Restless Leg Syndrome on the sleep quality of Parkinson's disease patients with or without the syndrome, comparative to control. *Methods:* A total of 120 subjects were recruited; 40 patients with PD and RLS (PD+RLS+), 40 patients with PD without RLS (PD+RLS-) and 40 healthy age-matched controls (PD-RLS-). In terms of PD, the brain bank criteria were used for diagnosis and the severity of symptoms and associated complications were measured using the Unified Parkinson's Disease Rating Scale (UPDRSIII). In terms of RLS, the RLS diagnostic criteria were used for diagnosis. As well, the Pittsburgh Sleep Quality Inventory (PSQI) was used to assess overall sleep quality in all groups by means of the global PSQI score. *Results:* Global mean PSQI scores differed significantly across PD+RLS+, PD+RLS- and PD-RLS- groups ($F(2,117) = 13.432$, $P < 0.0001$, $\eta 2 = 0.1867$). Tukey post-hoc comparisons of the three groups indicated that the RLS+PD+ group ($M = 10.15$, $SD = 4.435$) had a significantly higher global PSQI score than PD+RLS- patients (95% CI[2.0358, 6.3642], $P < 0.0001$) and PD-RLS- controls (95% CI [1.8101, 6.1392], $P < 0.0001$). *Conclusions:* The quality of sleep is worse by the presence of RLS in PD patients, comparative to PD only patients and control.

Neurology (Neurocritical Care / Trauma)

P.054

Redefining the diagnostic (and prognostic) criteria for the vegetative state

B Young (London) A Owen (London)*

Background: Making a diagnosis of one of the varieties of disorders of consciousness (DOC) carries with it prognostic and management implications. The criteria for vegetative state (VS), formulated in 1994 and still in use, are entirely clinically based. It has been shown that up to 40% of "VS patients" can show cognitive responses with fMRI, EEG and event related potentials (ERPs) and are, therefore, not truly vegetative. *Methods:* We reviewed prognostic critieria for anoxic-ischemic encephalopathy and traumatic brain injury to formulate a strategy by which patients with DOC can be rationally selected for the above testing procedures to determine whether cognitive responses are present or not. *Results:* The investigative algorithm limits the use of specialized testing to those patients for whom there is diagnostic/prognostic uncertainty. *Conclusions:* When cognitive responses are detected, these findings should be integrated into decision making regarding level of care.

P.055

The ketamine effect on ICP in traumatic brain injury

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Background: Literature sources have long expressed concerns over the use of ketamine in patients with ICP concerns. Our goal was to perform a systematic review of the literature on the use of ketamine in TBI, to better outline the effects on ICP. *Methods:* Articles from MEDLINE, BIOSIS, EMBASE, Global Health, HealthStar, Scopus, Cochrane Library, the International Clinical Trials Registry Platform (inception to November 2013), reference lists of relevant articles, and gray literature were reviewed. Two reviewers identified manuscripts on the administration of ketamine in TBI patients with recorded effects on ICP. Two reviewers independently extracted data. Strength of evidence was adjudicated using the Oxford and GRADE methodology. *Results:* Our search produced a total 371 citations. Seven articles, 6 manuscripts and 1 meeting proceeding, were considered for review, with all utilizing ketamine. All studies were prospective studies. Across all studies, of the 101 adult and 55 pediatric patients described. ICP did not

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increase in any of the studies. Three studies reported a significant decrease in ICP with ketamine bolus. No adverse events related to ketamine were recorded, and outcome data was poorly documented. *Conclusions:* There exists Oxford level 2b, GRADE C evidence to support that ketamine does not increase ICP in severe TBI patients that are sedated and ventilated, and in fact may lower it.

P.056

Is there a cerebral ECG for PRES?

*CB Gervais (Saskatoon) T Lamb (Saskatoon) S Wardell (Calgary) C Plewes (Saskatoon) GR Hunter (Saskatoon) L Perlett (Saskatoon)**

Background: Electrocardiographic (ECG) abnormalities are well documented in subarachnoid hemorrhage. Recent studies have evaluated ECGs in patients with posterior circulation stroke & subdural hematoma. Prolonged QTc in association with T-wave flattening or T-wave inversion have been proposed as findings supportive of "Neurogenic" or "Cerebral" ECGs. Our study evaluates ECG changes in patients with Posterior Reversible Encephalopathy Syndrome (PRES) & Hypertensive Encephalopathy. *Methods:* Retrospective Audit. Cases of PRES & Hypertensive Encephalopathy between January 2008 & January 2013 were identified by systematic review of regional PACS & diagnostic coding databases. Admission ECG's for each case were collected & compared to baseline ECGs. Analysis was performed by two blinded Cardiologists using established guidelines. *Results:* 13 cases of PRES & 7 cases of Hypertensive Encephalopathy were identified. 1 case of PRES (7.7%) and 3 cases of Hypertensive Encephalopathy (42.8%) were identified as having prolonged QTc & either T-wave flattening or T-wave inversion. *Conclusions:* In our study, a minority of cases of PRES & Hypertensive Encephalopathy are in keeping with Cerebral ECG findings proposed within the literature. Comparison of findings in these diagnoses allows for speculation as to whether the mechanism of ECG changes exists on the same pathophysiological continuum. The power of our study is limited by the overall small number of cases identified within our regional database

P.057

Analgesia in neurocritical care: survey and practice audit

FA Zeiler (Winnipeg) F AlSubaie (Montreal) J Teitelbaum (Montreal) Y Skrobik (Montreal)*

Background: Systematic assessment of pain in the neurologically critically-ill is feasible. Disease-specific conditions may alter the analgesic pharmacological agents utilized. Our goal was to survey international neurocritical care practice and audit two local Neuro-ICU pharmacies. *Methods:* The survey was based on a Delphi method-based round table of ICU experts from 3 academic centers and validated for content and reproducibility among 5 independent experts. It addressed pharmacologic intervention and clinical context for disease-specific choices. In addition, we performed a practice audit of analgesia ordered over a two week period within two Montreal Neuro-ICU's. *Results:* Ninety-four physicians responded, with the majority from Canada (43.6%) and Australia (41.5%); average ICU experience was 16 years. The three most common analgesics were reported as: opiates (97.2%), Acetaminophen (97.2%), and Anti-epileptics (Gabapentin/Pregabalin) (43.8%/38.4%). Fentanyl was the favored opiate. The ICU practice audit included 53 patients with a variety of pathologies. Patients received one (20.8%), two (41.5%), or three (20.8) analgesics. The first, second and third most commonly prescribed analgesics were: acetominophen (85.9%), opiates (41.5%), and anti-epileptics (7.5%). The favored opiate was hydromorphone. *Conclusions:* Acetaminophen, opiates and antiepileptics are the commonly reported and prescribed medications in the neuro-ICU patient. Further prospective studies should address practice patterns and effectiveness, to better inform neuro critical care practice.

P.058

The Ketamine effect on ICP in non-traumatic neurological illness

FA Zeiler (Winnipeg) J Teitelbaum (Montreal) M West (Winnipeg) LM Gillman (Winnipeg)*

Background: Controversy exists surrounding ketamine in neurological illness due to ICP issues. We performed a systematic review of literature on ketamine in non-traumatic neurological illness and its effects on intracranial pressure (ICP). *Methods:* All articles from MEDLINE, BIOSIS, EMBASE, Global Health, HealthStar, Scopus, Cochrane Library, the International Clinical Trials Registry Platform, reference lists of relevant articles, and gray literature were searched. We identified manuscripts with ketamine use in humans with non-traumatic neurological illness, that recorded ICP. Secondary outcomes: cerebral hemodynamics, patient outcome, and adverse effects were recorded. The strength of evidence was adjudicated using Oxford and GRADE methodology. *Results:* Our search produced 179 citations. Sixteen articles, 15 manuscripts and 1 meeting proceeding, were considered for the review. Eleven studies were prospective; 5 were retrospective. Eleven and 7 studies had data on adults and pediatrics respectively. There were 127 adult and 87 pediatric patients described. ICP did not increase in adult studies reporting premedication during ketamine administration, with two studies reporting a decrease. A similar trend was identified in the pediatric population. No non-ICP adverse events from ketamine were recorded. *Conclusions:* Currently, Oxford level 2b, GRADE C evidence exists in adults, and level 4/C evidence in pediatrics, to support that ketamine does not increase ICP in non-traumatic neurological illness patients that are sedated and ventilated.

P.059

Giant SSEPs coincident with epileptiform activity in acutely comatose patients

DA Houlden (Ottawa) MI Boulos (Toronto) BJ Murray (Toronto) L Norton (London) G Young (London)*

Background: The relationship between epileptiform discharges and giant median nerve somatosensory evoked potentials (SSEPs) has not been elucidated. *Methods:* Median nerve SSEP and EEG studies were performed in a comatose patient (Patient 1) one and five days after cardiac surgery. He had tranexemic acid administered prior to and during surgery. Another comatose patient (Patient 2) had the same studies performed one day after sustaining 10 minutes of pulseless electrical cardiac activity. *Results:* Both patients had epileptiform discharges that were coincident with giant cortically generated SSEPs bilaterally. In Patient 1, the EEG and SSEP studies

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repeated five days post-operatively showed no epileptiform discharges, and the cortically generated SSEP amplitudes were decreased (normalized) compared to those obtained one day post-operatively. He emerged from coma and had a good recovery. Patient 2 died shortly after initial EEG and SSEP testing. *Conclusions:* Epileptiform discharges were associated with giant cortically generated median nerve SSEP amplitude (tranexemic acid was implicated in Patient 1 and anoxic brain injury in Patient 2). Those who use the amplitude of cortically generated SSEPs for predicting outcome in comatose patients should consider the presence of epileptiform discharges (detected by EEG) as a potential confounding factor.

P.060

Effect of status epilepticus on cerebrospinal fluid white blood cell count in the absence of infection

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Background: Advancements in diagnostics have led to earlier treatment of status epilepticus (SE). However, treatment of an underlying cerebral infection is delayed in cases with minor cerebrospinal fluid (CSF) abnormalities presumed to be caused by prolonged seizures. This study was designed to assess whether SE increases the number of white blood cells (WBCs) in the CSF in the absence of an underlying infection. *Methods:* This retrospective study included patients with SE admitted to Saskatoon Royal University Hospital since January 2010 using the international classification of diseases code. Charts were then reviewed for the duration of seizure and CSF analysis. SE defined as seizure longer than 30 minutes or multiple seizures over 30 minutes with no gain of consciousness. Four or less CSF WBCs was normal. *Results:* Out of 40 patients admitted with SE, 19 had CSF analysis. All CSF samples showed normal WBC count with negative bacterial and viral studies. *Conclusions:* In our study, CSF pleocytosis was not seen in the status epilepticus without infection, suggesting that this finding is uncommon, and infectious etiologies should be carefully excluded when pleocytosis is found. Therefore, CSF pleocytosis may warrant empirical antimicrobial treatment while awaiting infectious work up results.

P.061

Analgesia in neurocritical care: systematic review of the literature

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Background: Neurological Intensive Care Unit (NICU) patients often suffer from pain. Adequate analgesia impacts on quality of care and cost in general ICUs; we reviewed its evidence in NICUs. *Methods:* Pain management effectiveness and outcomes in adult NICU patients were reviewed using MEDLINE, Cochrane Database of Systematic Reviews, Cochrane Central Register of Controlled Trials, CINAHL, Scopus, ISI Web of Science, and the International Pharmaceutical Abstracts databases for original data. Key words incorporated diagnoses and analgesic interventions. *Results:* Of 4314 studies were screened, 32 were relevant, and 9 excluded for poor quality. Diagnostic groups included intracerebral hemorrhage (9%), post-operative cranial/ spinal interventions (50%/ 23%), neuropathy (4%) and traumatic brain injury (14%); none described epilepsy or stroke patients, or non-pharmacological intervention. Only 10% included validated pain assessment tools (Visual Analogue scale (52%), Numerical-rating scale (14%) and Pain severity scale (5%); paradoxically, analgesia was the primary outcome in 88%. Sedation, PaCO2, Vitals, Opioid complications, narcotic consumption, and patient satisfaction constituted the other outcomes (5-8%). Opioids (16) and acetaminophen (5) were most commonly assessed. Quality of evidence was moderate (GRADE B 31%, GRADE C 69%). *Conclusions:* Effectiveness analgesia in NICU is underreported. Insufficient evidence exists to recommend any specific type of intervention.

NEUROLOGY (NEUROMUSCULAR)

P.062

Axon regeneration and tumor suppression machinery: the case for neuronal BRCA1

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Background: The limited plasticity of adult post mitotic neurons requires new strategies to change their behavior. Manipulating molecular pathways involved in tumorigenesis, nonetheless expressed in neurons, offer this possibility. The tumor suppressor BRCA1 (breast cancer susceptibility gene 1), acts as a transcriptional regulator, DNA repair agent and ubiquitin ligase. *Methods:* Immunohistochemistry, in vitro neurite outgrowth analysis, western blot, real-time PCR and *in vivo* nerve regeneration models. *Results:* We identified widespread expression of BRCA1 in primary sensory neurons. A gain in nuclear expression of BRCA1 was observed in injured neurons *in vivo* at 3 day post-injury and maintained through 7 days; a period corresponding to accelerated outgrowth of injured neurons. In culture, differential treatments that enhance neurite outgrowth positively regulate the nuclear entry of BRCA1. Interestingly, neurons having cytoplasmic enrichment of BRCA1 overlapped with a subpopulation with low intrinsic capacity to outgrow. Knockdown of BRCA1 in culture led to lesser neurite outgrowth. Finally, a novel peptide that mimics the nuclear localization signal (NLS) of BRCA1 attenuated the nuclear entry of BRCA1 and impaired the neurite outgrowth. *Conclusions:* Nuclear BRCA1 appears essential for the optimal outgrowth of sensory neurons. Selective manipulation of this protein may identify novel opportunities to enhance peripheral nerve regeneration.

P.063

Sensory-motor axonal polyneuropathy secondary to intravascular B-cell lymphoma as the presenting feature of waldenstrom's macroglobulinemia: an unusual case presentation

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Background: Neuropathy associated with tumor infiltration in Waldenstrom's macroglobulinemia is rare and challenging to diagnose due to the heterogeneous nature of neuropathies associated with this hematological condition. *Methods:* Case presentation and literature review. *Results:* We report the case of a 78-year-old female

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who presented with a one-month history of a progressive sensory motor polyneuropathy that occurred after a diarrheal illness. She was found on workup to have lymphoplasmacytic lymphoma involving the bone marrow and multiple lymph nodes. Nerve conduction studies and electromyography were consistent with a severe axonal polyneuropathy. As she had no other significant consititutional symptoms or cytopenias, it was not immediately clear whether her neuropathy related to her Waldenstrom's macroglobulinemia and whether it warranted treatment. Further work up was performed, including a nerve and muscle biopsy, which provided the diagnosis, although this resulted in a delay in treatment during which time the patient continued to progress significantly. *Conclusions:* While rare, Waldenstrom's macroglobulinemia associated B-cell lymphoma causing an axonal sensory-motor polyneuropathy has been previously reported in the literature. Awareness of this possible presentation is important for early detection and management.

P.064

Risk of steroid-induced exacerbations in myasthenia gravis: are certain steroid regimens safer?

