CANADIAN NEUROLOGICAL SCIENCES FEDERATION
FÉDÉRATION DES SCIENCES NEUROLOGIQUES DU CANADA

The journal

Canadian Journal of Neurological Sciences

Volume 37 Number 3 (Supplement 1) May 2010

45th Annual Congress of the Canadian Neurological Sciences Federation

Québec, Québec

45e congrès annuel de la Fédération des sciences neurologiques du Canada

ABSTRACTS / RÉSUMÉS

Quebec City
Ville de Québec

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The official Journal of: The Canadian Neurological Society, The Canadian Neurosurgical Society, The Canadian Society of Clinical Neurophysiologists, The Canadian Association of Child Neurology

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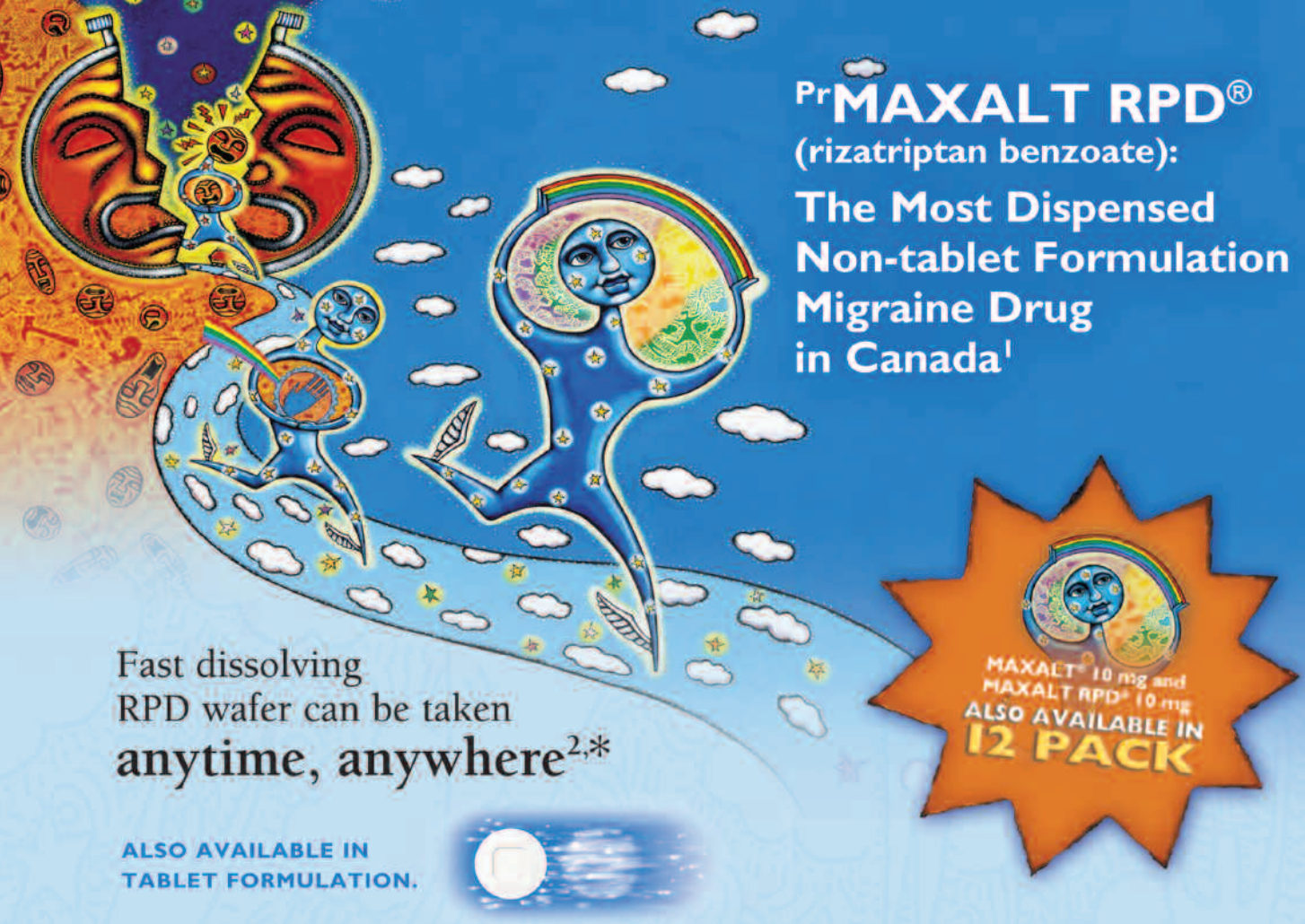

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RPD = Rapidly dissolving

References:

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

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See prescribing summary on page S112-S115

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QUEBEC, QUEBEC JUNE 8-11, 2010

ABSTRACTS
AND PROGRAM

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La Société Canadienne de Neurologie

The Canadian Neurosurgical Society
La Société Canadienne de Neurochirurgie

The Canadian Society of Clinical Neurophysiologists
La Société Canadienne de Neurophysiologie Clinique

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

The permanent secretariat for the four societies and the Canadian Neurological Sciences Federation is at:
Le secrétariat des quatre associations et du Fédération des sciences neurologiques du Canada est situe en permanence à:

7015 Macleod Trail SW, Suite 709
Calgary, Alberta, Canada T2H 2K6

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ABSTRACTS

Quebec City
Ville de Québec

SOCIETY PRIZE PRESENTATIONS

Canadian Association of Child Neurology – President's Prize
Canadian Neurosurgical Society - K.G. McKenzie Prize in Basic Neuroscience Research
Canadian Neurosurgical Society - K.G. McKenzie Prize in Clinical Neuroscience Research
Canadian Neuroligical Society - Francis McNaughton Memorial Prize
Canadian Neurological Society - Andre Barbeau Memorial Prize
Canadian Society of Clinical Neurophysiologists - Herbert Jasper Prize

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Wednesday, June 9, 2010

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B. Multiple Sclerosis ..... B-01 to B-09
C. General Neurology and Dementia ..... C-01 to C-09
D. Neuromuscular and Neuro-oncology ... D-01 to D-09
E. Pediatric Neurology ..... E-01 to E-09
F. Stroke Prevention and Treatment 1 .... F-01 to F-09
G. Stroke Recovery and Rehabilitation .... G-01 to G-09
H. Spine ..... H-01 to H-10
I. Epilepsy ..... I-01 to I-10
J. General Neurosurgery and Neuroradiology ..... J-01 to J-10
K. Trauma, Critical Care and Neurosurgery ..... K-01 to K-10
L. Stroke Prevention and Treatment 2 .. L-01 to L-10
M. Stroke Health Services Research and Acute Treatment ..... M-01 to M-10

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Thursday, June 10, 2010 - Friday, June 11, 2010

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Dementia ..... P-009 to P-012
General Neurology ..... P-013 to P-044
Multiple Sclerosis ..... P-045 to P-050
General Neurosurgery ..... P-051 to P-080
Spine ..... P-081 to P-096
Pediatric Neurology ..... P-097 to P-106
Epilepsy (EEG, Basic Science, Imaging, Neurology and Epilepsy Surgery) ..... P-107 to P-122
Neuro-oncology (Medical and Radiation Oncology, Imaging, Tumour Surgery, Basic Science) ... P-123 to P-134
Neuromuscular (Basic Science, EMG/NCS and Peripheral Nerve Surgery) ..... P-135 to P-138
Trauma, Critical Care ..... P-139 to P-143
Stroke - Prevention and Treatment ..... P-144 to P-202
Stroke - Recovery and Rehabilitation ..... P-203 to P-227
Stroke - Systems Change Policy and Knowledge Translation ..... P-228 to P-233
AUTHORS INDEX ..... S-107 to S-111

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Bring your camera!!!