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Background: Corticosteroids remain a mainstay of treatment for myasthenia gravis but an initial worsening of symptoms is often described as a potential side-effect of treatment. This study analyzes the frequency and severity of this complication, and compares the frequency with different steroid regimens. *Methods:* Medical records myasthenia gravis patients at two McGill University hospital sites were retrospectively reviewed. Primary outcome was the incidence of steroid-induced exacerbations of myasthenia gravis as defined by the treating physician's subjective impression. *Results:* To date 98 myasthenia gravis patient charts have been reviewed, of whom 41 were treated with prednisone and 6 had steroid-induced exacerbations. The risk of steroid-induced exacerbations was lower in patients treated with alternate day as opposed to daily prednisone (1/12 vs 5/29 patients), fixed-dose as opposed to escalating dose prednisone (3/12 vs 3/29 patients), and prednisone alone as opposed to prednisone plus adjuvant treatment (3/32 vs 3/9 patients). *Conclusions:* Full results will be available in time for the Canadian Neurological Sciences Federation meeting. The preliminary results suggest that steroid-induced exacerbations of myasthenia gravis do occur but that certain regimens may reduce the risk.

P.065

New ideas on the mechanisms underlying diabetic sensory neuron degeneration

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Background: Diabetic polyneuropathy (DPN), present in up to 50% of diabetics, has no specific therapy to arrest or reverse it. Novel forms of therapy could be based on the concept that diabetes involves direct targeting of sensory neuron gene output and function. *Methods:* Quantitative morphometry, multifiber electrophysiology, immunohistochemistry, behavioural sensory testing, two models of experimental DPN. *Results:* Two differing type 1 STZ induced DPN models in rats and mice had expected motor and sensory conduction slowing and were linked to a range of changes in gene output. Both models had evidence of sensory neuron nuclear atrophy. Diabetic nuclei were associated with a rise in the number of Cajal bodies (CB), sites for posttranscriptional modification. Interestingly, a strategy previously shown to signal sensory neurons by direct ligation of DRG neurons through intranasal insulin treatment [Francis, Toth et al, Diabetes, 2009], improved sensory abnormalities in mice after 8 weeks of diabetes and further increased nuclear CB expression. *Conclusions:* The findings provides additional evidence that diabetes directly targets sensory neurons, particularly nuclear structure and function in rendering neuropathy, a basis for novel forms of treatment of human DPN. [Supported by the Hotchkiss Brain Institute Denyse Lajoie-Lake Fellowship, CIHR, JDRF and CDA]

P.066

High-dose subcutaneous immunoglobulin (Hizentra 20%) for treatment of multifocal motor neuropathy

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Background: Subcutaneous immunoglobulin (SCIG) 10% and 16% have been reported for treatment of multifocal motor neuropathy (MMN). We aimed to transition 15 patients with MMN from intravenous immunoglobulin (IVIG) to SCIG using a 20% formulation. *Methods:* Weekly 20% SCIG dose was calculated by dividing the monthly IVIG dose by four and multiplying by 1.53. Training occurred immediately after the last IVIG infusion and administration lasted for 6 months. *Results:* Twelve patients have been treated to date. Three patients have completed the 24-week program and 6 have maintained strength to month 3. These 9 patients have experienced only mild erythema and edema at the injection sites which improved with modification of technique, rate and site rotation. Two patients tolerated SCIG but were rescued with IVIG due to deterioration in strength at 3 months. One patient experienced intolerable skin reactions and elevation of liver enzymes at 2 months which resolved after discontinuation of SCIG. *Conclusions:* Preliminary results show that most patients with MMN tolerate transition from IVIG to SCIG, and appear to maintain strength at 3 months. Monitoring is needed as some patients experience neurological deterioration or intolerable local or systemic reactions. Final results are expected by June 2014.

P.067

The effects of home-based strength and strength-endurance training in patients with CMT1A

SK Baker (Hamilton) J Turna (Hamilton)*

Background: CMT is a polygenic hereditary neuropathy with an estimated frequency of 1:2500. Currently no treatment exists for CMT. Supervised exercise training has been proven to improve physical performance in this patient population. However, self-directed home-based exercise has not been established as an effective intervention. *Methods:* Thirty CMT1A outpatients of the Peripheral Nerve Clinic were recruited and randomized into one of three groups: control, strength only, and strength and endurance. Each exercise program involved 3 sets of the eight assigned Theraband® exercises and one hand grip exercise performed 5 d/wk for 8 weeks. Each exercise condition differed based on Theraband® resistance and repetitions which increased every two weeks. The control group remained sedentary. Both baseline and endpoint assessments involved the completion of 3 MVC's for isometric

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muscle strength tests and isometric muscle fatigue protocols. The Six-Minute Walk Test and SF-36 questionnaire were also completed. *Results:* Patients in the combined training group showed significant improvement in only handgrip strength (p=0.0370). Muscle fatigue protocol for isometric knee extension showed significant improvement in force generation over the last 4 MVCs. Significant differences for the Six-Minute Walk Test were reported for both groups. *Conclusions:* Combined endurance and strength training holds practical importance as it suggests patients can improve muscle function through a home-based program without physician supervision.

P.069

Autologous stem cell transplant for stiff person syndrome: two cases from the Ottawa Blood and Marrow Transplant Programme

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Background: Stiff Person Syndrome (SPS) is an autoimmune disorder resulting in axial muscle stiffness and superimposed episodic painful muscle spasms. There is a growing body of evidence that supports stem cell transplant for refractory autoimmune diseases. *Methods:* Two anti-GAD antibody positive patients underwent autologous stem cell transplant with a CD34+ selected peripheral blood graft for refractory SPS. Peripheral blood grafts were mobilized with cyclophosphamide and granulocyte colony stimulating factor. Conditioning was completed using busulfan, cyclophosphamide and rabbit anti-thymocyte globulin as intensive immune ablative therapy. *Results:* Both patients have achieved clinical remission, with significant improvement in symptoms and return to pre-morbid functioning. Patient A is now 54 months post-transplant. Her symptoms improved within the first month post-transplant, with weaning of benzodiapines over one year. Patient B is 30 months post-transplant. Symptoms improved over 6 months with ongoing occasional episodic stiffening of less severe intensity and duration. Weaning of benzodiazepines occurred over two years following transplant. *Conclusions:* SPS represents a novel indication for autologous stem cell transplant. Both patients have had significant improvement in symptoms and return to pre-morbid functioning, which warrants this approach in severe refractory disease. Ongoing follow-up will be needed to watch for long-term effects and to determine if clinical response is maintained.

NEUROLOGY (STROKE)

P.070

Atypical ischemic lesions leading to Anton's Syndrome

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Background: We report a case of Anton's Syndrome with atypical localization. This rare complication of cortical blindness presents with visual anosognosia leading the patient to confabulate and otherwise behave as if they were sighted. It classically occurs after bilateral occipital lobe infarcts. A review of the literature found only 30 articles concerning Anton's, and none describing thalamic involvement. *Methods:* Case report. *Results:* An 81-year-old man presented with extinct visual fields and intact pupillary reflexes, inconsistent left sided neglect, left hemiparesis and unilateral left-sided asterixis. The patient confabulated when asked to describe his visual perceptions to the examiner. Diffusion weighted MRI revealed acute ischemic infarcts in the left occipital lobe and the dorsal right thalamus, presumably involving the lateral geniculate nucleus and accounting for left visual field deficits. *Conclusions:* Cerebrovascular disease is the most common cause of Anton's Syndrome, however any condition that leads to retrochismatic/cortical blindness may theoretically produce this phenomenon. To our knowledge this is the first report of thalamic involvement leading to Anton's Syndrome, making our case unique, as we describe a previously unidentified localization.

P.071

Quantitative T2 imaging is an important complement to diffusion MRI for acute ischemic stroke

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Background: A quantitative apparent diffusion coefficient (ADC) map can isolate the diffusion effect in diffusion weighed imaging (DWI) and is commonly assessed in acute ischemic stroke. Quantitative T2 (qT2) may provide important information about tissue properties not appreciated with DWI and ADC alone. *Methods:* 21 ischemic stroke patients were imaged within 6 hours of symptom onset and at 24 hours (3T MRI). qT2 mapping was performed using a CPMG sequence. DWI was also performed to provide ADC maps. Volumetric analysis was performed on DWI, FLAIR images, ADC and T2 maps using a combined manual and threshold-based approach. *Results:* Lesions were identified in 18 (86%) of patients and tPA and/or endovascular treatment was administered in 83% of these patients (recanalization confirmed in 73%). Lesions were detectable at baseline in 16 (89%) of ADC maps, 17 (94%) of qT2 maps and 11 (61%) of FLAIR images; ADC lesions grew by a median of 97% while qT2 lesions grew by 42%. The median ADC/qT2 lesion overlap grew by 16%. qT2 lesions were larger than ADC in 72% of patients at baseline, and 67% of patients at 24 hrs. *Conclusions:* qT2 depicts a lesion size that is often larger than depicted by ADC, and this may be important for defining lesion extent.

P.072

Nonbacterial thrombotic endocarditis presenting as acute cortical blindness: a case report

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Background: Nonbacterial thrombotic endocarditis (NBTE), also known as marantic endocarditis, refers to noninflammatory lesions involving the heart valves, usually in the setting of malignancy. Vegetations have a tendency to embolize and consist of amorphous platelets interwoven with strands of fibrin. The most common clinical presentation is ischemic stroke, but systemic embolic events are also seen. Treatment consists of systemic anticoagulation and management of the underlying process. *Methods:* Case report. *Results:* We report a 56-year-old man who presented with sudden onset blindness. He previously had metastatic pancreatic

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adenocarcinoma, pulmonary embolism requiring life-long anticoagulation, and recent right MCA stroke resulting in a left homonymous hemianopia. Physical examination revealed no light perception in all visual fields. Pupils were equal and reactive to light. Brain MRI revealed scattered areas of diffusion restriction throughout all territories, the largest of which was located in the left posteromedial occipital lobe. A transesophageal echo showed small, independently mobile masses on the aortic valve. Bacterial and fungal blood cultures were negative. Vasculitic workup was negative. The patient was continued on high-dose tinzaparin for treatment. *Conclusions:* Nonbacterial thrombotic endocarditis should be suspected in the setting of malignancy and recurrent ischemic stroke. Anticoagulation is essential as opposed to bacterial endocarditis.

P.073

Neurogenic Stuttering as an atypical presentation of acute infarct

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Background: We present a case of clinically diagnosed stroke with a neurogenic stutter. This is a rare presentation. Lesions causing neurogenic stutter have been reported in all cortical lobes, however, pontine lesions are uncommon. *Methods:* Case report. *Results:* 54-year-old male presenting with two-day history of acute right-sided hemiparesis and parasthesia who subsequently developed a disabling stutter, which prompted him to seek the emergency room attention. Examination revealed a neurogenic pattern of stutter, with no adaptation affect. He stuttered on every word as well as stuttering on multiple syllables throughout individual words. The patient had a history of right pontine stroke approximately 2 years ago. On admission, CT head and CT angiogram were normal. 1.5 T MRI brain did not show diffusion restriction. Old right pontine infarct was visualized. The patient was discharged with outpatient speech language rehabilitation. *Conclusions:* This is a rare presentation of acute infarct. As we did not visualize diffusion-restriction on MRI, we wonder whether his symptoms represent cumulative deficit in light of his chronic pontine stroke. Pathophysiology of neurogenic stutter is unknown, but is thought to involve multiple neural circuits spanning the brainstem to cortex.

P.074

Inactivation of microglia/macrophage reduces brain injury following intracerebral hemorrhage

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Background: The mechanisms of brain injury following intracerebral hemorrhage (ICH) involve activated microglia/ microphages, which can release numerous cytotoxic mediators. We hypothesized that the activation of microglia/macrophage promotes the acute neuronal injury and that inhibiting their activity attenuates ICH brain injury. *Methods:* Ten μl of autologous blood obtained from tail was injected into the right striatum of adult male mice. C57/B6 wildtype mice were used to evaluate the time course of brain injury from 1-7 day(s). We evaluated the area of brain damage and the extent of neuronal death and microglia/macrophage activity. We used transgenic CD11b thymidine kinase (CD11b-TK) mice where proliferating microglia/ macrophage were removed by ganciclovir treatment. *Results:* ICH injury resulted in activation of microglia/macrophages through 1-7 days. The area of brain damage peaked at 2-3 days; the number of dying neurons peaked at 1-3 days, while the activation of microglia/macrophages peaked at days 3-4. We choose day 3 for further studies. The activation of microglia/macrophage was significantly reduced in CD11b-TK transgenic mice with ganciclovir treatment after ICH compared to various control groups. *Conclusions:* Activation of microglia/ macrophages plays a detrimental role in the acute ICH brain injury. These results shed light on the advent of new medications (microglia deactivators) for ICH patients.

P.075

The risk of complications in acute stroke patients with hypotension

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Background: Hypertension is common following stroke or TIA. Less is known about the risk of acute hypotension with TIA or stroke, and whether it affects outcome. A case of stroke with hypotension at our institution prompted us to investigate this issue further. *Methods:* This was a retrospective chart review of all acute stroke or TIA cases seen in the emergency room (ER) by one of the authors (FM) from February 1st, 2005, to May 15th, 2013. The ER nursing triage sheets and ER consult notes were examined to identify patients with systolic blood pressure less than 120 or diastolic blood pressure less than 90. Charts of patients meeting these criteria were reviewed. Any complications possibly related to hypotension were noted. *Results:* 266 charts were reviewed of which 46 were excluded for incomplete or missing data. Of the remaining patients, 113 were males and 107 were females. The average age was 75. A total of 21 patients (10%) met the criteria for hypotension. The only complication identified was a single patient with a myocardial infarction. *Conclusions:* Although hypotension is relatively common in patients presenting to the ER with acute stroke or TIA, only rarely is it associated with complications.

P.076

Carotid webs/shelves are associated with a high early or late stroke recurrence rate in a young adult stroke population: potential role for endarterectomy?

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Background: Most common carotid disease causing stroke is atherosclerosis. Carotid web has rarely been identified in causative association of stroke. Our aim is to describe the characteristics of patients with recurrent strokes associated with carotid web. This is one of the largest case series of carotid webs and stroke in literature. *Methods:* Every patient with internal carotid artery (ICA) territory stroke & ipsilateral carotid web on CT Radiogram (CTA) was identified over an 8 month period. Carotid web was identified as a shelf like structure seen on CTA at ICA origin without any features typical of atherosclerotic plaque or dissection. *Results:* There were 8 patients with carotid web/shelf over the study period. The mean age at the onset of stroke was 50. Male to female ratio was 1:3. Seven

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patients presented with acute occlusion of middle cerebral artery. Sixty percent of patients suffered recurrent strokes in the same vascular territory. Four patients with recurrent strokes underwent carotid endarterectomy (CEA) and remain stroke free at last follow-up (1-7 months). *Conclusions:* Carotid webs may be associated with high risk of recurrent strokes. Further studies are required in understanding their etiological role, mechanism of high recurrent stroke risk and the potential benefit of CEA.

P.077

CT perfusion thresholds to separate acute infarct core from penumbra using optimized imaging and advanced post-processing

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Background: CT Perfusion (CTP) may change thrombolytic/endovascular treatment decisions when compared to NCCT/CTA alone. *Methods:* CTP (120s, 8cm) was performed on 180 patients within 12hrs of ischemic stroke. Two patient cohorts were analyzed: (1) recanalization (TICI 2b,3) <90mins post CTP and (2) persistent occlusion at 24hrs. Follow-up DWI occurred between 8-48hrs. CTP 4D-GE Healthcare was used to calculate cerebral blood flow (CBF), cerebral blood volume (CBV), Tmax maps. DWI hyper-intensity on follow-up was 3D-registered to admission CTP maps. For group (1) CBF, CBV, and Tmax values were obtained from within this region, and a peri-infarct region with Tmax>6s. For group (2) CBF, CBV, and Tmax values were obtained from within the final infarct region, and total ipsilateral hemisphere, excluding infarction. CBF, CBV and Tmax were used in univariate regression models. *Results:* For group (1) [n=11], mean time from CTP to recanalization was 60±19min. CBF parameter (thresholds for gray and white matter 7.2 and 5.2 ml·min^-1·(100g)^-1) had the highest sensitivity(90.9%) and specificity (81.8%) for infarction. For group (2) [n=15], the Tmax parameter (thresholds for gray and white matter 11.3s and 11.8s) had the highest sensitivity (86.6%) and specificity (80.0%) for penumbra. *Conclusions:* We used an optimized stroke imaging data set and an advanced perfusion algorithm and processing to delineate acute stroke tissue states.

P.078

Collateral scoring on single phase CTA must consider timing of image acquisition and evaluate ACA-MCA and MCA-PCA separately

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Background: We measure ACA-MCA and PCA-MCA pial filling independently on single-phase CTA (sCTA) and correlate it with the CTA-based MGH and DSA-based ASITN collateral scores. *Methods:* Patients with acute stroke and M1 MCA +/- intracranial ICA occlusion on CTA were assessed for image acquisition phase by evaluating contra-lesional vasculature Hounsfield Units. Early arterial and late venous sCTA were excluded then a rater assessed collaterals using the Calgary Collateral Score. Pial ACA-MCA and PCA-MCA arterial filling was scored separately on a 5-point scale and correlated to the MGH and ASITN scores using non-parametric statistics. *Results:* Of 71 patients, sCTA was acquired in early arterial phase (9.9%), peak arterial (50.7%), equilibrium (32.4%), early venous (5.6%) and late venous (1.4%). sCTA image timing may mislabel collaterals in 10% of patients with 32% of PCA-MCA variance explained by ACA-MCA collaterals (rs=0.56). The MGH score correlation between ACA-MCA and PCA-MCA collaterals was strong (rs=0.8) and modest(rs=0.55) respectively. ASITN score correlation with ACA-MCA and PCA-MCA collaterals was modest (n=27, rs=0.45) and poor (rs=0.33) respectively. *Conclusions:* ACA-MCA and MCA-PCA collaterals require separate evaluation as MCA-PCA collaterals vary by assessment method. Multiphase CTA is a potential solution as 10% of sCTAs are acquired too early or late for assessment.

P.079

Endovascular treatment for small core and anterior circulation proximal occlusion with emphasis on minimizing CT to recanalization times

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Background: There is no convincing, randomized trial evidence that modern endovascular therapy is better than routine care, including routine intravenous thrombolysis, for acute ischemic stroke. *Methods:* A Phase 3, randomized, open-label with blinded outcome evaluation, controlled design. The study will test the hypothesis that patients undergoing endovascular revascularization will show a 20% absolute risk benefit (RR = 1.5 relative benefit) over patients receiving clinical routine care. The assumed rate of good outcome in the control arm is 40% and 60% in the treatment arm. With 85% power and no interim analyses for efficacy, the sample size consists of 242 evaluable patients (141 in each group). Sample size is inflated to 250 for crossovers, loss to follow-up. *Results:* Active, Recruiting. NCT01778335. 85 recruited from 16 active sites in Canada and U.S.A. as of Jan 2014. *Conclusions:* N/A.

P.080

Early anti-coagulation after ischemic stroke is safe and prevents recurrent stroke

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Background: Patients with acute cardio-embolic stroke from atrial fibrillation (AF) are at risk for recurrence with up to 50% of recurrent stroke occurring within 2 weeks. Anti-coagulation with heparinoids within 48 hours of stroke has been shown to increase risk of symptomatic intracranial hemorrhage (ICH) with no clear benefit on early stroke recurrence. *Methods:* This study was a retrospective review of consecutive patients who were admitted to the stroke service at the Foothills Medical Centre between 2009 and 2011. All patients with an acute cardio-embolic stroke and a diagnosis of AF were reviewed. We hypothesized that anti-coagulation within two weeks of stroke decreased rates of recurrent stroke without causing an increase in rates of symptomatic ICH. *Results:* During the three-year period 324 patients were identified for inclusion. 61.4% of patients were therapeutic on anti-coagulation within 2 weeks of stroke. Three (0.9%) patients suffered a clinically

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significant ICH; only one patient was actively anti-coagulated at the time of ICH. Recurrent stroke occurred in 11 patients (3.4%). Therapeutic anti-coagulation within 2 weeks was associated with a decreased risk of recurrent stroke (RR 0.14, 95% CI 0.03 – 0.64). *Conclusions:* Anti-coagulation within 2 weeks of acute stroke in patients with AF appears to be safe among patients with smaller infarcts and may prevent early recurrent infarction.

P.081

INTERRSeCT CTA recanalization score - a reliability study

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Background: Recanalization is critical for attaining good outcomes in acute ischemic stroke. Tools to quantify recanalization with IV tPA are limited. We aimed to develop a CTA-based recanalization scale, and test the reliability of its components. *Methods:* Data is from INTERRSeCT, a multi-center prospective study examining clot characteristics associated with early recanalization after IV tPA. Two raters assessed CTAs of 30 randomly selected patients at baseline and post-treatment. Baseline scans were scored for site of primary intracranial arterial occlusive lesion (PIAOL), residual flow through PIAOL and distal thrombus burden (DTB). Recanalization was assessed on follow-up CTA using PIAOL debulking, change in residual flow, change in DTB, and modified Arterial Occlusive Lesion (AOL) score. Reliability was quantified using kappa. *Results:* Agreement on PIAOL location varied from excellent proximally (extracranial ICA, M1, M2, A1 and A2 branches) to poor for more distal sites. At baseline agreement was substantial on residual flow (k=0.69), but moderate on DTB (k=0.42). Follow-up imaging reliabilities were excellent for PIAOL debulking (k=0.93), residual flow change (k=0.90), AOL score (k=0.88), but slight for DTB change (k=0.18). *Conclusions:* Debulking and change in residual flow are reliable CTA recanalization indices. Further training could improve distal thrombus scores. Future studies should focus on comparing CTA with other recanalization and reperfusion modalities.

P.082

The conundrum of measuring clot length within the cerebral arterial tree

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Background: There is no gold-standard for measuring clot length. We compare clot length on multi-phase CT-angio (mCTA) at 3 time points (peak arterial, equilibrium and late venous phase) and compare these with length of hyperdense sign (HDS) on non-contrast CT (NCCT). *Methods:* Data is from the PRove-IT (2012-current), a prospective CT-based imaging study in patients with acute ischemic stroke. Patients with M1-MCA occlusions on CTA were included. Clot length was measured on 0.5mm 1st-phase mCTA, and 3mm MIP in the next two phases. Presence and length of HDS was measured on axial 5mm NCCT. *Results:* 56 patients (mean age 71, 47% male, median baseline NIHSS=18) had M1-MCA occlusion on mCTA, only 31/56 (55%) had HDS on NCCT. Median clot length on mCTA 1st, 2nd and 3rd-phases were 16.2mm, 11.3mm, and 11.3mm respectively. Median HDS length on NCCT was 15.5mm. Spearman's correlation coefficient between clot length measured on the 3-phases of mCTA and HD length on NCCT was: (1st vs. 2nd phase r=0.87, 1st vs. 3rd r=0.8, 2nd vs. 3rd r=0.93, 1st vs. HDS r=0.38, 2nd vs. HDS r=0.39, 3rd vs. HDS r=0.45). *Conclusions:* Peak arterial CTA may over-estimate clot length when compared to the late venous phase. The HDS on NCCT lacks sensitivity in detecting M1-MCA clots, and length of HDS correlates poorly with CTA clot length.

P.084

Thrombolysis for minor ischemic stroke with proven acute symptomatic occlusion using TNK-tPA (TEMPO-1)

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Background: Minor stroke and TIA are associated with high risk of neurological deterioration, especially when an intracranial occlusion is present. TNK-tPA (TNKase) compared to alteplase is easier to administer, has a longer half-life, higher fibrin specificity and possibly a lower rate of intracranial hemorrhage. *Methods:* TEMPO is a multi-centre, prospective cohort, TNK-tPA dose-escalation, safety and feasibility trial. Patients with an NIHSS<6 within a 12h window will be enrolled. The first 25 patients have been treated at a dose of 0.1 mg/kg, after which safety was established. A second cohort of 25 patients will be treated at a dose of 0.25 mg/kg. Primary outcomes will be the rate of symptomatic intracranial and extracranial hemorrhage and feasibility of enrolment and treatment. Secondary outcomes include complete neurological and functional recovery at 90 days, recanalization at 4-8 h and minor bleeding. *Results:* 25 patients have been enrolled with a median baseline NIHSS of 3.0. Arterial recanalization was complete in 21.7%, partial 26.1%, no recanalization 52.2%. Median ASPECTS at 24h was 8. 23 patients have concluded the 90 days assessment, of which 18/23 (78.3%) reached neurological recovery and 12/23 (52.2%) functional recovery. There were no drug related complication. *Conclusions:* Assuming safety of this approach, we will pick the higher dose and proceed with a randomized trial in this population.

NEUROSURGERY (CRITICAL CARE / NEURO TRAUMA)

P.087

Acute quadriplegia in the setting of Staphylococcus Aureus Meningitis

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Background: Although more common in paediatric patients, bacterial meningitis can rarely be complicated by spinal cord involvement in adults. We present a case of acute quadriplegia in a patient with bacterial meningitis. *Methods:* A previously healthy 62-year-old male was admitted with altered level of consciousness and a three day history of worsening low back pain. CSF analysis revealed unreportable WBCs, protein of 25 g/L and glucose of 0.3 mmol/L. CSF cultures grew methacillin sensitive Staphylococcus

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aureus. *Results:* The patient started treatment with intrathecal vancomycin and systemic amoxicillin and rifampin. On post-admission day three the patient demonstrated flaccid quadriplegia and areflexia on examinaton. MRI showed diffuse T2 hyperintense signal changes in the cervical cord with corresponding diffusion restriction. The patient was diagnosed with acute myelopathy in the setting of bacterial meningitis, with consideration of infectious, inflammatory, and ischemic causes. The patient had minimal return of function and required long-term ventilatory support for respiratory muscle weakness. Follow-up MRI showed extensive myelomalacia in the high cervicothoracic cord. *Conclusions:* Spinal cord infarction and myelitis can be associated with bacterial meningitis. The pathophysiology is not entirely clear but literature suggests an inflammatory arteritis leading to ischemic cord involvement, alternatively a direct bacterial myelitis is possible. Prognostically, high cervical involvement should be considered akin to traumatic spinal cord injury.

P.088

Characterizing patients undergoing decompressive craniectomy following traumatic brain injury

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Background: Decompressive craniectomy (DC) for refractory intracranial hypertension in the setting of traumatic brain injury (TBI) has been the subject of published and ongoing clinical trials. *Methods:* We performed a population-based, retrospective cohort study involving consecutive patients with TBI undergoing DC in Southern Alberta from November 2008 to August 2013. Operative reports were reviewed to determine surgical indications. Pre-operative imaging was reviewed for mass lesions and degree of midline shift. Characteristics of patients undergoing DC were compared with those of other critically ill patients with TBI. *Results:* A total of 510 patients were admitted to the ICU with TBI. Thirty-seven (7%) underwent DC. Patients who underwent DC had a lower initial median GCS score ($p=0.02$) and were more likely to have a subdural hematoma ($p<0.0001$), and midline shift ($p<0.0001$), but did not differ in age or the etiology of TBI. Twenty-one decompressions (56%) were carried out urgently at admission to hospital. Sixteen patients were decompressed in a delayed fashion, four for refractory intracranial hypertension (11%), and 13 (35%) for deterioration in clinical exam and neuroimaging. ICU mortality for patients undergoing DC was 41%. *Conclusions:* Refractory ICP elevation is an uncommon indication for DC in our region. Clinical and radiographic deterioration, regardless of ICP, are far more common indications.

P.089

Role of neuropsychological impairment in the rehabilitation process for patients with combined head trauma and brachial plexus injury

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Background: Traumatic brain injury (TBI) associated with brachial plexus (BP) injuries are rare (1.2%). High velocity mechanism is often to blame. The objective of this study is to evaluate the neuropsychological impact of TBI on BP injury rehabilitation process. *Methods:* Retrospective study from 1998 to 2011 including 131 patients with BP injury were divided in three groups: no, mild, moderate-severe TBI. We reviewed brain imaging and neuropsychological evaluation of all 23 patients with concomitant TBI and correlated those with their motor outcome from BP injury. Motor recovery for every nerve root taken separately was also compared between the three groups. *Results:* There is an increased severity of initial BP injury and the roots motor results are poorer if associated with TBI. There is a correlation between the TBI severity (clinical and radiological) and the motor outcome of BP injury. *Conclusions:* The number of patients is limited. Behaviour and motivation are important factors in the motor rehabilitation process. Relearning movements requires good brain capacity in order to achieve the task. Neuropsychology evaluation and treatment along with physiotherapy are important in order to optimize the outcome in patients with combined TBI and BP injury.

P.090

Apparent diffusion coefficient values may help predict outcome in patients with severe traumatic brain injury

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Background: Traumatic brain injury (TBI) is a major cause of mortality and morbidity worldwide. Currently there are no tools available to reliably predict recovery and prognosis in patients with severe TBI. We hypothesized that the apparent diffusion coefficient (ADC) values extracted from magnetic resonance imaging studies reflect the degree of axonal injury. The objective of this study is to determine if ADC values obtained within 72 hours of the injury are predictive of patient outcome. *Methods:* Ten patients with severe TBI were enrolled in the study, and the ADC maps were obtained within 72 hours after the injury. The ADC values measured in a number of subcortical areas were correlated with the Glasgow Outcome Scale score and the somatosensory evoked potentials (SSEPs) for each patient. *Results:* The ADC values from right temporal lobe white matter were significantly different in patients with poor outcome when compared to patients with good outcome. All patients with good outcomes had normal SSEP studies. *Conclusions:* White matter ADC values obtained early after injury may aid in outcome prediction in patients with severe TBI. We are currently looking to compare the ADC values between the patients with severe and mild TBI.

P.091

Traumatic brain injury in native vs non-native population of northwest of Ontario

*IU Haq (Thunder Bay)**

Background: To determine the association and compare the demographic, psychosocial, and injury-related characteristics and traumatic brain injury (TBI) occurring in native vs non-native people in the northwest of Ontario. *Methods:* Retrospective review of the records of patients admitted to neurosurgery department in the last 10 years were differentiated between: (1) who were native in origin (n=250), (2) in the general non native population (n=150). History of TBI prior to the TBI Model System Index injury, pre-Index injury demographic and behavioral characteristics, injury

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characteristics, post injury behavioral health, financial burden on the institution and outcome results were studied. *Results:* At present, there are no published epidemiological, cross-sectional or prospective studies relating to TBI in native population residing in northwest of Ontario. Data about the the speculation that TBI in native population vs non-native has higher incidence with its behavioral sequel, hospital bed occupancy and financial burden will be presented. *Conclusions:* Findings suggest that TBI in native population may have important implications for rehabilitation after TBI, especially for anticipating behavioral issues in the chronic stage of recovery with significant subsequent incidence of TBI and financial strain on the hospital. Enhanced detection of TBI among native people will assist clinicians in addressing the associated psychosocial sequelae.