Québec City is truly one of the most beautiful cities in Canada. Visitors can explore the historic downtown core as it was an original walled city with the Chateaux Frontenac overlooking the St. Lawrence River.

Rich in French culture and history, Québec City is known for its antique shops where treasures can be found around every corner. As the capital of Québec, Québec City is a "must see" for any traveler to Canada.

Welcome to Quebec!!

Join us for the Canadian Neurological Sciences Federation's 45th Annual Congress June 8-11, 2010

Apportez votre appareil-photo!!!

Québec est réellement l'une des plus belles villes du Canada. Les visiteurs peuvent arpenter le centre historique, car il s'agissait à l'origine d'une ville fortifiée avec le Château Frontenac surplombant la voie maritime du Saint-Laurent.

Riche d'une culture et d'un passé français, Québec est réputée pour ses magasins d'antiquités où des trésors abondent à chaque carrefour. En tant que capitale du Québec, la ville de Québec est incontournable pour tous les voyageurs qui viennent au Canada.

Bienvenue à Québec!!

45e congrès annuel de la Fédération des Sciences neurologiques du Canada - 8-11 juin 2010 Québec, Québec

Photos Courtesy of Ministère du Tourisme du Québec / from left to right 1. Mondoux, Louise / 2. Hurteau, Paul; Parent, Claire / 3. Bourdeau, Jacques
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2009 Society Prize Papers

The President's Prize

Canadian Association of Child Neurology

Electrocorticography and seizure outcomes in children with lesional epilepsy

JN Gelinas (Vancouver), AW Battison (Vancouver), MB Connolly (Vancouver), P Steinbok (Vancouver)*

Background: The use of electrocorticographically (ECoG) – guided cortical resection in children with lesional epilepsy is controversial. Given the important developmental issues associated with seizures in children, we evaluated the effect of the decision to perform lesionectomy or ECoG-guided cortical resection on seizure outcome, seizure recurrence, and surgical morbidity in this population. *Methods:* We retrospectively analyzed seizure outcomes in 67 patients between the ages of 3 months and 16 years who underwent surgery for lesional epilepsy at British Columbia Children's Hospital. Thirty-four patients underwent ECoG, and 33 patients had lesionectomy without ECoG. *Results:* One year post-operatively, approximately 80% of patients who had ECoG-guided cortical resection or lesionectomy were seizure free. However, there was a trend toward improved seizure freedom in patients who had ECoG at most recent follow-up (79% patients with ECoG seizure free, vs. 61% with lesionectomy only; mean follow-up time 5.8yrs, p = 0.078). There was no increase in neurological morbidity in patients who had ECoG-guided cortical resection, and these patients were less likely to experience repeat epilepsy surgery. *Conclusions:* Overall, using ECoG to guide additional cortical resection may lead to more robust seizure freedom in children with lesional epilepsy without increasing their risk of surgical morbidity.

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K.G. McKenzie Prize in Basic Neuroscience Research

Canadian Neuosurgical Society

2010 Prize Awarded to Two Recipients

Augmenting adult hippocampal neurogenesis using targeted brain stimulation: implications for memory networks

SS Stone (Toronto), K Zaslavsky (Toronto), CM Teixeira (Toronto), AM Lozano (Toronto), PW Frankland (Toronto)*

Background: New neurons are continually generated in the adult hippocampal dentate gyrus (DG) and can incorporate into circuits supporting hippocampus-dependent memories. Factors can increase neurogenesis, including targeted limbic electrical stimulation. DBS could theoretically accomplish this; however, it is not known if this could add functional neurons capable of network integration at the cellular level. Using immediate-early gene expression as a surrogate for neuronal activation, we evaluate the participation of an entorhinal cortex (EC) stimulation-induced neuron population in hippocampal memory networks. *Methods:* Adult male mice underwent stereotactic EC stimulation. New cells were labeled with thymidine analogues or retroviral-expressed GFP, and examined for Fos expression following Morris water maze testing. *Results:* DG proliferation nearly doubled 3-5 days after surgery without altering apoptosis. New neurons displayed normal morphology at 1, 6, and 10 weeks of age. Two 6 week-old cohorts of neurons, induced by stimulation and born at baseline, were examined. Neurons from both cohorts were equally likely to recruit into networks, and as their availability increased, they accounted for a greater proportion of neurons within networks. *Conclusions:* Electrically stimulating DG inputs creates a larger pool of new neurons capable of memory network integration, potentially of functional benefit as a hippocampal regenerative therapy.

Oligodendroglioma cell lines containing t(1;19)(q10;p10)

JJ Kelly (Calgary), MD Blough (Calgary), O Stechishin (Calgary), M Perizzolo (Calgary), JA Chan (Calgary), D Demetrick (Calgary), RN Auer (Calgary), WJ Hader (Calgary), R Jenkins (Rochester), S Weiss (Calgary), J Cairncross (Calgary)*

Background: Investigating the biology of oligodendrogliomas and their characteristic combined deletion of chromosomal arms 1p and 19q, mediated by an unbalanced translocation, t(1;19)(q10;p10), has been hampered by the lack of cell lines that harbor these traits. *Methods:* Cell culture was performed using the neurosphere assay on fresh tissue samples obtained from adult patients during resection of cerebral oligodendrogliomas. Molecular diagnostic methods were employed. Chemosensitivity to temozolomide was tested in vitro. Oligodendroglioma cells were implanted into immunocompromised mice to assess tumorigenicity. *Results:* Oligodendroglioma cells express neural stem cell and brain tumor stem cell (BTSC) markers and grow as multipotent spheres in vitro. Propagation of these cells led to the development of stable oligodendroglioma cell lines named BT054 and BT088. BT054 and BT088 harbor co-deletion of chromosomes 1p and 19q and t(1;19)(q10;p10). BT054 and BT088 cells proliferate slowly but display divergent chemosensitivity in vitro. BT054 cells harbor an IDH1 mutation and BT088 cells initiate oligodendrogliomas in immunocompromised mice. *Conclusions:* Oligodendrogliomas harbor a subset of cells that possess properties of BTSCs in vitro and in vivo. We describe the first two oligodendroglioma cell lines generated from 1p/19q co-deleted anaplastic oligodendrogliomas, that contain a co-deletion of chromosomes 1p and 19q mediated by the unbalanced translocation, t(1;19)(q10;p10).