P.092

Incidence and risk factors for suicidal ideation after mild traumatic brain injury

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Background: Mild traumatic brain injury (mTBI) is prevalent and associated with depression and risk of suicidal ideation (SI). Little attention is given to the identification of risk factors for SI. We examined the prevalence and risk factors for SI following mTBI at a large trauma hospital. *Methods:* Prospective data collection spanning 14yrs. Over 50 demographic, outcome and psychometric measures were evaluated: radiological and clinical features at admission; psychiatric and social at 3 and 6 months. X2 analyses were used to determine correlates of SI, followed by logistic regression to model predictors. *Results:* 82% of 2296 patients were mild TBI (mTBI). Frequency of SI was high: 24% (3 months); 53% (6 months). Altered LOC (p=.008) and female sex (p=.01) were correlated with higher risk of SI. Radiological and clinical variables (GCS, amnesia length, CT findings) were not. At 6 months there was an increase in incidence of SI and initial findings were not predictive of higher risk, but unemployment (p=.024) and no previous TBI (p=0.0008) were. *Conclusions:* Following mTBI, SI is frequent and risk does not decrease with time. Current assessment methods fail to identify patients at highest risk and could be improved with inclusion of demographic, psychiatric and socioeconomic factors in initial evaluation. A delayed increase in SI indicates a time window for intervention.

P.093

MRI CO2 stress testing in patients with post-concussion syndrome

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Background: There is an urgent need for novel diagnostic neuro-imaging biomarkers that can discriminate between acute and recovered stages of sports-related concussion (SRC). Here we present a pilot study evaluating a novel MRI CO2 stress test in patients with SRC and post-concussion syndrome (PCS). *Methods:* We report on 5 volunteer control subjects and 5 patients with SRC and PCS. Subjects underwent anatomical, blood oxygen level-dependent (BOLD) and arterial spin labelling (ASL) magnetic resonance (MR) imaging during iso-oxic model-based prospective end-tidal (MPET) CO2 targeting 10mmHg above and below the patient's resting end-tidal carbon dioxide (ETCO2) level. *Results:* By Statistical Parametric Mapping (SPM) analysis 72±29% of brain voxels responded physiologically to hypercapnia in the control group vs. 57±19% in the SRC group (p = 0.19 between groups). Conversely, an abnormal CO2 response to hypocapnia was seen in 0.02±126% of brain voxels in controls vs. 1.7±101% of voxels in the SRC group (p = 0.063 between groups). *Conclusions:* Inverse hypo-hypercapnia maps may represent regions of vasoparalyzed cerebrovasculature following SRC. Statistical trends are evident for the metrics shown. Prospective studies examining the relationship between symptomatology, neuro-cognitive profiles, and cerebrovascular parameters (CVR, CBF, cerebral oximetry) using this novel assessment paradigm are currently underway at our institution.

NEUROSURGERY (GENERAL NEUROSURGERY)

P.094

Differentiating slowly progressive hydrocephalus from arrested hydrocephalus in adults

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Background: Arrested and compensated hydrocephalus is a heterogeneous neurological condition associated with ventricular enlargement without evidence of high intracranial pressure often identified in young and middle aged adults. *Methods:* Patients with a diagnosis of "arrested hydrocephalus" enrolled in the Calgary Adult Hydrocephalus Clinic between January 2000 and July 2013 were reviewed using a clinic database. *Results:* 153 patients were identified. The mean age at diagnosis was 57.9 years. Mean/median followup was 33/14 months for all patients. Hydrocephalus diagnosis included: aqueductal stenosis (n=98), aqueductal pattern (n=56), panventriculomegaly (n=28). Clinical complaints were: cognitive problems (n=99), gait problems (n=80), headache (n=71), urinary urgency or frequency (n=31). Primary surgical treatment was undertaken in 98 patients when symptoms were considered progressive or cognitive dysfunction was significant: endoscopic third ventriculostomy (ETV) in 74 (14/74 later underwent ventriculoperitoneal (VP) shunt insertion) or VP shunt in 24 (total n=41). Serial clinical observations were undertaken in 55 patients and 3 went on to treatment with VP shunt. After treatment, clinical complaints that significantly improved were: cognitive (n=56), gait (n=56), headache (n=37), urinary (n=21). *Conclusions:* Sixty-four percent of patients presenting with "arrested" hydrocephalus underwent treatment resulting in significant improvement or stabilization of clinical complaints. ETV is an important treatment modality for these patients. Clinically stable patients may be safely followed with serial clinical evaluations.

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P.095

Development of a framework for improved integration of image processing techniques to surgical planning and image guidance in neurosurgery

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Background: Throughout the last several decades, a wealth of image processing tools have been developed for surgical planning and image guidance in neurosurgery. Unfortunately, despite these advances, translation of these tools to the operating room remains a significant challenge. Pre-operative multimodal imaging data (e.g. CT, MRI, angiography) is most often not maximized to the benefit of both patient and the neurosurgeon performing the operation. Based on a prior needs-based questionnaire performed by our group, qualitative evidence suggests that neurosurgeons feel that image processing techniques can lead to safer and more effective operations. *Methods:* In collaboration with researchers at Robarts Imaging, all stages of the clinical neuroimaging workflow were scrutinized from data acquisition, to image fusion for surgical planning and pre-operative/intra-operative visualization of relevant processed data. *Results:* We have devised a platform for the practical application and testing of image processing software for neurosurgical purposes. Our findings have been summarized in a schematic diagram outlining the workflow for the translation of image processing technologies to the OR. *Conclusions:* We have developed a clinical framework for validating image-processing algorithms. We believe that formally evaluating the processes involved will allow for more open discussion of centre-specific idiosyncracies and toward more standardized surgical planning and intra-operative neuronavigation and appropriate integration of image processing technologies into the clinical realm.

P.096

The incidence of medically refractory trigeminal neuralgia: a 10-year prospective population based study

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Background: Trigeminal Neuralgia is a relatively rare disease with an estimated incidence of 4/100,00/year. We set out to determine the incidence of medically refractory TN leading to utilization of neurosurgical intervention. *Methods:* Clinical data regarding local TN patients assessed in 2001-2010 were prospectively recorded at our centre that provides the exclusive neurosurgical services for a relatively constant provincial population of 1.26 million. Among those naive to prior surgical interventions for TN, date and type of first surgery were recorded, as well as any future TN interventions up to the year 2013. *Results:* First neurosurgical intervention for TN was performed for 177 patients, a rate of 1.4/100,00/year. During a minimum follow-up of 3 to 13 years, 54 patients (30%) required additional intervention(s). Such failures were seen after 14% of microvascular decompression surgeries (MVD) and 58% of rhizotomies (glycerol, balloon compression or radiosurgery), a significant difference ($p<0.05$). The average time to failure was 2 +/- 2 years among all surgeries. *Conclusions:* We found approximately 1/3 of TN sufferers eventually develop medically refractory pain and elect surgical treatment. MVD associated with the lowest chance of requiring additional surgery (14%) while approximately half of those undergoing rhizotomy procedures required additional surgery within 2 years.

P.097

Chronic subdural hematoma management: a systematic review and meta-analysis of 34,829 patients

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Background: Current management strategies of chronic subdural hematomas remain widely controversial. Treatment options vary from medical therapy and bedside procedures to major operative techniques. Therefore, we undertook a systematic review and meta-analyses to examine the efficacy and safety of multiple treatment modalities. *Methods:* We searched several databases for studies evaluating percutaneous bedside twist-drill drainage, single or multiple operating room burr holes, craniotomy, corticosteroids as a main or adjuvant therapy, use of drains, irrigation of the hematoma cavity, bed rest, and treatment of recurrences. Mortality, morbidity, cure, and recurrence rates were examined for each management option. Randomized, prospective, retrospective, and overall observational studies were analyzed separately. Pooled estimates, confidence intervals (CIs), and relative risks (RRs) were calculated for all outcomes using a random-effects model. *Results:* A total of 34,829 patients from 250 studies met our eligibility criteria. Sixteen trials were randomized, and the remaining 234 were observational. We included our unpublished single center series of 834 patients. When comparing percutaneous bedside drainage to operating room burr hole evacuation, there was no significant difference in mortality (RR0.69,95%CI0.46–1.05,P=0.09), morbidity (RR0.45,95%CI0.2–1.01,P=0.05), cure (RR1.05,95%CI0.98–1.11,P=0.15), and recurrence rates (RR1,95%CI0.66–1.52,P=0.99). *Conclusions:* Percutaneous bedside twist-drill drainage is a relatively safe and effective first-line management option. These findings may result in potential health cost savings and eliminate perioperative risks related to general anesthetic.

P.098

Endoscopic transsphenoidal pituitary adenoma resection outcomes and complications: a recent Montreal Neurological Institute experience

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Background: The use of the endoscope for transsphenoidal surgery (ETSS) for pituitary adenoma resection is gaining popularity due to better visualization of the sellar anatomy and reports of promising outcomes. This case series reports patient demographics, visual field improvements (VFI), gross total resection rates (GTRR), endocrine remission, OR time, length of hospital stay and complications with ETSS. *Methods:* One-hundred and forty-four patients having undergone pituitary resection with ETSS by the senior author (DS) between 2006 and 2013 were identified. Forty patients were preliminarily analyzed. Data was extracted from pre and post-op MRIs, patient files, neurosurgery, ENT, endocrinology and neuro-ophthalmology clinic notes. *Results:*

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Demographics		
Age, y, mean ± SD	54 ± 16	N=40
Sex, No. (%)		N=40
female	16 (40)	N= 40
male	24 (60)	N= 40
Pituitary tumor type, No. (%)		N = 40
Non Functioning		
Pituitary Adenoma	22 (68)	N= 40
Acromegaly	8 (14)	N= 40
Cushings	4 (7)	N= 40
Prolactinoma	6 (11)	N= 40
Tumor size, No. (%)		N = 40
Macroadenomas	31 (77)	N= 40
Microadenomas	9 (23)	N= 40
NFPA (symptoms) , No. (%)		N = 22
VF defects	13 (59)	N = 22
Headache	12 (54)	N = 22
Apoplexy	2 (9)	N = 22
Symptoms for FA , No. (%)		N= 18
VF defects	1 (6)	N= 18
Headache	12 (67)	N= 18
Apoplexy	1 (6)	N= 18
Tumor extensions on MRI for NFPA, No. (%)		N = 22
supra-sellar	17 (76)	N = 22
cavernous sinus	12 (56)	N = 22
sphenoid sinus	5 (24)	N = 22
Previous operation, No. (%)	9 (23)	N= 40
Lumbar drain used intra-op	8 (20)	N= 40
Outcomes		
Post-op hospital stay, days ± SD	4.6 ±2.9	N= 40
Mean Follow-up, y ± SD	3.25 ±1.7	N= 40
Average OR time, mins ± SD	176 ±67	N= 40
GTR rate	23 (58)	N= 40
VFI for NFPA patients with visual deficits, No. (%)	11 (83)	N= 13
Acromegaly remission rates, No. (%)	5 (62.5)	N= 8
Cushing's disease , No. (%)	3 (75)	N= 4
PRL levels normalized, No. (%)	3 (50)	N= 6
Complications		
Complications No. (%)		N= 40
Transient DI	6 (15)	N= 40
Epistaxis	6 (15)	N= 40
CSF leak post-op	4 (10)	N= 40
Sinusitis	2 (5)	N= 40
Re-operatation rates No. (%)		
NFPA	2 (9)	N= 22
FA	4 (22)	N= 18

Conclusions: Preliminary VFI, GTRR and endocrine remission results are encouraging and we look to complete the analysis of the remaining patients. Future research, will aim to use consensus endocrine remission criteria, objective VF testing and tightly scheduled post-op MRI analysis to help more clearly define ETSS outcomes.

P.099

Reducing infections associated with implantable devices used in neurosurgery: retrospective analysis of prospective data

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Background: Implantation of spinal cord stimulators and intrathecal devices has become a widely used method in the management of chronic pain and muscle spasm. These procedures have a high risk of postoperative infectious complications associated with implantation of foreign bodies and frequent need for revision surgeries. Significant morbidity can result from deeper infections leading to neuraxial infections. Surgical protocols based on aseptic and antiseptic principles can reduce the rates of infections. *Methods:* We present prospectively collected data gathered over 5 years by the senior author. Several simple steps adhering to the basic principles of asepsis and antisepsis were followed consistently. The data was analyzed retrospectively, looking at the infection rates. Also, the literature review was conducted, and our findings were compared with the published data. *Results:* The sample included 286 patients, with 67 pump-related procedures and 219 stimulator-related procedures. Our infection rate was 1.4 percent. Reported infectious complication rates ranged from 2 to 10 percent. *Conclusions:* Strict adherence to the steps of asepsis and antisepsis can be effective in terms of the infection rate reduction. With the increased use of the implantation methods in Neurosurgery, sharing our experience and the systematic analysis of aseptic and antiseptic steps can have a positive influence on reducing morbidity and health care costs associated with these surgical procedures.

P.100

Pocket site infection prevention for patients with neuromodulation devices utilizing a new fully resorbable antimicrobial envelope: a two center Canadian prospective study

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Background: The impact of pocket site infections can be devastating for patients with Neuromodulation devices. The use of an antimicrobial envelope is known to be associated with reduced infections in high risk patients with cardiac implantable electronic devices. The goal of this study was to review the feasibility of the use of the antimicrobial envelope in our patient population with Neuromodulation devices. *Methods:* A prospective study among two centers; Regina Qu'Appelle and the Montreal Neurological Hospital have recruited ten consecutive patients for pulse generator insertion using the AIGISRx R antimicrobial envelope by TYRX. A design validation clinician questionnaire was provided rating the feasibility of the implantation. *Results:* Ten patients, six male and 4 female, on average 57.8 years-old were recruited. Four pulse generator placements were in the pectoral region and 6 in the abdominal region with average surgery duration of 14.6 min. Ten patients were rated acceptable for the implantation technique. *Conclusions:* This study demonstrates that it is feasible to use an antimicrobial envelope to prevent infections for patients with co-morbidities and multiple hardware placements. This approach will assist in maintaining the patient's therapy and reduce healthcare costs by minimizing the risk of surgical site infections.

P.101

Position-adaptive spinal cord stimulation provides a unique objective functional assessment in failed back surgery syndrome patients

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Background: Position-adaptive spinal cord stimulation has the novel advantage of recording real-time mobilization trends, percentages of time spent in upright and supine positions, as well as time spent transitioning between positions. This quantitative data is irrefutable and should complement answers obtained in validated functional questionnaires. This study analyzes the relationship

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between position and mobilization data and patient responses in corresponding sections of the Oswestry Disability Index (ODI). *Methods:* 42 patients were implanted with a RestoreSensor between 2010 and 2013. Data obtained from the stimulator diary was compared with ODI questionnaire responses concerning tolerance in sitting and upright positions, maximal ambulatory distances, and total amount of sleep. *Results:* There appears to be good reliability between the stimulator position-related data and ODI sitting and standing durations. The amount of undisturbed sleep also correlated well with the transitions documented by the stimulator while in a supine position. Mobilization data is less consistent with patients' reported walking distances. *Conclusions:* The position-adaptive stimulation diary is a useful complementary tool to objectively measure patient functional outcomes and refine their treatment plan.

P.102

Success rate of a more anterior entry point for endoscopic third ventriculostomy that is potentially safer to be used to biopsy posterior ventricular lesions

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Background: To examine the safety and efficacy of a more anterior entry point just behind the usual hair line for endoscopic third ventriculostomy (ETV) that may also be utilized for lesions biopsy in the third ventricle and pineal region with less chance of causing injury at the foramen monro level. *Methods:* We retrospectively reviewed our database for patients who had an attempt of ETV using a standard technique. A more anterior entry point just behind the usual hair line was selected. Data was collected at 6 weeks and 1 year, respectively. Analyses were done using the student chi-square method. *Results:* A total of 75 patients were included, 49 of which were male with an average age of 51.4 years. The procedure was aborted in 5; the most common cause was hemorrhage, followed by a thickened tuber cinereum. Twelve patients had successful biopsies, 8 of which were in the third ventricle and 6 in the pineal region. Indications for ETV were obstructive lesion in 34 cases, followed by NPH in 24 patients. All procedures were performed with no complications except in 9 operations. *Conclusions:* The described entry point is a safe and effective method for ETV. This method may be considered, especially when attempting ETV in addition to posterior ventricular lesions biopsy.

P.103

Subdural hematoma mimickers: literature review

D Catana (Hamilton) D Reddy (Hamilton) A Cenic (Hamilton) E Kachur (Hamilton)*

Background: Despite classic radiologic features of subdural hematomas, many authors report unexpected underlying etiologies. This work consolidates previous publications of non-vascular subdural hematoma mimickers. *Methods:* A search of English medical literature was conducted for subdural hematoma mimickers and related synonyms. Title screening of 462 articles yielded 103 pertinent publications. Forty-six cases from 1978 to 2013 were retained following abstract or article analysis. Two additional cases from our own experience are included for a total of 48 cases. *Results:* Non-vascular etiologies that mimicked subdural hematoma radiologic features included 10 cases of lymphoma, 7 metastatic lesions, 6 sarcomas, 6 primary CNS neoplasms, 5 infectious, and 3 autoimmune pathologies were also identified. Meningeal fibrosis, leptomeningeal myelomatosis, plasmacytoma, meningeal extramedullary hematopoesis, Rosai-Dorfman disease, and contrast extravasation post percutanenous coronary intervention populated the list of miscellaneous pathologies. *Conclusions:* This collection of records helps broaden the differential diagnosis of a common intracranial radiologic presentation. Radiologic and clinical factors for suspicion of unusual etiologies are discussed.

P.104

Use of time driven activity-based costing to assess personnel cost in a neurosurgical episode of care

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Background: Time-driven activity-based costing (TDABC) has been gaining popularity in health economics as a methodology potentially supporting value optimization initiatives. We assessed the feasibility of implementing the TDABC methodology in an academic neurosurgical department, concentrating specifically on personnel cost. *Methods:* Using process mapping methodology, each step of the care episode for patients referred for a microvascular decompression procedure was mapped. For each process step, time estimates of activities performed by the various personnel were noted. Each healthcare provider capacity cost rate was calculated ($/min). *Results:* Process mapping of the care episode was completed within 6 weeks, capturing all steps, time estimates, and different types of involved providers (61). Capacity-cost rate calculation was easily standardized for most non-physician health care providers ($0.24/min to $2.40/min). For physician capacity-cost rates, flexibility was required given the variability in work and salary models ($2.29/min to $3.87/min). Total personnel capacity cost was $730.88, $9147.01, and $174.91, respectively, for the outpatient pre-operative, inpatient peri-operative and outpatient post-operative phases. *Conclusions:* TDABC methodology enables to know precisely the cost (and its variability) of all activities of an episode of care, event those not accounted for by current accounting systems. TDABC facilitates accurate measurements, guiding operational planning and care redesign strategies to achieve optimal value of care.

P.105

Current deep brain stimulation practices across Canada

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Background: The number of Canadian patients being treated with Deep Brain Stimulation (DBS) for neuropsychiatric disorders is increasing, though the exact 'landscape' of DBS practice in Canada is unknown. We aimed to characterize the practice of DBS in Canada by region, volume and case type. *Methods:* An online survey regarding case types and volumes for 2012 was sent out to DBS practitioners nationwide. Surveys left entirely blank were excluded. Partially completed surveys were analyzed where answers were provided. *Results:* Results are preliminary. Nine surveys were included. All respondents were neurosurgeons. Five of nine respondents were the sole DBS practitioner at their site. 89% served

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populations greater than 1 million. Practitioners most commonly offered DBS for dystonia (89%), essential tremor (100%) and Parkinson's Disease (100%). In 2012, 33% performed 0 cases, 33% performed 6-25 cases and 33% performed over 30 cases. *Conclusions:* In Canada, DBS is primarily offered at centers serving large populations, averaging one DBS practitioner per center. Canadian practitioners most frequently treat PD, dystonia and essential tremor. Annual case volumes are low compared to other developed nations, suggesting under-utilization of DBS in Canada. There may be an argument for increased DBS utilization in Canada if future studies show a cost benefit to DBS.

NEUROSURGERY (NEURO INTERVENTIONAL)

P.106

Safety and efficacy of balloon-assisted coiling of intracranial aneurysms: a single-center study

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Background: Balloon-assisted and stent-assisted coil embolizations have become important adjuncts in the endovascular treatment of wide neck intracranial aneurysms. The need for anti-platelet agents when deploying intracranial stents, which could lead to increased morbidity and mortality in patients with ruptured aneurysm, has made the use of balloon-assisted coiling (BAC) a more prevalent approach in the last several years. We evaluated the safety and efficacy of balloon remodeling at our institute. *Methods:* We performed a retrospective review of all patients who underwent endovascular coiling of aneurysms from June 2012 to July 2012. *Results:* Total of 46 aneurysms were treated with endovascular technique. Balloon remodeling was used in 29 (63%). 23/29 (79%) were ruptured aneurysms. Following adverse events occurred: Thrombus formation 6/29 (21%); Vessel perforation 0/29 (0%); Dissection 0/29 (0%) and stroke related to thrombus formation 0/29 (0%). All of the thrombus formation occurred in ruptured aneurysms. Balloon inflation time did not correlate to thrombus formation *Conclusions:* In our single-center study, balloon remodeled coil embolization of aneurysm was not associated with serious complication. The thrombus formation occurred only in ruptured aneurysms. All thrombus formation resolved with antiplatelet agents and no permanent neurological deficits occurred. Balloon remodeling enabled treatment of wide neck aneurysm without stent assistance.

P.107

Stent-assisted vs non-stent-assisted coiling for embolization of intracranial aneurysms: clinical and angiographic results

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Background: The purpose of this study was to identify the predictors of retreatment, and favorable clinical and angiographic outcomes in aneurysms treated with stent-assisted coiling. *Methods:* We retrospectively analyzed data from the prospectively maintained Ottawa Hospital Aneurysm Database treated between December 2003 and June 2012. Characteristics of aneurysms and patients were recorded and analyzed in stent-assisted and non-stent assisted subcohorts. Univariate and multivariate logistic regression analyses were conducted to identify predictors of favorable clinical and radiological outcomes. A p-value of <0.05 was considered as statistical significance. *Results:* Out of 516 aneurysms, 63 (12.2%) had stent-assisted coiling of which 56 (89%) had unruptured status ($p<0.0001$) and 24 (38%) were in anterior circulation ($p=0.0024$). Baseline complete occlusion (Class I) was achieved in 24 (38%), and favorable outcome mRS 0-2 in 57 (90%) of cases of the stent group. The rate of retreatment was 9.5% vs 11.3% in the stent and non-stent group, respectively ($p=0.003$). In the multivariate regression analysis, age <55 years, absence of vasospasm and low WNFS grade (grades 1-3) at presentation were predictors of favorable clinical outcome, whereas female gender and small dome and neck size were predictors of favorable angiographic outcome. *Conclusions:* Stent-assisted coiling technique significantly decreases retreatment rates. We find no significant difference in the clinical outcome of stent-assisted and non-stent assisted coilings.

P.108

Dual-lumen balloon-assisted remodeling technique for complex intracranial aneurysms

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Background: Endovascular techniques in treating intracranial aneurysms have been evolving rapidly. Traditionally, a balloon remodelling technique for coiling aneurysms involves employing multiple microcatheters that may confer additional risks including vessel rupture and thromboembolic events. We report on the use of a dual-lumen balloon catheter that can be used as a single catheter microcoil delivery system, thereby reducing intra-procedural risks. This case series is intended to supplement the existing literature by highlighting the use of this technique in aneurysms with complex angioarchitecture. *Methods:* Retrospective review of 10 cases in whom the dual-lumen Ascent balloon microcatheter was used for coil embolization of intracranial aneurysms with complex angioarchitecture. *Results:* The dual-lumen balloon catheter system eliminated the need for multiple catheters, provided stability during coiling, prevented coil herniation, achieved proper coil packing, and preserved proximal vessels. There were no incidence of intraprocedural aneurysm rupture, vessel injury or dissection, thromboembolic consequences or branch occlusion with the use of this device. At 3 and 6 month follow-up, there has been no significant aneurysm recanalization or branch occlusion. *Conclusions:* Our initial experience with the dual-lumen Ascent balloon-microcather demonstrates a safe and effective technique with many key advantages in achieving successful embolization of complex aneurysms.

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NEUROSURGERY (NEURO ONCOLOGY)

P.109

Supratentorial tanycytic ependymoma (TE)

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Background: Portrayal of a giant more than 3 cm supratentorial TE and two years follow-up. *Methods:* A 20-year-old, male patient was admitted in our service in October 2011 with headache, diplopia and temporary loss of memory for the past three months. Brain-MRI showed a 3.4-3.3-3.1 cm lesion in the left lateral ventricle with obstruction of the foramen Monroi exerting pressure in the optic chiasm. Spinal cord-MRI revealed no metastases. Surgery was performed two days later. Histology revealed a TE. *Results:* A supratentorial giant TE taking its origin from the frontal horn of the lateral ventricle obstructing the foramen Monroi was completely removed. An external ventricular drainage was placed to avoid eventual complications. After surgery we remarked disturbance of memory and temporary disorientation. These symptoms disappeared one week later. A two years follow-up shows no recurrence. *Conclusions:* Large supratentorial TE is very rare. Only a few cases have been reported. Most of them affect the spinal cord. A complete resection might result in a complete healing.

P.110

Shedding light on brain tumours: testing the combination of photothermal therapy and 17-AAG in the treatment of glioblastoma multiforme

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Background: Glioblastoma Multiforme (GBM) treatment is limited by suboptimal surgical resection. Photothermal therapy (PTT) using light irradiation and gold nanoparticles (GNPs) may permit localized hyperthermic treatment. However, PTT is hindered by thermotolerance, facilitated by heat-shock proteins (HSPs). We hypothesized that the chemotherapeutic drug 17-(allylamino)-17-demethoxygeldanamycin (17-AAG), a HSP-90 inhibitor, would synergize with GNP-mediated PTT in GBM. *Methods:* 17-AAG and GNPs were delivered individually and in combination via dual-region loaded liposomes, to 90 wells of the WT U343 GBM cell line, with 12 control GBM wells. Treatment wells were irradiated using a 15W/cm2 500nm Light-Emitting Diode for 60 minutes. The viable cells were quantified using an Adenosine Tri-phosphate Bioluminescence Assay. *Results:* Direct light irradiation alone resulted in 6.6% cell lysis (95% confidence interval [CI] 5.4-8.2%). The addition of GNPs showed a limited improvement to 9.9% (95% CI 7.4-11.7%, P=0.007 versus light alone). 17-AAG by itself precipitated 68.8% lysis (95% CI 66.1-71.3%) and potentiated PTT even without GNPs, causing 75.9% lysis (95% CI 73.0-78.6%, P<0.0001 versus light alone). The combination of 17-AAG, GNPs, and light maximized lysis at 89.0% (95% CI 86.8-90.9%, P<0.0001 versus 17-AAG and light). *Conclusions:* Locally-delivered 17-AAG and GNPs demonstrated a synergistic effect in potentiating PTT-mediated GBM cell lysis. Ensuring the relative safety of healthy cell lines is critical before transitioning to animal models.

P.111

Renal cell carcinoma metastatic to the spine: a systematic review of prognostic features and treatment

*J Pearl (Saskatoon)**

Background: Although general indications for the treatment of spine metastases are widely publicized, there is a lack of evidence-based guidelines for renal cell carcinoma (RCC), that incorporate specific prognostic factors. Our objective was to answer two key questions: 1. Are there any clinical, radiologic or pathological features of spinal RCC that significantly affect life expectancy or local control? 2. What is optimal treatment including radiation therapy, stereotactic body radiation therapy (SBRT), vertebral augmentation, and intralesional or en bloc surgery? *Methods:* A systematic search of PubMed was conducted. We excluded non-English and non-clinical publications, review articles and reports with <10 patients. For Q1 we included all studies assessing prognostic or therapeutic factors for metastatic RCC. For Q2 we included studies after 1990 addressing any treatment for spinal RCC. *Results:* Several prognostic factors were identified. Most consistent were the Memorial Sloan-Kettering Cancer Center (MSKCC) criteria, In 7 articles for Q2, there were no comparative studies addressing radiation therapy, SBRT, vertebral augmentation, intralesional surgery or en bloc surgery. The role of en bloc surgery for solitary spinal RCC is questionable given the disease control achieved with SBRT. *Conclusions:* This review highlights the need for controlled studies comparing treatments for spinal RCC. An understanding of prognostic factors specific to RCC may help the development of evidence-based guidelines.

P.113

Resection extent improves progression-free survival for grade 2 Astrocytoma patients

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Background: The treatment of grade 2 astrocytomas (G2A) remains controversial as the effects of resection extent, radiotherapy (RT), chemotherapy (CT), and treatment combinations on progression-free survival (PFS) remain unclear. This case series reports PFS in G2A patients treated with combinations of surgery, CT and RT at the Montreal Neurological Institute from 2002 to 2012. *Methods:* Forty-three histologically confirmed G2A patients, treated between 2002-2012, were retrospectively analyzed using medical records, pathology reports, pre-operative and post-operative MRIs, operative reports, and outpatient clinic notes. *Results:* A total of 43 subjects were included in the analysis (24 males and 19 females). The subjects' ages at diagnosis ranged from 18 to 77 years (mean = 41.9, SD = 13.3). The overall median PFS was 64 months. A Cox Proportional Hazards regression model was fitted for the following variables: resection extent, age at diagnosis and concomitant treatment with CT and/or RT. Only the extent of tumor resection was shown to be protective in terms of G2A PFS (Hazard Ratio = 0.45, CI = 0.22-0.91). *Conclusions:* Our data suggests that only resection extent improves progression free survival in G2A patients. An IDH1 analysis of all the tumors studied in this analysis

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is currently underway. We hope to confirm our recent observational experience that aggressive surgery is particularly beneficial in IDH1 G2A.

P.114

Evaluation of vision-related quality of life (QOL) after transsphenoidal resection of pituitary adenoma

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Background: Reportedly 80% of patients demonstrate improvement in visual acuity and fields after transsphenoidal resection of pituitary adenoma. However, it remains unclear how these reported rates translate into subjective improvement in visual outcomes and general health as scored by patients in long-term follow-up. *Methods:* Our study prospectively collected data on 37 patients, who underwent transsphenoidal resection of pituitary adenomas between 2011-2013. Patients were requested to complete the National Eye Institute Visual Function Questionnaire (NEIVFQ-25) preoperatively, at 6-week and 6-month follow-up. The VFQ-25 consists of 25 questions, assigned to 1 of 12 subscales including general health, general vision, ocular pain, near activities, distance activities, social functioning, mental health, role difficulties, dependency, driving, color vision, and peripheral vision. *Results:* All patients had preoperative visual impairment and histologically verified pituitary adenomas. An improvement in general and peripheral vision, near and distance activities, mental health, and composite VFQ-25 score was seen 6 weeks post-operatively. This effect was maintained at 6 months follow-up, although without an associated improvement in reported general health. *Conclusions:* Vision-related QOL significantly improves after transsphenoidal surgery, seen at 6 weeks and persisting at 6 months. The use of QOL questionnaires such as the VFQ-25 provides a more comprehensive assessment of outcomes of transsphenoidal surgery.