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K.G. McKenzie Prize in Clinical Neuroscience Research

Canadian Neurosurgical Society

Efficacy and active ingredients in an epidural analgesic paste after lumbar decompression: a prospective randomized double-blind controlled trial

RJ Diaz (Calgary), R Hurlbert (Calgary)*

Background: The purpose of this study was to evaluate the efficacy and active ingredients of a previously described epidural analgesic paste in controlling post-operative pain after lumbar decompressive surgery. *Methods:* A prospective randomized double-blind controlled trial was conducted. Two-hundred and one patients were randomized to one of four analgesic epidural pastes at the time of lumbar spinal surgery: combo paste (morphine + methylprednisolone), steroid paste (methylprednisolone alone), morphine paste (morphine alone), and placebo. Primary outcome measures used were narcotic and non-narcotic use and McGill Pain Questionnaire (MPQ). Secondary outcome measures were: modified ASIA score, Aberdeen Back Pain Index (ABPI), SF-36, time to ambulation and discharge from hospital. *Results:* Administration of combo and steroid paste, but not morphine paste resulted in a statistically significant reduction in mean PRI and PPI components of the MPQ up to 7 days after surgery. Narcotic analgesic consumption was reduced on post-operative day 1 in the combo paste and steroid paste groups. No difference in time to ambulation or discharge, SF-36, and ABPI scores was observed between groups. *Conclusions:* Epidural analgesic paste containing methylprednisolone acetate produces a robust post-operative analgesic effect and demonstrates long-term safety. This paste should be considered for use in patients undergoing routine lumbar decompressive surgery.

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The Herbert Jasper Prize

Canadian Society of Clinical Neurophysiologists

A descriptive analysis of prognostic indicators in patients with non-convulsive status epilepticus in a tertiary hospital population

CT Hrazdil (Vancouver), R Alroughani (Vancouver), M Javidan (Vancouver)*

Background: Non-convulsive status epilepticus (NCSE) is defined as a change in mental state of at least 30 minutes associated with continuous or nearly continuous epileptiform discharges. Identification of prognostic indicators can guide decision making surrounding the use of poorly established treatment interventions in this heterogeneous population. *Methods:* We identified 66 consecutive inpatients with NCSE. Data surrounding clinical, electrographic, and treatment factors were collected via a retrospective systematic review of medical records and electronic EEGs, and were correlated with discharge outcome (return to baseline, new disability, or death). *Results:* Of all subjects, 21% returned to baseline, 26% acquired new disability, and 53% died, of whom half had anoxic encephalopathy. On univariate analysis, seventeen variables correlated significantly with death, although multivariate logistic regression analysis subsequently identified only comatose state and number of life threatening comorbidities as independent predictors of mortality. Of survivors, comatose state, critical care environment, length of hospital stay, and acute symptomatic seizures predicted new disability, with the latter two showing independent significance. *Conclusions:* NCSE is associated with variable morbidity and mortality. While one fifth of our NCSE patients returned to baseline, those comatose with acute symptomatic seizures and life threatening comorbidities were unlikely to survive without disability at discharge.

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Francis McNaughton Memorial Prize

Canadian Neurological Society

Cognitive impairment in ARCA-1, a newly discovered pure cerebellar ataxia syndrome

R Laforce (Quebec), JP Buteau (Quebec), J Bouchard (Quebec), GA Rouleau (Montréal), B Lefebvre (Lévis), RW Bouchard (Quebec), N Dupré (Quebec)*

Background: Cerebellar contribution to cognition and affect has been supported by several animal, human and functional neuroimaging studies. Its extent remains unclear, however, partly because authors have studied patients with extracerebellar lesions. This research explored the role of the cerebellum in cognition and affect using patients with ARCA-1, a newly described inherited cerebellar disease characterized by middle-age onset of ataxia and pure/severe cerebellar atrophy. *Methods:* The performance of 21 ARCA-1 patients and 21 controls paired for age and education was compared on a detailed battery of cognitive tests and neuropsychiatric inventories. *Results:* Both groups showed similar IQ, naming and declarative memory abilities. ARCA-1 patients showed deficits in attention, verbal working memory and visuospatial/visuoconstructional skills. None presented a significant affective syndrome. Structural imaging indicated pure/severe cerebellar atrophy while functional imaging also showed a small area of right parietal hypometabolism. Correlational analyses suggested that impairments could not be explained by motor deficits, duration of disease or mood. *Conclusions:* Altogether, this study suggests that pure cerebellar damage as seen in ARCA-1 is associated with significant cognitive impairments but not with psychiatric comorbidity. Our data favours an indirect participation of

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the dorsolateral prefrontal and posterior parietal cortical areas to the cerebrocerebellar circuit.

Andre Barbeau Memorial Prize

Canadian Neurological Society

Molecular mechanisms associated with an increased seizure susceptibility in adults after experimental febrile seizures in juveniles

A Reid (Calgary), K Riazi (Calgary), GC Teskey (Calgary), QJ Pittman (Calgary)*

Background: Prolonged febrile seizures (FSs) are associated with the development of epilepsy, however the molecular mechanisms behind this are still largely unknown. We have utilized an ethologically relevant animal FS model to test the hypothesis that FSs cause long-term molecular and synaptic alterations leading to increased neuronal excitability in the adult brain. *Methods:* FSs were induced in ~50% of 14 day old rats receiving the bacterial endotoxin lipopolysaccharide and subthreshold kainic acid. Adult rats then underwent one of the following: 1) continuous video-EEG monitoring; 2) seizure threshold testing with chemical convulsants; 3) hippocampal slice recordings to evaluate neuronal excitability and synaptic strength; 4) polymerase chain reaction for specific glutamate and GABA receptor subunits and cation-chloride co-transporters (CCCs); 5) application of the CCC blocker bumetanide to determine its effect on reversing seizure thresholds in vivo and in vitro. *Results:* Seizure thresholds post-FS were lower in vivo and in vitro, but no animals developed spontaneous seizures. Reduced GABA(A) and increased AMPA receptor subunits, and elevated levels of the juvenile CCC (NKCC1) were observed, and are in keeping with a more excitable state. Bumetanide blocked the increased seizure susceptibility found both in vivo and in vitro. *Discussion:* An increased level of excitability in the brain post-FS, as measured by altered expression of receptors and transporters and by electrophysiology, is associated with an increased susceptibility to subsequent seizures. Enhanced seizure susceptibility can be blocked, in part, by application of the drug bumetanide, which may prove useful for patients with epilepsy that had a previous FS.

patients in need of a levator palpebrae resection for ptosis, levator palpebrae biopsy is preferable to a limb muscle biopsy for diagnosis of CPEO. Patients with negative muscle biopsy from another site may subsequently have diagnostic levator palpebrae biopsy. Electron microscopy or genetic studies may provide criteria for diagnosis even when histopathology is nondiagnostic, and should be performed in all patients.