P.115

Endonasal ressection of a neuroendocrine tumor of the anterior skull base: an unusual case of tumor induced osteomalacia

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Background: The purpose of this study is to describe a very unusual case of an 8 year investigation and treatment of advancing osteomalacia. *Methods:* Ethics approved retrospective analysis of medical records from a patient with induced osteomalacia by a hormone producing tumor of the Interior Cranial Fossa. *Results:* A 56-year-old male patient presented with a loss of height of two inches in two years. Investigations revealed vitamin D deficiency with high levels of alkaline phosphatase. Further investigations led to diagnoses of advanced osteomalacia through bone biopsy. Within two years vitamin D and calcium levels improved with supplementation, however the alkaline phosphatase would not normalize. Two years later the patient had multiple fractures indicative of advancing osteomalacia. An endocrinologist was consulted. They proceeded to measure FGF23 hormone levels for a suspected mesenchymal tumor. Also a octreotide scan with Tomographic CT of the head revealed the tumor in the Interior Cranial Fossa. The tumor was removed endonasally without complication nearly 8 years after the diagnosis of osteomalacia and within 7 months the patient's phosphate, calcium, magnesium and vitamin D levels had all normalized. *Conclusions:* We report here a very unusual case of an 8 year investigation on tumor induced osteomalacia. The skull base tumor was removed endoscopically and the patient recovered well.

P.116

The utility of different MRI sequences in glioblastoma

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Background: One of the most commonly utilized clinical tools when deciding treatment for, and following patients with glioblastoma (GBM) is the T1-weighted post-gadolinium magnetic resonance imaging (MRI) sequence (T1-PG). Furthermore, T1-PG sequence has been used primarily for volumetric assessment of GBM pre-operatively and to assess extent of resection post-operatively. It is unclear how contrast enhancing tumor volume relates to tumor volume in other MRI sequences such as fluid attenuated inversion recovery (FLAIR) and whether additional prognostic information can be derived from this supplementary MRI sequence. *Methods:* Pre-operative MRI of 10 patients (4F:6M, mean age 68 years) with a diagnosis of GBM were reviewed retrospectively and volumetric measurements of their tumors were performed on T1-PG and FLAIR sequences. Enhancing tumor volume on the T1-PG sequence was calculated using manual tracing method while volume of abnormal signal intensity on the FLAIR sequence was measured using the modified MacDonald Criteria. *Results:* Mean volume of enhancing tumors in the T1-PG sequence was 38.2 cm3, while mean volume of abnormal signal intensity in the FLAIR sequence was 167.8cm3. There was significant correlation between the two volumetric measurements (r= 0.70). *Conclusions:* While contrast enhancing tumor volume remains central in radiographic characterization of GBM, further examination of various available MRI sequences, including FLAIR, may yield new information for patient management and prognosis.

P.117

Confocal laser endomicroscopy: A new technique for performing optical biopsies in neurosurgery

*C Charalampaki (Cologne)**

Background: Early detection and evaluation of brain tumors during surgery is crucial for accurate resection. Currently cryosections during surgery are regularly performed. Confocal laser endoscopy (CLE) is a novel technique permitting *in vivo* histologic imaging with miniaturized endoscopic probes at excellent resolution. Aim of the project is to evaluate CLE for *in vivo* diagnosis in different types and models of intracranial neoplasia, and found out its intraoperative usability for better resection of malignant brain tumors. *Methods:* To evaluate the surgical application in patients, fresh surgical resection specimen of human intracranial and spinal tumors were examined. Healthy tissue adjacent to the samples served as control and was used for better differentiation between normal and pathological tissue. *Results:* CLE yielded high-quality histomorphology of normal brain tissue and tumors. Different fluorescent agents revealed distinct aspects of tissue and cell structure (nuclear pattern, axonal pathways, hemorrhages). CLE discrimination of neoplastic from healthy brain tissue was easy to perform based on tissue and cellular architecture

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and resemblance with histopathology was excellent. *Conclusions:* Confocal endomicroscopy is a developing method for diagnosis of various neurosurgical disorders. It provides real-time images to aid in the diagnosis and management for these conditions. CLE achieves a more targeted optical biopsy of the abnormal tissue to expedite the therapeutic planning and decisions regarding surgical intervention.

P.118

Confocal laser endomicroscopy for real time histomorphological diagnosis: our clinical experience with 150 cases

*C Charalampaki (Cologne)**

Background: Confocal laser endoscopy (CLE) permits *in vivo* histologic imaging with miniaturized endoscopic probes at excellent resolution. Goal was: 1) to analyze the technical aspects of CLE technique, 2) to investigate the integration of CLE in daily workflow in the operation room, 3) to create an easily integration of the technique into the daily routine used endoscopic setting and providing immediate and intraoperativ histopathologic diagnosis of the entire entity on real time. *Methods:* Fresh surgical biopsies of 150 intracranial and intraspinal lesions were examined to test the signal intensity and adequate contrast for CLE imaging after topical application of 0.1ml acriflavine. Reproducible and specific histomorphologic criteria was the *ex vivo* histopathologic gold standard stainings according to our neuropathologists data. *Results:* We combined the CLE equipment, with the microscopes and endoscopes in a picture in picture modus. The insertion of the CLE optical probe into the working channel of conventional endoscopes was easy to performed. CLE yielded high-quality histomorphology of brain and spinal tumors. CLE discrimination of tissue was easy to perform and the resemblance with histopathology was excellent. *Conclusions:* CLE allows immediate *in vivo* imaging of normal and neoplastic brain tissue at high resolution. It may become helpful to screen for tumor free margins to accurate surgical resection of malignant brain tumors on a cellular level.

P.119

Giant meningiomas of the anterior and middle fossa: removal under endoscope-assisted key“burr”hole conditions via an eyebrow incision

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Background: Conventional open surgery of giant meningiomas contains some special difficulties. In the present study, we retrospectively analyzed the surgical technique, and outcome in 40 patients with giant meningiomas located in the frontal fossa and partly extended into the middle fossa. All patients were treated via a keyhole craniotomy. *Methods:* Within 5 years, 40 patients (12 male, 28 female) underwent surgery in the frontal and temporal base for giant meningiomas (diameter>5cm). Depending on the localization of the tumor, the skin incision in the eyebrow was between 2.5 and 3 cm long. Subsequently, a key“burr”hole craniotomy was performed of approximately 0.8 x1.2-1.4 cm in diameter. *Results:* Headache and psycho-organic syndrome were the most common symptoms. Disturbances were associated with psychological deterioration in 23, visual disorder in 19, and anosmia in 17 patients. Intraoperative complications were not existed. Postoperative 2 patients underwent emergency surgery because of an acute subdural bleeding and a pneumocephalus. *Conclusions:* Choosing the correct placed keyhole approach with a refinement of the classic keyhole craniotomy to a more smaller key“burr”hole approach, with the use of modern and new designed equipment it is possible to perform complex skull base procedures with the same safety, efficiency and less complication rates as described in the literature for giant meningeomas even performed with classic keyhole craniotomies.

P.120

Primary central nervous system lymphoma and corticosteroid use: a single-centre study

*M Binnahil (Edmonton)**

Background: In patients with imaging-suspected Primary CNS Lymphoma (PCNSL), corticosteroid therapy for cerebral edema is typically withheld because of a perceived association with non-diagnostic biopsy. We aimed to determine to what degree corticosteroid administration actually impacts biopsy yield in PCNSL. *Methods:* From an institutional operative database, we identified all patients who underwent stereotactic biopsy at our centre for a cerebral mass lesion between March, 2007 and March, 2013. We determined the number of patients with biopsy-confirmed PCNSL, and by chart review identified how many had received corticosteroids pre-biopsy. Further, among all patients with a initial, non-diagnostic biopsy, we determined if any eventually went on to receive a diagnosis of PCNSL, and, of these, how many had been treated with corticosteroids. *Results:* We identified 20 patients with biopsy-proven PCNSL. Of these, 15 had received corticosteroids prior to biopsy, without any negative impact on diagnostic yield. In addition, no patients with a cerebral mass lesion and an initial, non-diagnostic biopsy ever went on to receive a diagnosis of PCNSL either on repeat biopsy or at autopsy. *Conclusions:* In our sizeable series, corticosteroid therapy in patients with suspected PCNSL does not appear to result in a higher rate of non-diagnostic biopsy.

Neurosurgery (Neurovascular Adult and Pediatric)

P.121

Pharmacokinetics of intraventricular tissue plasminogen activator in aneurysmal subarachnoid hemorrhage patients

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Background: Intraventricular hemorrhage (IVH) frequently complicates intracerebral or subarachnoid hemorrhage (SAH) and is associated with poor outcomes. Administration of intraventricular tissue plasminogen activator (TPA) accelerates blood clearance, but the optimal dosing interval is unknown. *Methods:* We randomly allocated patients with aneurysmal SAH and IVH treated with endovascular coiling and ventricular drainage to receive 2 mg intraventricular TPA or placebo every 12 hours (5 doses). CT scans were performed 12, 48 and 72 hours after initial administration and intracranial blood was quantified using SAH and IVH Scores. Cerebrospinal fluid (CSF) TPA and D-dimer levels were measured at baseline and 1, 6 and 12 hours after the first TPA dose using ELISA. *Results:* Median CSF TPA concentrations (with interquartile ranges) in seven TPA-treated patients were 525 (352-2129), 323 (233-413),

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and 47 (29-283) ng/ml, respectively, 1, 6 and 12 hours after drug administration. Peak concentrations varied markedly (401-8398 ng/ml). Two patients still had elevated levels (283-285 ng/ml) when the next dose was due. There were no hemorrhagic complications and no correlation between TPA concentration and D-dimer levels or rate of blood clearance. D-dimer concentration peaked at 6 hours and correlated strongly with radiographic IVH clearance (r=0.94, p=0.005) *Conclusions:* The pharmacokinetics of CSF TPA vary considerably between individual patients. Administration every 12 hours is an appropriate dosing interval.

P.122

Third nerve palsy recovery after posterior communicating artery aneurysm coiling: a single centre experience and systematic review of the literature

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Background: The treatment modality of intracranial aneurysm associated with third nerve palsy (TNP) remains a controversial topic. While microsurgical clipping has been the traditional treatment of choice, endovascular coiling has become a valid alternative. In this study, we conducted a systematic review of the literature and analyzed the TNP recovery rates after coiling at our centre. *Methods:* A retrospective review of patients with TNP resulting from posterior communicating artery (PcomA) aneurysms that underwent a coiling procedure at the Hamilton General Hospital were reviewed between July 2006 and July 2010. *Results:* Of the 10 patients identified only 3 patients had ruptured aneurysms. Six patients presented with a complete TNP while 4 had a partial presentation. At one year, recovery was complete in 7 patients. Three patients had partial improvement. In the literature review, 14 studies were included resulting in a total of 133 patients with third nerve palsy from PcomA aneurysms. Of these, 53.3% had ruptured aneurysms. The recovery rates were 51.1% and 46.6% for complete and partial recoveries respectively. Only 4.5% of patients had no recovery on follow up. *Conclusions:* Endovascular coiling results in high rates of third nerve palsy recovery.

P.123

Balloon test occlusion and vessel sacrifice of a distal A3 segment for the treatment of a giant aneurysm: a case report

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Background: Balloon test occlusion (BTO) is a common endovascular procedure for the evaluation of appropriate collateral supply to a distal vascular territory. This method is used to determine the safety of a permanent occlusion for the management of head and neck tumors, giant aneurysms or aneurysms with complex anatomy. BTO is commonly performed in the cervical- or proximal intracranial vessels. Literature on test occlusion of small, distal intracranial vessels is limited. *Methods:* A 65-year-old male with a mild headache presented with an unruptured giant 5.8 cm, partially-thrombosed, aneurysm of the distal right anterior cerebral artery (ACA) with surrounding vasogenic edema and mass effect on the left frontal lobe. A well-tolerated BTO of the distal ACA, just proximal to the aneurysm, was performed. The ACA segment was sacrificed with coils with the patient awake throughout the procedure. *Results:* The patient had an unremarkable post-operative recovery. His symptoms improved and an interval decrease in size of the aneurysm, with no evidence of recent ischemic events demonstrated on follow-up MRI. *Conclusions:* BTO in a small distal terminal branch of the ACA proved to be useful in determining the safety of a permanent vessel sacrifice for the treatment of a giant intracranial aneurysm.

P.125

Principle component based regression analysis of the cerebral collateral circulation using CT angiography measurements and carotid stump pressure

BH Wang (London) B van Adel (London) E Small (London) A Leung (London) S Karlik (London) MR Boulton (London) SP Lownie (London)*

Background: The Circle of Willis (CoW) is the most effective collateral circulation to the brain. Carotid stump pressure (CSP) is an established surrogate measure of cerebral collateral circulation. This study aims to quantitatively assess the adequacy of collateral circulation using CT angiography (CTA) measurements via correlation with CSP. *Methods:* CSP was measured intra-operatively during carotid endarterectomy on 91 patients. Vessel segment diameters and mean arterial pressure (MAP) were correlated with CSP using the partial least squares (PLS) regression – a technique based on principle component analysis. The analysis was also performed on 22 patients with severe contralateral carotid stenosis. *Results:* Three main factors influence the cerebral collateral circulation: MAP, contralateral ICA stenosis and anterior circulation (specifically contralateral A1 and A-Comm). The posterior circulation (specifically ipsilateral P1 and bilateral P-Comm's) consistently influenced the CSP only in the subgroup of patients with severe contralateral carotid stenosis. CSP can be predicted based on MAP and vessel diameters using the following equation(R2=0.37,±12.3mmHg):

CSP=-11.2+0.36*MAP+1.8*cICAst+8.2*cA1+9.3*ACo

For patients with severe contralateral carotid stenosis (R2=0.75,±6.4mmHg):

CSP= 42.2+0.47*MAP+9.2*ContraA1+9.7*IpsiP1+12.8*iPCo+6.9 *cPCo

Conclusions: The anterior pathway plays a greater role than the posterior pathway during ipsilateral carotid occlusion except for patients with severe contralateral carotid stenosis. The most favourable condition exists in patients with large contralateral A1, patent A-Comm and minimal contralateral ICA stenosis.

P.127

Intracranial dural arteriovenous fistulas: incident, clinical presentation, and treatment outcomes. The Saskatchewan experience

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Background: Intracranial dural arteriovenous fistulas (dAVF) can be grouped into intracranial dAVF's and carotid cavernous fistulas (CCF's). The purpose of this study was to report our experience

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managing dAVF's. *Methods:* A prospective database was searched from November 2007 to October 2013. Treatment methods, outcomes and complications were analyzed. *Results:* 6 patients with CCF's and 13 with dAVF's were identified. 16 patients underwent endovascular embolization and 3 underwent endovascular embolization followed by surgery. Complete obliteration of dAVF by endovascular embolization alone was achieved in 13/ 16 patients (81.3%). When considering CCF, 6 / 6 patients (100%) were cured by embolization alone. The 3 remaining dAVF patients had symptomatic improvement, correction of retrograde corticovenous drainage and further treatment was felt to be unnecessary. All 3 patients who received embolization followed by surgery were cured of their disease (100%). There were 3 complications in total. One patient with CCF developed CN VI palsy post-embolization. For the group who underwent surgery, one patient developed deep vein thrombosis and another a post-craniotomy infection. No patients experienced hemorrhage as a result of dAVF treatment. *Conclusions:* Endovascular treatment of both CCF's and dAVF's in Saskatchewan has a very high cure rate with low complications. Multimodality treatment is necessary in some patients.

P.128

Management of ruptured intracranial aneurysms in a Canadian tertiary care centre: clinical outcomes for coiling and clipping over a ten-year period post-ISAT

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Background: The results of the International Subarachnoid Aneurysm Trial (ISAT) published in 2002 marked a turning point in the management of ruptured intracranial aneurysms. We present the Halifax experience and outcomes of aneurysmal subarachnoid hemorrhage (aSAH) managed with surgical clipping and endovascular coiling over a ten-year period post-ISAT. *Methods:* The Division of Neurosurgery maintains a prospective database of all patients admitted with cerebrovascular conditions. This was queried for all patients admitted with aSAH from 2003-2012. Demographic variables, comorbidities, WFNS grade, Fisher grade, treatment modality and Glasgow Outcome Scores (GOS) at hospital discharge and follow-up were extracted and analyzed. *Results:* There were 464 admissions for SAH, with 385 patients proceeding to aneurysm treatment. Of these, 124 (32%) were clipped and 261 (68%) coiled. Age of treated patients ranged from 17-90 years (mean 55), with a female preponderance (71%). Mortality was 16%. At time of hospital discharge, 80% of survivors were independent (GOS 4 or 5), improving to over 90% in follow-up. Rates of mortality and dependence were not significantly different between treatment modalities, though were related to grade at presentation. *Conclusions:* The majority of ruptured aneurysms were treated with endovascular coiling. Outcomes were not significantly different between patients treated with coiling or clipping.

P.129

Ruptured giant middle cerebral artery aneurysm in infancy

*RA Alyoubi (Toronto)**

Background: Intracranial aneurysms are uncommon in children. Rupture of giant intracranial aneurysms is extremely uncommon in infants even in autopsy studies. *Methods:* it is a case report, presenting an unusual case of ruptured giant middle cerebral artery aneurysm in an 11-month-old female infant who presented acutely with unresponsiveness and seizures. The aneurysm was clipped during an urgent craniotomy for evacuation of an associated hematoma. *Results:* She recovered slowly with mild residual right-sided weakness. Follow-up arterial angiography revealed no residual or other aneurysms. Further follow-up revealed motor delay and recurrent partial seizures. Active physiotherapy was performed and she could walk independently by 3 years-of-age. *Conclusions:* Intracranial aneurysms have to be considered in the differential diagnosis of infants presenting with acute raised intracranial pressure. Favorable outcome is noted in children who are managed promptly in hospitals with neurosurgical units

P.130

Catheter based selective brain cooling to facilitate giant aneurysm repair

P Lopez Ojeda (London) TK Mattingly (London) M Arango (London) P Allen (London) B Lehrbass (London) SP Lownie (London)*

Background: Hypothermia is the most potent available neuroprotectant against cerebral ischemia. However, total body cooling techniques are associated with significant systemic risk. Selective brain cooling may offer similiar neuroprotection without the need for full cardiopulmonary bypass. *Methods:* A 49-year-old man presented with an unruptured giant aneurysm of the right middle cerebral artery. Endovascular coiling was not an option due to the wide aneurysm neck and extensive intraluminal thrombus. Evacuation of the aneurysm and clipping was anticipated to require an extended period of ischemia and high risk for stroke. *Results:* Using a 14 French / 8 French coaxial balloon catheter system specifically manufactured for selective infusion, endovascular transfemoral cannulation of the right common carotid artery was performed. Via extracorporeal cooling of the aortic outflow blood, and reinfusion into the common carotid territory, selective cooling of the hemicranium to 26 degrees was accomplished. This permitted a prolonged period of cerebral circulatory arrest for the removal of the aneurysm thrombus and successful aneurysm neck clipping. There were no neurological complications. *Conclusions:* This is the first report of the clinical use of a selective brain cooling catheter. Based on this preliminary success, further investigation of this technology for neuroprotection against focal cerebral ischemia is warranted.

P.131

Surgical treatment of radiation necrosis for arteriovenous malformations: a case series

*JD Sharma (Vancouver)**

Background: Stereotactic radiosurgery (SRS) is an effective treatment for arteriovenous malformations (AVMs). SRS can result in radiation necrosis (RN), a severe form of radiation injury. Surgery is indicated for symptomatic RN that fails to respond to systemic corticosteroids. This case series examines potential risk factors and reviews outcomes for cases of RN post-AVM treatment that were managed with surgery at our institution. *Methods:* A retrospective chart review was undertaken to identify patients with AVMs treated with radiation at the BC Cancer Agency between September 1997 and April 2011. Electronic records were searched to identify patients who underwent surgery for the treatment of RN. We extracted data

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on patient demographics, radiation type (SRS vs. fractionated), AVM characteristics, RN characteristics and outcome after surgery. *Results:* Of the 103 patients treated with radiation for AVMs, 5 patients underwent surgery for symptomatic RN. All surgically treated patients received single dose SRS. There was mass effect and cystic changes in all 5 patients. All patients experienced symptom improvement after surgery. *Conclusions:* Surgery is effective for the treatment of RN in irradiated AVMs. Potential risk factors for surgery include single dose SRS, cystic changes and mass effect. More research is needed to determine if long-term outcomes are also favourable.

NEUROSURGERY (PEDIATRIC NEUROSURGERY)

P.132

Pediatric neurosurgery in Kenya - the experience of 2 Canadian paediatric neurosurgeons

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Background: Kenya, a country of 43 million people, is serviced by 1 paediatric neurosurgeon, centred at Kijabe Hospital, 60 km northwest of Nairobi. 2 Canadian paediatric neurosurgeons visited Kijabe to act as consultant neurosurgeons for two separate two week intervals in 2013 and 2014. *Methods:* The operative experience of the 2 surgeons was reviewed. Cases were divided into the following categories: 1) Hydrocephalus 2) Spinal dysraphism 3) Encephalocele 4) Tumour 5) Miscellaneous. Major morbidity and mortality was also recorded. *Results:* The two paediatric neurosurgeons participated in a total of 70 cases, 65 in children. 33 procedures treated hydrocephalus, with 21 shunt insertions, 3 shunt revisions, 3 endoscopic third ventriculostomies (ETV), 4 ETVs with choroid plexus coagulation (ETV/CPC) and 1 external ventricular drain (EVD). 18 operations to treat spinal dysraphism were done, 14 to close open neural tube defects (ONTD), 3 to treat closed dysraphic states and one spinal cord detethering. 3 occipital encephaloceles were treated. There were 11 brain tumours and 1 spinal cord tumour. There were 4 miscellaneous cases. There was one preoperative mortality and 3 wound dihiscences. *Conclusions:* Kenya represents an extremely underserviced area for paediatric neurosurgery. Procedures to treat hydrocephalus and spinal dysraphism represent the majority of cases. The environment offers a unique set of rewards and challenges to visiting neurosurgeons.

P.133

Decompression of Chiari malformation type 1.5 improves sleep-disordered breathing on polysomnography

*A Hockley (Calgary)**

Background: Chiari 1.5 is a newer addition to the Chiari malformation family. It is characterized by tonsillar and midbrain descent below McRae's line. One of the presenting symptoms complexes is that of sleep disordered breathing, which is best formally evaluated by polysomnography. *Methods:* This is a retrospective review of consecutive patients presenting with Chiari 1.5 malformation and sleep-disordered breathing. The sleep disordered breathing was characterized with polysomnography both before and after surgery allowing documentation and comparison of several variables including: apnea hypopnea indices, respiratory arousal indices, and mean oxygen saturation. The surgery performed was a standard suboccipital craniectomy followed by removal of the posterior arch of C1 and expansile duraplasty. *Results:* Our review uncovered four patients with Chiari 1.5 malformation and polysomnographic evidence of sleep disordered breathing. The mean tonsillar descent was 24.1mm (+/- 4.6). Three of four showed marked improvement in their polysomnographic testing, with one other patient confounded by premature post-operative testing. *Conclusions:* When evaluating pediatric patients with Chiari malformation it is necessary to inquire about signs and symptoms of sleep disordered breathing. For patients with Chiari type 1.5 malformation presenting with sleep disordered breathing as part of their symptom complex, a posterior fossa decompression and duraplasty appears to offer marked improvement in sleep disordered breathing, as evidenced by post-operative polysomnography.

P.134

Outcomes of intraventricular hemorrhage and post-hemorrhagic hydrocephalus in a population-based cohort of very-preterm infants born to residents of Nova Scotia from 1993 to 2010

JA Radic (Halifax) M Vincer (Halifax) PD McNeely (Halifax)*

Background: Intraventicular hemorrhage (IVH) and post-hemorrhagic hydrocephalus (PHH) are common complications of preterm birth. We describe 2-3 year outcomes of IVH, PHH and shunt surgery in a population-based cohort of very-preterm infants (> 19 and < 31 weeks gestational age) with minimal selection bias. *Methods:* A perinatal database that includes all very-preterm infants born from 1993 onwards to residents of Nova Scotia was screened for successfully resuscitated infants born from January 1, 1993 to December 31, 2010. Univariate/multivariate logistic regression were used to look at the associations between IVH and primary outcome measures ('overall mortality at 1 year after birth', 'any disability'), and secondary outcome measures ('severe disability', 'cerebral palsy (CP)', 'hydrocephalus', 'shunt surgery', 'blindness, 'deafness', 'MDI cognitive testing score') between birth and final follow-up. *Results:* On univariate analysis, IVH was significantly associated with an increased overall mortality (OR=2.40, p<0.001) by 1 year, and disability (OR=1.60, p=0.002), severe disability (OR=1.82, p=0.003), CP (OR=3.37, p<0.001), hydrocephalus (OR=undefined, p<0.001), shunt for hydrocephalus (OR=undefined, p<0.001), deafness (OR=3.30, p=0.020), and a lower MDI score (-4.10 points, p=0.008) by 2-3 years after birth. The risk increases with IVH grade. *Conclusions:* IVH grades 1/2 are associated with better outcomes vs grades 3/4. Given the low risk of selection bias, this study's numbers may help characterize the prognosis of IVH/PHH.

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P.135

A physical simulator for intraventricular neuroendoscopy – validation and performance assessment

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Background: Neuroendoscopy is well-suited for simulation, given its technical demands and potential risk. We constructed a realistic, low cost, reusable simulator for Endoscopic Third Ventriculostomy (ETV) and evaluated its fidelity. We also developed three assessment tools to standardize evaluation. *Methods:* A silicone brain replica including relevant anatomy (choroid, mamillary bodies, thinned out third ventricular floor etc.) was immersed in water. Standard neuro-endoscopic equipment was used. Fidelity was scored by 16 neurosurgical trainees (PGY 1-6) and 9 neurosurgeons. A procedural and error checklist and global rating score (GRS) were developed by electronic Delphi survey amongst 17 international experts. *Results:* The simulator is portable and sets quickly. Over 95 % of participants agreed or strongly agreed that the simulator's features (anatomy, tissue properties, bleeding, etc.) were realistic. Participants stated that the simulator developed required hand-eye coordination and camera skills. Delphi panelists reached consensus on each ETV step, error and GRS item within 3 iterations. *Conclusions:* A low-cost reusable silicone-based ETV simulator realistically represents the surgical procedure to trainees and neurosurgeons. It can develop the technical and cognitive skills for ETV including managing complications. Further validation of the assessment tools at international endoscopy training courses is underway.

NEUROSURGERY (SPINE)

P.136

Neurenteric Cyst of spinal cord (unusual posterior location)

*M Maleki (Montreal)**

Background: Neurenteric Cysts (NC) rare developmental lesions which are formed due to inappropriate partitioning of the embryonic notochordal plate and presumptive endoderm, during the third week of human development. Heterogeneous rests of epithelium, reminiscent of gastrointestinal and respiratory tissue, lead to eventual formation of compressive cystic lesions of paediatric and adult spinal cord. Clinical presentation usually happens in the second & third decade of life, with myelopathy and/ or radiculopathy. Majority are located ventral to the spinal cord and are intradural-extramedulary. They are rarely purely located posteriorly, as in our case. *Methods:* Female age 57, presented with a long standing paresthesia of left hemi-body. MRI, showed an intradural lesion located posterior to C4-C5 spinal cord *Results:* She was operated with a C4-C5 laminectomy and gross total excision of a cystic lesion, with pathological diagnosis of Neurenteric Cyst. She had improvement of her left hemibody paresthesia. F/U MRI four years later did not show any recurrence of neurenteric cyst. *Conclusions:* Nerenteric cysts of spine are developmental anomalies. They account for 0.7-1.3% of spinal axis tumors. Majority occurs ventral to thoracic spinal canal, and are intradural extra-medullary. Majority could be removed safely with microsurgery. Incomplete removal may lead to recurrence.

P.137

Lower stimulation thresholds at the apical pedicle in pediatric spine deformity

HD Hansen (Saskatoon) J Norton (Saskatoon) L Allen (Saskatoon) D Hedden (Edmonton) A Dzus (Saskatoon)*

Background: Electrical stimulation of the pedicles, using a probe, during spine deformity surgery is a tool that can assist surgical decision making during instrumentation. Spine stimulation guidelines have not been well-developed for the thoracic spine, or for severely scoliotic spines. We suspected that thinner pedicles around the apex of a deformity on the concave side might lead to lower stimulation thresholds than pedicles that are less deformed. *Methods:* We compared the stimulation thresholds for pedicles at both the apex and the upper and lower instrumented levels. We reported only pedicles for which a stimulation threshold was reported, but no breach found. *Results:*

	Apex	**Terminal level**	
Threshold (mean +/-s.d)/mA	16.62 +/-0.78	18.25+/-0.67	(p<0.05 t-test)
Number of pedicles	192	169	

Conclusions: In this study we report only the thresholds for the concave side, the pedicle that is most likely to be reduced in size. The threshold for stimulation is reduced compared to those seen at the highest and lowest instrumented level. We believe that this study provides preliminary evidence that the apical, concave pedicle has a lower threshold than the end pedicles.

P.138

Vascular injury from Rheumatoid Spondyloarthropathy - a challenging diagnosis

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Background: Neurological symptoms in the presence of rheumatoid cervical instability are frequently attributed to neural compression. Vascular compromise is an infrequently recognized aetiology and often identified only after irreversible injury. The diagnosis and management of rheumatoid patients with vascular insufficiency is not established. *Methods:* Case series and literature review. *Results:* We present two cases where vascular compromise due to rheumatoid cervical instability was recognized early and treated, resulting in symptom resolution without permanent impairment. There are only 12 previous cases. Most presented with vertebrobasilar circulation symptoms. 2 patients presented moribund or dead. The vertebral arteries were injured at the atlanto - axial junction most frequently. Two patients without structural abnormalities had dynamic vascular imaging to demonstrate flow limitation from pathologic motion across the cranial - cervical junction. Most underwent occipital-cervical fusion although stabilization in a hard collar was also effective for some patients. *Conclusions:* A small number of patients with rheumatoid spondyloarthropathy will suffer vascular injury from cranial cervical

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instability. Recognition of this condition requires dedicated vascular imaging; dynamic imaging may assist in the diagnosis in select cases. Management is complex and requires consideration of the natural history, indications for mechanical stabilization, and potential morbidities in compromised patients. Ultimately, physicians must consider whether the interventions proposed outweigh risks that the patients may face.