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Distinguished Guest Lecture / Conférencier émérite invité

Friday June 11 / Vendredi 11 juin 08:30-09:30

James Orbinski

Dr. Orbinski is a veteran of many of the world's most disturbing and complex humanitarian emergencies. He accepted the Nobel Peace Prize on behalf of Medecins Sans Frontieres (Doctors Without Borders) in 1999.

A brilliant and mesmerizing orator, Orbinski offers a compelling look at the ravages of genocide and civil war, the role of humanitarianism, and the conflict that arises from combining humanitarian assistance with a political agenda.

Orbinski is an outspoken and passionate speaker who is deeply committed to the core principles of volunteerism and impartiality, with a belief that everyone deserves both medical assistance and the recognition of his or her humanity.

Le docteur James Orbinski, humanitaire canadien et co-fondateur de Dignitas International, a été nommé officier de l'Ordre du Canada en reconnaissance de ses contributions en tant que médecin qui a œuvré pour améliorer l'accès et la prestation des soins de santé dans les pays en développement, ainsi qu'en tant que porte-parole des victimes de guerres, de génocides ou de famines.

L'Ordre du Canada est l'un des honneurs civils les plus importants au pays. Il a été établi afin de souligner les réalisations exceptionnelles, le dévouement à la communauté et le service au pays de toute une vie.

08:30 **Welcome & Introduction / Accueil et introduction**

Please bring this Abstract book with you to the Congress in Quebec for reference during poster and platform sessions; there will not be another distribution of the Abstract Book at the Congress. This is in response to numerous negative comments about receiving two copies, saves us approximately $10,000 in printing costs and has a positive environmental impact.

In addition, all Congress materials, i.e. Course notes, will be provided to registrants on a CD, mailed to delegates one to two weeks prior to the Congress. Everyone, therefore, will receive all Congress materials - not just for the courses/sessions they attend. We are asking delegates to either bring the CD and their laptop to the Congress and/or to print their required materials ahead of time. No Course materials will be distributed at the Congress. This will save close to $15,000 in printing costs and also has obvious environmental benefits.

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Platform Presentations

Chair's Select Plenary Presentations

A-01

Cognitive impairment in ARCA-1, a newly discovered pure cerebellar ataxia syndrome

R Laforce (Quebec), JP Buteau (Quebec), J Bouchard (Quebec), GA Rouleau (Montréal), B Lefebvre (Lévis), RW Bouchard (Quebec), N Dupré (Quebec)*

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A-02

Oligodendroglioma cell lines containing t(1;19)(q10;p10)

JJ Kelly (Calgary), MD Blough (Calgary), O Stechishin (Calgary), M Perizzolo (Calgary), JA Chan (Calgary), D Demetrick (Calgary), RN Auer (Calgary), WJ Hader (Calgary), R Jenkins (Rochester), S Weiss (Calgary), J Cairncross (Calgary)*

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A-03

Efficacy and active ingredients in an epidural analgesic paste after lumbar decompression: a prospective randomized double-blind controlled trial

RJ Diaz (Calgary), R Hurlbert (Calgary)*

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A-04

Meralgia paresthetica: topography of the sensory deficit

*JD Stewart (North Vancouver)**

Background: Meralgia paresthetica (MP) results from lesions of the lateral cutaneous nerve of the thigh (LCNT). This author observed that the area of abnormal sensation frequently differs from classic descriptions. *Methods:* Prospective study of patients referred for MP evaluated with sensory testing to map and photograph the deficit, had electromyography (EMG) of the quadriceps muscle and

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sometimes others, and lumbar spine imaging in some cases. MP was considered confirmed when sensory loss involved at least part of the lateral thigh, there were no motor or reflex abnormalities in the leg, and EMG of the quadriceps was normal. The classic sensory distribution was considered to involve a length of at least 50% of the thigh, not extending beyond the midline, nor below the lower edge of the patella. Each leg with MP was categorized as: classic, bigger medially, bigger inferiorly, or restricted. *Results:* 26 patients (22 males) aged 34-73 years, bilateral in 5 patients. Total legs with MP = 31. *Topographic patterns:* Classic 6 (19%); bigger medially 16 (52%), bigger inferiorly 3 (10%), restricted 6 (19%). *Discussion:* Sensory loss in MP frequently differs from classic descriptions. The area is often larger, sometimes smaller. Explanations include anatomic variation and partial LCNT damage.

A-05

Efficacy and safety of idebenone in children with Friedreich's ataxia: results of the 6-month US phase 3 study

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Background: A 6-month double-blind, placebo-controlled US study was conducted to evaluate efficacy/safety of the approved idebenone in children with Friedreich's Ataxia (FRDA). *Methods:* Patients aged 8–17 years with FRDA and mild/moderate neurological impairment received placebo or idebenone dose A (weight ≤45 kg: 450 mg/day; >45 kg: 900 mg/day) or dose B (weight ≤45 kg: 1350 mg/day; >45 kg: 2250 mg/day). Primary endpoint was change from baseline to week 24 in International Cooperative Ataxia Rating Scale (ICARS) score. *Results:* All 70 participants (mean age, 14 years) completed the study. ICARS decrease (mean ± SD) was greater with idebenone (A, -2.5 ± 6.3, n = 22; B, -2.4 ± 4.8, n = 24) than placebo (-1.3 ± 4.4, n = 24), but differences were not statistically significant. Both idebenone doses promoted numerical improvement in ICARS from baseline to week 12 and from week 12 to 24. Two serious AEs occurred, neither fatal nor treatment related. Treatment-related AEs were more common with dose A (14 [58%]) than B (6 [27.3%]) or placebo (11 [45.8%]). Most were gastrointestinal; most were mild. *Conclusions:* Idebenone treatment for 6 months was well tolerated by children with FRDA. Although ICARS improved more with idebenone than placebo, differences were not statistically significant.