P.139

Lumbosacral discitis-osteomyelitis after mesh abdominosacrocolpopexy

Z Tymchak (Saskatoon) A Epp (Saskatoon) D Fourney (Saskatoon)*

Background: Lumbosacral discitis-osteomyelitis is a well-described complication of mesh abdominosacrocolpopexy in the gynaecology literature, however there are few reports in the spine literature. We present the case of a L5/S1 discitis-osteomyelitis following trans-vaginal mesh abdominosacrocolpopexy. *Methods:* A 61-year-old female presented with a one-month history of left L5 radiculopathy and worsening low-back pain. She had undergone transvaginal hysterectomy and mesh abdominosacrocolpopexy for vaginal prolapse two months prior. Investigations revealed elevated C-reactive protein and MRI showed discitis-osteomyelitis at L5/S1 with a pre-vertebral phlegmon communicating with the vaginal vault. CT-guided biopsy failed to isolate an organism. *Results:* The patient underwent removal of her mesh abdominosacrocolpopexy. She was treated with six weeks of vancomycin and eight weeks of moxifloxacin. She had resolution of her left L5 radiculopathy and follow-up MRI showed resolution of her discitis-osteomyelitis. *Conclusions:* L5/S1 discitis-osteomyelitis is a rare complication of sacrocolpopexy. It is hypothesized that inadvertent placement of bone anchors in the L5/S1 disc space may lead to a contiguous source of infection when communicating with an ulceration of the vaginal vault. Most cases have been reported in the gynaecology literature. Our case represents, to the best of our knowledge, the first MR images of this process in the spine literature.

P.140

A Canadian perspective on the repair of dural tears during lumbar spine

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Background: Evidence for the best surgical method for dural tear repair during lumbar is lacking. The purpose of this study is to determine actual neurosurgeon practice in Canada regarding the repair dural tears during lumbar spine operations. *Methods:* A questionnaire was sent out using on-line survey program to all neurosurgeon members of the CNSS. End points are surgeon preference; for closure method based on tear size, products used and post-operative management. *Results:* A total of 156 surveys were sent with a 58% response rate. Open procedure type is performed most often (80.9%) compared to minimally invasive (19.1%). Surgeons prefer to use sealant only for pin-hole dural tears (35.2%). Suture and sealant for larger sizes (medium: 62%, large: 74.7%). Tisseal sealant is the sealant of choice for most surgeons (82.1%) and majority of surgeons recommend patients with repaired medium and large tears to lay horizontal for 24 hours. Surgeons prefer to admit patients with all sizes of dural tears (50.5%) regardless if they had been repaired or not. *Conclusions:* This survey has delineated various practices of dura tearl repair utilized by different neurosurgeons. As evidence is lacking there is a need for a clinical trial to determine the effectiveness of these various methods in order to come up with a best practice guideline.

P.141

Spontaneously regressing lumbar intraspinal synovial cysts: case report and review of the literature

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Background: Controversy persists regarding conservative versus surgical treatment for lumbar intraspinal synovial cysts (LISC). We report a case whose symptomatic LISC spontaneously regressed and review the literature of this phenomenon. *Methods:* A 63-year-old woman presented with low-back and sciatic pain. Magnetic resonance (MR) imaging revealed spinal stenosis and a left-sided synovial cyst at L4–L5. Conservative treatment (analgesics and physiotherapy) was initiated. Embase and Medline databases were systematically searched for reports of spontaneously regressing LISC, and only those reporting radiologically documented cases were analyzed. *Results:* The patient's symptoms did not improve and surgery was scheduled for 26 months after presentation. One month before surgery, MR images showed persistent spinal stenosis but the LISC had spontaneously regressed. Given the underlying stenosis, the patient underwent L4–L5 laminectomy, and at six-week follow-up, her symptoms had improved. Thirteen other cases of spontaneously regressing LISC were identified and characterized. All cases had undergone non-invasive conservative treatment (e.g., orthopedic bracing, physiotherapy), followed by symptomatic improvement or resolution (range, 1–18 months after initial visit). Spontaneous LISC regressions were subsequently noted on imaging (3–25 months after initial imaging). *Conclusions:* LISCs can spontaneously regress, often with symptomatic improvement or resolution. Future research is required to understand the underlying mechanism and to determine if there are predictors of spontaneous LISC regression.

P.142

Intraoperative monitoring as an aide in prognostication following resection of intradural, extra-medullary spinal tumors

S Husak (Saskatoon) I Alnaami (Edmonton) J Norton (Saskatoon)*

Background: Compression of peripheral nerves slows conduction velocity. Release of entrapment rapidly increases velocity. Nerve conduction velocity is used to diagnosis and assess peripheral nerve entrapment. The spinal cord contains many long fibre tracts. We propose that intradural, extra-medullary spinal tumors exert a compressive effect on the fibre tracts similar to that observed in peripheral nerve entrapment. *Methods:* Motor evoked potentials we recorded intraoperatively during tumor resection. Measurements included baseline recordings prior to tumor excision and those following tumor removal. Patient clinical presentation was assessed at a pre-op appointment and post-op function was assessed at 6 week follow-up. *Results:* Nine patients were included in the study. Baseline MEP latency was found to be increased compared to control data, ranging from 115-210%. Functional improvement was noted in patients where baseline MEP latency decreased ≥ 10% (6 of

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9) and was greatest in those demonstrating the largest change in MEP latency. This clinical improvement was not observed in patients that did not show a change in MEP latency. *Conclusions:* We report a relationship between functional improvement following resection of intradural extra-medullary spinal tumors and decreases in MEP latency. While further study is needed, our results suggest that intraoperative monitoring may help predict functional outcomes.

P.143

Adjacent segment pathology: progressive disease course or a product of iatrogenic fusion?

A Jack (Edmonton) G Hardy St-Pierre (Edmonton) A Nataraj (Edmonton)*

Background: Cervical spine clinical adjacent segment pathology (CASP) etiology remains controversial. Here, its relationship to degenerative and mechanical factors is investigated by comparing CASP prevalence in traumatic and spondylotic patient cohorts. *Methods:* All traumatic cervical spine fusion cases in Edmonton from 2002-2008 were reviewed. Surgery for CASP and radiological adjacent segment degeneration were identified by telephone and chart review in this group and compared to those in patients having elective cervical fusion for degenerative disease. *Results:* There was a higher proportion of males (50/100 vs 37/46, $p<0.001$, Fisher's exact test) in the traumatic group. Median age between groups was not significantly different (47 years in the trauma cohort, 50 years in the degenerative cohort, $p>0.05$, Wilcoxon-test), nor were mean follow-up times (6 years in the trauma group, 7 years in the degenerative group, $p>0.05$, t-test). The degenerative group was found to have a significantly higher reoperation rate for CASP (10/100 vs 0/46, $p=0.031$, Fisher's exact test), and rate of radiological adjacent segment degeneration (20/100 vs 1/32, $p=0.025$). *Conclusions:* A higher rate of repeat surgery for CASP in patients with degenerative disease compared to trauma patients was found. This finding suggests that CASP is likely more related to progressive degenerative change and not mechanical factors.

P.144

Minimal invasive endoscopic rhizotomy– technique and clinical experience

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Background: Radiofrequency rhizotomy or cryotherapy of the dorsal nerve branches can provide pain relief. The result of the intervention is highly depended on surgeons experience and the positioning of the intervention needles. Endoscopy allows a controlled anatomical rhizotomy under direct visualization of the facet joints. Goal of this study is to describe the endoscopic technique, and analyze our results according our clinical experiences. *Methods:* We performed endoscopic rhizotomy of the lumbar and sacroiliacal facet joints in patients who have previously reported after infiltration test at least a pain relief of 50% on the numerical analogue scale (NAS). We analyzed the surgical technique, and described advantages and disadvantages. *Results:* A total of 117 patients (62 women, 55 men; mean age 60.37 years; 26-87 years) were included. 351 facets and 42 sacroiliac joints were endoscopically thermo frequency coagulate. At discharge, 102 of 117 (84%) and at follow-up study 91 of 117 (78%) patients reported improvement in pain of> 50% on the NAS. Complications were minimal and average surgical time per segment was 17 minutes. *Conclusions:* Endoscopic visual control of the facet joints diminished complication rate and surgical time, and increases the accuracy of the treatment. This leads to improve the results and achieve very promising outcome in back pain relief.

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Development of a clinical prediction model for surgical decision making in patients with degenerative lumbar spine disease

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Background: In Alberta for the fiscal year 2009-2010, over 25000 lumbar spine MRI were performed. We aimed to identify a low risk group of patients who would not benefit from Lumbar MRI by creating a clinical prediction model. *Methods:* We performed retrospective analysis of prospectively collected data at the Kaye Edmonton clinic on 200 randomly selected patients from 2009-2013. Age, work status, litigation, narcotic use, alcohol use, smoking status, medical comorbidity, psychiatric comorbidity, conservative management, sensory deficit, motor deficit, bowel/bladder/sexual symptoms, prior spine operation, claudication, leg dominant pain, back dominant pain, BMI, duration of pain, pain improving and neural compression on MRI. A decision analysis model was used, with logistic regression analysis for the odds of having surgery based on the clinical symptoms. *Results:* We performed multivariate logistical regression analysis which revealed three variables leading to a convergent model: leg dominant pain (Odds Ratio 62.3), claudication (OR 5.80), and high BMI (OR 0.91). Two additional variables did not take part in the best convergent model but when absent were 100% predictive of not offering surgery: improving pain and neural compression on MRI. *Conclusions:* The absence of improving pain, presence of leg dominant pain, presence of claudication, low BMI and presence of neural compression on MRI were sufficient to predict all patients offered an operation.

MULTIDISCIPLINARY

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A novel model of optic nerve sheath diameter

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Background: Given concerns of optic nerve sheath diameter (ONSD) ultrasound for determination of ICP, our goal was to create a model to determine the intra/inter-operator variability of ultrasound for ONSD in a controlled environment. *Methods:* Part 1: Model Design. We created gelatin models of the globe of the eye. The optic nerve sheath was recreated using 3D printed discs. The discs were attached with adhesive. Ultrasound was conducted with the models using standard techniques of ONSD ultrasonography. Part 2: Intra/Inter-Operator Variability. We utilized 8 different models measured 10 times each by an expert operator to determine the intra-operator variability in our model. For inter-operator variability we used 7 difference operators measuring 8 different models, two times each. *Results:* Part 1: We created realistic

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ultrasound images with our model that mimic *in vivo*. Part 2: The intra-cluster correlation coefficient value for intra-operator variability was 0.643. Accuracy of measurements was +/- 0.11 to 0.22 mm. With two measures occurring per model (per operator), there was an intra-cluster correlation coefficient of 0.453. Comparing operators, the inter-cluster correlation coefficient value was 0. *Conclusions:* We have created a unique model of ONSD and we have determined the intra- operator reliability of ONSD measurement to be moderate to high, with no appreciable difference amongst multiple operators.

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Reluctant properties of adult non-peptidergic sensory neurons influence recovery from sensory deficits

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Background: Reinnervation of the skin through regenerative growth or collateral sprouting of axons is an important goal of neurological repair. An overlapping population of adult primary sensory neurons that innervate the skin express the GDNF coreceptor GFRα1, the lectin IB4 and the 'regenerative brake' PTEN (phosphatase and tensin homolog deleted on chromosome ten). *Methods:* Immunoselection of adult GFRα1 sensory neurons from rats, immunohistochemistry, adult neuron outgrowth and turning assays, qRT-PCR. *Results:* In outgrowth and turning assays adapted to immunoselected adult GFR α1 sensory neurons, we noted less robust baseline growth than unselected sensory neurons and reluctant responsiveness to individual growth factors including GDNF. However they did respond to synergistic types of input from GDNF, HGF, a selective PTEN inhibitor or to a downstream RHO kinase inhibitor. HGF and the PTEN inhibitor were associated with growth cone turning. A gradient of protein extracted from skin samples, a primary target of GFRα1 axons, replicated the impact of synergistic support. Within skin, GDNF was expressed within epidermal axons indicating an autocrine role accompanying local HGF synthesis. *Conclusions:* Our findings identify unique reluctant growth properties and plasticity of a population of epidermal axons, relevant to repair in neuropathy. [Supported by CIHR]

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A poetic neuropathy

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Background: POEMS is a rare paraneoplastic syndrome associated with plasma cell dyscrasias. *Methods:* We present a case of POEMS syndrome which is unusual in its clinical course. The patient had an isolated polyneuropathy for 3 years before developing the other systemic manifestations that allowed for recognition of the syndrome. *Results:* The patient is a 45-year-old female with no significant past medical history. In the spring of 2010, she developed a sensorimotor demyelinating polyneuropathy affecting predominantly the lower extremities. Serum electrophoresis was negative at the time. She was diagnosed with CIDP and treated with IVIG. This yielded minimal results and she required placement in a nursing home. In the summer of 2013, she developed ascites with splenomegaly, hypothyroidism, and an L3 sclerotic lesion. Urine protein electrophoresis revealed a monoclonal peak. She was diagnosed with POEMS and treated with chemotherapy. *Conclusions:* This is an atypical presentation of POEMS syndrome in that there was a 3-year delay between the onset of a very severe neuropathy and the development of multisystemic manifestations of the plasma cell dyscrasia. Clinicians should be wary that although initial screening for paraproteinemia is negative, patients with CIDP should continue to be screened for years after the initial neuropathy develops.

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Rapid NLRP3 inflammasome activation in microglia by lentivirus infection promotes neurovirulence

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Background: Human immunodeficiency virus (HIV) infects and activates innate immune cells in the brain resulting in inflammation and neuronal death with neurological deficits, termed neurovirulence. Induction of inflammasomes causes cleavage and release of cytokines, representing pathogenic processes that underlie inflammatory diseases although their contribution HIV neurovirulence is unknown. *Methods:* Gene expression was examined in brain tissue from HIV/AIDS and control patients in cultured human microglia and macrophages and in brains from animals with or without feline immunodeficiency virus (FIV) infection. *Results:* Inflammasome-associated genes, IL-1β, IL-18 and caspase-1, were induced in brains of HIV-infected persons and detected in brain microglial cells. HIV infection induced pro-IL-1β in human microglia at 4 hr post-infection, which was prevented by the caspase inhibitor, YVAD-fmk. Exposure of microglia to HIV gp120 caused IL-1β production. HIV-dependent release of IL-1β from human macrophages was inhibited by NLRP3 deficiency and high extracellular [K+]. *In vivo* FIV infection activated multiple inflammasome-associated genes in microglia, which was accompanied by cortical neuronal loss and neurobehavioral deficits; multivariate analyses of FIV-infected and uninfected animals disclosed that IL-1β, NLRP3 and caspase-1 in the cerebral cortex represented key molecular determinants of neurovirulence. *Conclusions:* NLRP3 inflammasome activation was an early and integral aspect of HIV infection of microglia, leading to neurovirulence and might represent a potential target for therapeutic interventions.

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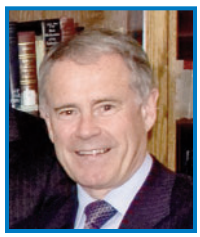

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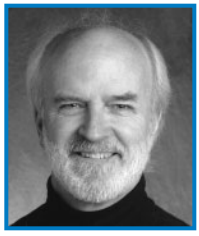

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