A-06

Treatment of acute ischemic stroke in Old World primates with the PSD-95 inhibitor NA-1

DJ Cook (Toronto), L Teves (Toronto), M Tymianski (Toronto)*

Background: Administration of NA-1, an inhibitor of the interactions of NMDA glutamate receptors with the submembrane scaffolding protein PSD-95, confers neuroprotection in rodent models of middle cerebral artery occlusion(MCAO). To test whether NA-1 is neuroprotective in acute ischemic stroke in a gyrencephalic species, we performed a blinded, randomized trial of NA-1 versus drug vehicle in a reperfused MCAO model in the cynomolgus macaque with MRI and neurobehavioural outcomes. *Methods:* 20 male cynomolgus macaques(2.85-5.05kg) underwent anesthesia with physiologic monitoring and surgical MCAO followed by immediate MRI perfusion. NA-1(2.6mg/kg) or drug vehicle were administered in blinded fashion 60-minutes following MCAO. The MCA was reperfused 90 minutes following occlusion. Animals underwent MRI diffusion-weighted(DWI) and T2 imaging at 4h, 24h and 30d after MCAO. A battery of sensory-motor testing was undertaken serially following MCAO. *Results:* Analysis was performed on an intent-to-treat basis. Stroke volume on 24h DWI was reduced from 103mL in placebo treated animals to 58mL in NA-1 treated animals(P=0.039) and this effect was maintained on 30d T2-weighted MRI. There was a significant improvement in Non-Human Primate Stroke Score measured serially from 8h to 30d post-MCAO (P=0.018, Repeated Measures two-way ANOVA). There were also significant improvements in sensory and motor function as measured by the two-tube, six-well and hill/valley tests. *Conclusions:* NA-1 confers both structural and functional improvements in outcome in an NHP model of reperfused MCAO. This study confirms the feasibility of neuroprotection in the gyrencephalic brain and supports further study preceding human clinical trials for NA-1 in acute ischemic stroke.

A-07

Untangling the mystery of poor clinical outcomes despite excellent recanalization: analysis of data from the Penumbra Pivotal Stroke Trial

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Background: We sought to evaluate whether a good initial NCCT (> 7 on ASPECTS scoring system) and short time to reperfusion predicts good clinical outcome in the Penumbra Pivotal Stroke Trial. *Methods:* NCCT at presentation was evaluated by two readers blinded to clinical outcomes using ASPECTS. Patients were divided into 3 groups: ASPECTS 7-10(good); 4-6(intermediate) and 0-3(poor). TIMI reperfusion scores, stroke onset to reperfusion and CT to reperfusion times were noted. Primary clinical outcome was mRS≤2 at 90 days. *Results:* Of 125 patients, 85 satisfied all inclusion and exclusion criteria. Median NIHSS was 18, 49.4% had good ASPECTS≥7, 81.2% had TIMI 2-3 reperfusion and 27.1 % good clinical outcomes (mRS≤2). 0/22 patients with ASPECTS < 4 and 2/20 patients with ASPECTS(4-6) had good clinical outcomes when compared to 21/41 patients with ASPECTS ≥7 [RR 21, 95% CI 4.4-98.6]. Patients with onset to reperfusion time≤360 mins had better clinical outcomes[RR 3.04 95% CI 1.1-8.34]. In the good scan (ASPECTS ≥ 7) group (n=42), median NIHSS was 16.5, 83.3% achieved TIMI 2-3 with 50% showing good clinical outcomes. Patients with TIMI 2-3 scores (21/35) achieved better clinical outcomes than those with TIMI 0-1(0/6)[RR ∞] (p value 0.009). Patients with good ASPECTS and onset to reperfusion time≤360 mins achieved better clinical outcomes (14/18, 77.8%) when compared to >360 mins group(7/19, 36.8%)[RR 6, 95% CI 1.4-25.58]. *Conclusion:* Proper patient selection based on initial NCCT and faster recanalization are essential in achieving good clinical outcomes in patients with acute ischemic strokes undergoing IA procedures.

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Multiple Sclerosis

B-01

HLA-DRB1 and pediatric multiple sclerosis

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Background: Susceptibility to adult onset multiple sclerosis (AOMS) in Northern European populations has been fine mapped to the extended HLA class II haplotype. HLA-DRB1*15 allele frequency is 0.33 in AOMS; 0.13 in controls. *Methods:* We studied 21 children with pediatric onset MS (POMS), 148 with Acquired Demyelinating Syndrome (ADS) and 196 controls. HLA-DRB1 alleles were typed by allele-specific PCR amplification with allele frequencies calculated using the Unphased-2.404-w32 program. Chi-square and/or Fisher's exact test were used. To avoid population stratification, the analysis was first restricted to Caucasian individuals. Results: Allelic frequencies of HLA-DRB1 alleles for Caucasians were 0.31 (POMS), 0.19 (ADS) and 0.14 (controls). The frequency of HLA-DRB1*15 in POMS was significantly higher than controls (p=0.011) with an odds ratio of 2.73. When non-Caucasian POMS and ADS were included, the HLA-DRB1*15 allele frequencies were 0.36 and 0.21 respectively (OR=2.05, c2=4.31, p=0.03). *Conclusions:* The association of HLA-DRB1*15 with POMS very closely resembles that seen in AOMS, thus unifying these phenotypes. Genotyping data distinguished ADS from adult clinically isolated syndrome (CIS). Thus studies of the interactions of this allele with known environmental factors associated to MS (e.g. vitamin D; Epstein Barr virus) may be key in elucidating the causal cascade of POMS.

B-02

8-week interim analysis of the compliance with interferon beta 1a (Avonex® PS) administered intramuscularly (IM) every week (qW) to patients with relapsing-remitting multiple sclerosis (COMPASS) study

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Background: Interferon beta 1a IM qW (Avonex® PS) is indicated for patients with Multiple Sclerosis (MS). The MS Alliance ™ (MSA) program provides assistance with prescribing, administering, and monitoring patients on Avonex therapy. *Methods:* Compliance was assessed prospectively, while persistence was assessed both prospectively and retrospectively between patients in the current and previous MSA program through a chart audit process. For compliance and persistence, prospective patients were assessed at 8 weeks from initiation of therapy. *Results:* At 8 weeks, 100% (n=63) of retrospective patients and 100% (n=82) of prospective patients were deemed persistent with therapy. The average age of prospective patients was 40 years, with 82% (n=67) of them women. Of 82 patients, 76% (n=62) completed the survey and deemed compliant with 89% (n=55) never missing a dose (100% compliance) and only 10% (n=6) missing less than a dose per month (80% compliance). *Conclusions:* These preliminary results demonstrate that at 8 weeks, retrospective and prospective patients were 100% persistent with therapy. Furthermore, 89% of prospective patients were 100% compliant with therapy. The results are based on data available for patients enrolled prior to December 2009 and the final analyses, expected in 2011, will incorporate the month 22 data.

B-03

Comparability of randomized controlled versus observational studies: findings from the Toronto observational study of natalizumab in multiple sclerosis

KM Krysko (Toronto), PW O'Connor (Toronto)*

Background: Natalizumab is indicated for the treatment of relapsing multiple sclerosis (MS) with insufficient response to first-line disease-modifying therapy (DMT). We studied the efficacy of natalizumab for treatment of MS in a single centre observational design. *Methods:* A retrospective observational study of 146 patients [66% female; mean age 37.4; 72% RRMS, 28% SPMS] referred for natalizumab treatment at St. Michael's Hospital MS Clinic 2007-2009. Data included demographic, clinical (EDSS and annualized relapse rate (ARR)) and patient self-report measures. *Results:* The mean number of infusions was 13 and 97% had received prior DMTs. Baseline ARR and EDSS were 1.6 and 2.6 in RRMS patients versus 1.1 and 4.9 in SPMS with relapses. The ARR decreased with natalizumab treatment to 0.41 (74% reduction, p<0.001) in RRMS versus 0.3 in SPMS patients (72% reduction, p=0.01). There was a treatment associated 20% reduction in EDSS to 2.1 (p<0.001) in RRMS, but no significant change in SPMS. 85% of patients reported improved overall quality of life (QOL) and 62% indicated improved energy. *Conclusions:* There was a major reduction in relapse rate, stabilization or improvement in EDSS and an overall improvement in QOL and energy on natalizumab, all similar to treatment effects in the pivotal trial.

B-04

Treatment of aggressive MS with high intensity immunoablation and autologous stem cell transplant (IA/ASCT) can stabilize or improve disease outcomes without compromising on patient related outcomes

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Background: IA/ASCT controls aggressive MS, but associated morbidity and mortality can offset gains by reducing the quality of life (QoL). Design: Validated MSQoL-54 and fatigue impact scales (FIS) and MSFC were applied in the 3 months pre-transplant and every 6 months thereafter for 3 years. Results: 1 year post-transplant (PT) QoL and FIS data were available for 17/24 treated patients and 2 controls and full datasets were available on 14 treated and 1 control out to 36 months. 1 patient died in the 1st 3 months PT. All treated patients remained free of MS relapses or any new MRI activity. All but 3 patients improved/stabilized in physical QoL (pQoL) and all but 1 improved/stabilized in mental QoL (mQoL) in the 12-36 month PT period. All but 2 patients improved/stabilized in FIS - 1 patient worsening along with progression of his illness. 1 control showed worsening in pQoL, stable mQoL and worsening overall fatigue; the other experienced several new relapses after 18 months and underwent IA/ASCT. MSFC: 15/17 improved/stabilized in the PASAT-2 and 15/17 improved/stabilized in the PASAT-3; 1

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worsened in both PASAT tests over the 3 years PT and 1 showed worsening at 12 months. 12/17 improved/stabilized in the dominant 9HPT while 5 worsened. 11/17 improved/stabilized in the non-dominant 9HPT and 6 worsened. 10/17 patients improved/stabilized in the 25 foot walk and 7 required more time to complete the walk. Conclusion: IA/ASCT stabilizes or improves very aggressive MS patients without compromising patient-related outcomes of wellbeing.

B-05

Canadian Asians with multiple sclerosis (CAMS) study: comparison of clinical features in Canadian-born versus immigrant patients

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Background: Although MS is rare in Asian countries, elevated prevalence has been reported in migrants residing in high-prevalence regions. Here we compare and contrast clinical characteristics of MS in immigrant and Canadian-born Chinese-Canadians. *Methods:* Chinese patients with a diagnosis of definite or possible MS were identified in the UBC MS Clinic Database, and stratified by whether or not they were born in Canada. Clinical characteristics of each group were determined by retrospective chart review. *Results:* of 57 MS cases, 18 (32%) were Canadian-born and 39 (68%) were immigrants. Among immigrants, disease onset occurred after immigration for a disproportionate number of cases ($p = 0.035$). Mean age of onset was 27.6 among Canadian-born cases, versus 32.1 for immigrants ($p = 0.049$). Sensory disturbance was the onset symptom in 67% (12/18) of Canadian-born cases, versus 38% (15/39) of immigrants. Conversely, motor dysfunction was the first symptom 23% of immigrant cases, but none of the Canadian-born cases ($p = 0.045$). Progressive course was observed in 11% of Canadian-born cases, versus 18% of immigrants. *Conclusions:* Putative environmental factors that are inherent to rearing in Canada but irrelevant to adult immigrants influence the timing and clinical presentation of MS onset in Chinese-Canadians.

B-06

The impact of disease modifying therapies (DMTs) on the health-related quality of life (HRQL) of men with relapsing-remitting multiple sclerosis (RRMS)

SA Warren (Edmonton), KV Turpin (Edmonton), WJ Hader (Saskatoon), KG Warren (Edmonton)*

Background: We recently examined the impact of DMTs on the HRQL of women over time, and found significant declines in their physical HRQL, but improvements in their mental HRQL. The purpose of this study was to determine if DMTs would have a similar impact on the HRQL of men over 3 time points: pre-DMT baseline (T0), year 1 (T1) and year 3 (T2). *Methods:* SF-36 survey data from men participating in a long-term DMT evaluation study at the University of Saskatchewan were used (N=75). The SF-36 survey measures 4 physical and 4 mental HRQL domains: physical functioning (PF), role limitations due to physical health (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role limitations due to emotional health (RE) and mental health (MH); and provides a physical (PCS) and a mental (MCS) summary score. *Results:* There were initial improvements in 8 of the 10 SF-36 scores at T1, with significant increases in the RP, VT, SF, RE, MH and MCS scales ($p \leq .05$). The PF and PCS scores declined significantly from T0 to T1, and again from T1 to T2 ($p \leq .05$). The only scores to remain significantly better at T2 than T0 were the mental scores of SF, RE, MH and MCS ($p \leq .05$). *Conclusions:* Similar to our findings with women, the men's physical HRQL did not sustain an improvement over time, but their mental HRQL did. Despite a similar or worse physical HRQL, DMTs may instigate or facilitate better mental and social HRQL.

B-07

Quality of life, cognitive function and mood in young adults with pediatric-onset multiple sclerosis

KM Krysko (Toronto), PW O'Connor (Toronto)*

Background: Adult-onset MS (AOMS) negatively affects cognitive function, mood and quality of life (QOL), but these have not been well studied in young adults with pediatric-onset multiple sclerosis (POMS). These individuals are at a critical point in their lives, requiring career and family decisions. *Methods:* 34 young adults diagnosed with POMS [19 females; mean age 21.3 years] receiving care at St. Michael's Hospital were included. Participants completed assessments of physical disability (EDSS), cognitive function (SDMT), mood (BDI-II), and QOL (SF-36v2). Findings were compared to AOMS natural history databases, studies of AOMS and age-matched normative data. *Results:* Compared to AOMS of similar disease duration, POMS patients had higher relapse rates in the first 2 years of disease, but lower physical disability per year of disease. Additionally, those with POMS had higher cognitive function, physical QOL and mood than AOMS. Compared to age-matched normals, POMS patients had lower cognitive function and physical QOL, but equivalent mood and mental QOL. *Conclusions:* Compared to AOMS, young adults with POMS have lower disability accumulation per year and better physical and cognitive functioning, physical QOL and mood. However, POMS patients have lower cognitive function and physical QOL compared to peers. Further follow-up is required to determine how these factors are affected later in the course of POMS.

B-08

Modeling health outcomes in relapsing-remitting-onset multiple sclerosis cohorts treated with disease-modifying-drugs that delay disability progression

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Objective: To describe a model that simulates health outcomes (HOs) from disease-modifying-drug (DMD) therapy that delays disability (EDSS) progression in relapsing-remitting-onset MS (R-onset MS) cohorts. *Methods:* The model simulates EDSS progression under natural history (NH) and given DMD treatment, measured by Kaplan-Meier survival distribution functions (SDFs) over 40 years-since-onset to 18 sustained endpoints EDSS 1-9.5. DMD-effect-size was modeled as increased time to endpoints 1-9.5 per DMD-treatment-year. HOs accrued in treatment and post-treatment years were measured by total and per-patient person-years (PYs) gained, EDSS-weighted-QALYs (EDSS-QALYS) gained and Health Utility Index-weighted-QALYs (HUI-QALYs) gained as a result of increased time to sustained endpoints. Model components

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for EDSS NH, DMD-effect-size and treatment-years were populated using Nova Scotia 1979-1998 pre- and 1998-2007 post-DMD-treatment-program clinic-visits data from 1435 persons with definite R-onset MS. *Results:* A baseline "reference" scenario simulated PYs and QALYs gained from Nova Scotia's DMD treatment program in its first ten years, 1998-2007. Many other scenarios may be modelled and populated with RCT, observational, estimated or hypothetical data. *Conclusions:* MS DMD health outcomes were modeled for scenarios where DMD-effect-size may vary by disability severity. Such models may be populated using person-level data from pre- and post-DMD-treatment periods.

B-09

Monoclonal antibodies and progressive multifocal leukoencephalopathy: need for ongoing monitoring

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Background: Monoclonal antibodies have become an important treatment option for a number of serious conditions. Concerns have arisen about the potential association of these products with progressive multifocal leukoencephalopathy (PML). This has resulted in Health Canada reviewing the available data to determine the continued safety of these products. *Method:* The list of monoclonal antibodies authorized for sale was derived from Canada Drug Product Database. Cases of progressive multifocal encephalopathy were ascertained by searching Canadian Vigilance and WHO Adverse Event databases and through Pub MED and Medline literature search. *Results:* Since 1987, 18 monoclonal antibodies have been authorized for use in Canada. The search found 153 cases of PML associated with monoclonal antibody use (alemtuzumab (13 cases), bevacizumab (2), cetuximab (1), efalizumab (7), ibritumomab tiuxetan (1), inflixamab (6), natalizumab (22) and rituximab (105)). The manufacturer has voluntarily removed efalizumab from market. Natalizumab and ritiximab have black box warnings regarding risk of PML. Enhanced monitoring has been requested for natalizumab. *Conclusions:* Voluntary post market pharmacovigilance program identified that PML can be associated with the monoclonal antibodies, stressing the importance of reporting serious and/or unexpected adverse events to Health Canada (CanadaVigilance@hc-sc.gc.ca).

General Neurology and Dementia

C-01

Acquired mitochondrial toxicity in patients with adult-onset chronic progressive external ophthalmoplegia

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Objective: To demonstrate the presence of acquired mitochondrial toxicity (MT) in patients with chronic progressive external ophthalmoplegia (CPEO), a mitochondrial syndrome. *Background:* Reports have demonstrated that acquired MT may play a role in the pathogenesis of mitochondrial diseases, particularly for LHON and CPEO. Examples of acquired MT include cigarette and medication use, as well as chronic viral infections and their treatments. *Design/Methods:* This is a retrospective chart review of 43 consecutive patients with adult-onset CPEO assessed in the Adult Metabolic Disease Clinic (AMDC) up to 2008. The AMDC is the referral centre for adult-onset mitochondrial disorders for the province of British Columbia. Charts were reviewed for cigarette and statin use, and presence of hepatitis C and HIV. Clinical features and results of investigations was taken from a previous review of these patients conducted in 2008. *Results:* Twenty patients (47%) were cigarette smokers, four (9%) had hepatitis C infection and three (7%) had longstanding HIV infection on antiretrovirals. Five patients (12%) had used statin medication although duration of use was not known, and two (5%) had a history of alcohol abuse. The estimated prevalences for smoking, hepatitis C and HIV in British Columbia are respectively, 20.2%, 0.8% and 1.2%. *Conclusions/Relevance:* Although this is a small descriptive study, subjects in this series appear to have greater exposure to the measured sources of acquired MT than expected for the general population. Further study is warranted using larger series. Acquired MT may be of importance in the pathogenesis of adult-onset CPEO, and possible mechanisms and implications are discussed.

C-02

Invasive investigation for insular epilepsy: opened micro-dissection of the Sylvian fissure (type 1) vs. combined Yale-Grenoble stereotactic implantation (type 2)

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Evidence suggests that failure to recognize insular seizures may be responsible for epilepsy surgery failures. Confirmation of insular seizures requires an invasive study in absence of a clear epileptogenic lesion. We sought to investigate two methods of sampling the insula. A retrospective analysis of intracranial studies with insular sampling between 1996 and 2009 was performed. Seventeen patients with suspected insular involvement during epileptic seizures had an intracranial study with insular coverage. The first type of implantation consisted of an unilateral craniotomy, insertion of insular electrodes by micro-dissection of the Sylvian fissure, orthogonal implantation of medial temporal structures with neuronavigation, extensive coverage of the three adjacent lobes with subdural electrodes. The second type consisted of MRI-stereotactic frame-guided depth electrode implantation into the insula and the hippocampus using sagittal axes and insertion of subdural electrodes through burr holes to cover the three adjacent lobes. The first type was used for 15 subjects (total: 25 insular electrodes; 51 insular contacts) and the second type was used in 2 subjects (total: 5 insular electrodes, 27 insular contacts). Insular spikes were found in 9 subjects and insular seizures in 6. Two reversible complications occurred. The insula can be safely explored either by opened micro-dissection of the Sylvian fissure or a combined Yale-Grenoble stereotactic implantation. The former is better suited for unilateral insular and high spatial resolution investigation of adjacent lobes while the latter is indicated for unilateral or bilateral insular and adjacent lobes investigation

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C-03

Central nervous system granulomas associated with anti-tumor necrosis factor alpha therapy

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Background: Anti-tumor necrosis factor alpha (anti-TNF alpha) agents, such as Adalimumab, have been used to successfully treat autoimmune conditions. Case reports indicate these agents may induce granulamatous conditions: non-caseating granuloma in bone marrow (Rheum Int (2009) 29: 437), granuloma annulare (Ann Rheum Dis (2008) 67: 567) and sarcoidosis (Sem in Arth, in press). *Methods:* Here we report the case of a patient with a five-year history of rheumatoid arthritis, who had been treated with Adalimumab for five months. The treatment was stopped when the patient developed ascending, bilateral paresthesias. The patient presented to the emergency department 2 months post treatment cessation with personality changes and problems with inattention and balance. *Results:* The presence of extensive granulomas was confirmed by biopsy of the leptomeninges and frontal cortex, following an MRI indicating bifrontal lobe symmetrical vasogenic edema with leptomeningeal enhancement. Extensive serological testing and examinations of the leptomeninges, parenchyma, and cerebrospinal fluid failed to identify any infectious organisms. Consequently, the pathogenesis of the granulomas was thought to be autoimmune and a course of steroids was initiated. The patient recovered, with minor deficits in attention. *Conclusion:* To our knowledge, this is the first reported case of CNS granulomas associated with anti-TNF alpha therapy.

C-04

Early clinical features differentiate cerebellar variant of multiple system atrophy and sporadic ataxia

*AJ Lloyd-Smith (Vancouver), M Schulzer (Vancouver), SD Spacey (Vancouver)**

Background: Early differentiation between Multiple System Atrophy type C (MSA-C) and Sporadic Ataxia (SA) presents a diagnostic challenge. Our objective is to determine if there are clinical characteristics at presentation which lead to early differentiation of MSA-C and SA. *Methods:* A retrospective chart review was performed at a neurology clinic. 25 individuals with a diagnosis of MSA- C (2008 International Consensus Statement for MSA) and 31 with SA were identified and clinical features at time of presentation were recorded. *Results:* A multivariate forward step-wise regression analysis was performed and both intention tremor ($p= 0.015$) and urinary urgency ($p=0.001$) were a more common clinical finding at time of presentation in patients with a final diagnosis of MSA-C. Based on the ROC curve, a sensitivity of 80% was obtained at a specificity level of 80%. The AUC was 0.894 with a 95% confidence interval of 0.815 to 0.974. *Conclusions:* We have identified intention tremor, and urinary urgency, at initial presentation as features which are significantly more common in patients who go on to develop MSA-C. The combination of these 2 clinical features provides a specificity of 80% and a sensitivity of 80% in predicting an eventual diagnosis of MSA-C.

C-05

Headache severity, comorbidities, and healthcare resource utilization (RU) among chronic migraine (CM) and episodic migraine (EM) in Canada

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Background: Migraine is a prevalent and disabling condition. Migraine frequency and severity, as well as related comorbidities, are likely to affect healthcare resource use in Canadian migraineurs. *Methods:* Cross-sectional data were collected via web-based survey. Respondents were classified as having either CM or EM (ICHD-2 diagnosis of migraine and $\geq$ 15 headache days/month or $\leq$14 headache days/month, respectively). Demographic characteristics and healthcare provider visits within three months were assessed. Data were analyzed descriptively and logistic regression models examined RU by migraine group, adjusting for covariates. *Results:* Of 3,923 panelists contacted, 681 (17.4%) responders met migraine criteria; 8.1% (n=55) CM; 91.9% (n=626) EM. Demographic features were similar in this predominantly female (86.6%) midlife (mean age 47) sample. The CM group reported more severe headache pain than EM (87.3% vs. 76.2%, respectively) as well as more frequent pain and psychiatric sequelae. CM sufferers were 4.8 times (95% CI=2.5-9.4) as likely to have visited a primary care provider for headache than EM, after adjusting for covariates. CM were also more likely to have seen a specialist (OR=3.0, 95% CI=1.1-8.4) than EM. *Conclusions:* In comparison to the EM group, the CM group experienced more frequent headaches, more severe headache and used significantly more healthcare resources.
Study Supported by: Allergan, Inc.

C-06

Plastic change of neuromagnetic responses in auditory cortices over the course of music-supported motor rehabilitation program

T Fujioka (Toronto), S Jamali (Toronto), JE Ween (Toronto), DT Stuss (Toronto), B Ross (Toronto)*

Background: Converging evidence indicates that motivated learning such as music practice causes reorganization in a wide range of cortical and subcortical structures. This study is aimed to examine the efficacy of music-supported upper-limb motor rehabilitation program by non-invasive neurophysiological measures with magnetoencephalography (MEG). *Methods:* A 87-year-old male patient with left upper-limb motor impairment participated in the study 4 years after the onset of stroke, characterized as scattered microvascular infarcts and right posterior limbs of the internal capsule lacune. He received 15 music sessions within 4 weeks and learned how to play drums using both hands. We examined cortical responses during listening to a short tone at three timepoints (Pre, Mid, and Post-training). *Results:* The patient developed the ability to play more complex patterns over the sessions. We obtained successfully the auditory evoked responses at Pre- and Post-training. Although similar in morphology, the Post-training response amplitudes were larger than Pre-training at 100 and 200ms latency by 48%, and 56% in the left, and 50% and 90% in the right auditory cortex, respectively. *Conclusions:* Music-supported rehabilitation promoted substantial enlargement of cortical responses for a chronic

patient even after a short-term training. Individual neuromagnetic responses are promising measures of the trajectory of cortical reorganization.

C-07

Neuromagnetic sensory evoked response as a biomarker of cortical reorganization during stroke recovery

*S Jamali (Toronto), B Ross (Toronto), JE Ween (Toronto), DT Stuss (Toronto), T Fujioka (Toronto)**

Background: Functional reorganization in the somatotopic map of the hand area in primary somatosensory cortex (SI) may serve as biomarker for stroke recovery. We examined such reorganization noninvasively using magnetoencephalography (MEG) during the time course of a music-supported training program designed for improving motor skill in the chronic stage of stroke. *Methods:* Somatosensory evoked responses were recorded with MEG in a patient with lateralized upper-limb motor impairment before, midway, and after 15 days of music training. Vibrotactile stimuli at 20 Hz were applied to index and ring finger of the affected and unaffected hand in separate blocks. Sources of evoked activity were localized in SI. The spatial relationship between the two finger representations was compared across the three timepoints using non-parametric resampling statistics. *Results:* The somatotopic map in the unaffected hemisphere followed the normal somatotopic organization with the index finger located more medial and superior with respect to the ring finger. This was reversed in the affected hemisphere initially, but normalized gradually over the course of the intervention. *Conclusions:* The preliminary findings support the hypothesis that plastic reorganization in the somatosensory cortices is paralleled by changes in motor functions. Neuromagnetic sensory evoked responses are a useful measure for cortical reorganization.

C-08

A validation study of the diagnostic accuracy of the revised 2008 consensus criteria for the diagnosis of MSA-C in British Columbia

KL Jack (Vancouver), SD Spacey (Vancouver)*

Background: Multiple system atrophy (MSA) is a sporadic, progressive neurodegenerative disorder, which has a poor prognosis. There are two clinical forms of MSA: (1) MSA-C that presents predominantly with a cerebellar syndrome including varying combinations of ataxia, dysarthria, and/or oculomotor abnormalities, and (2) MSA-P that presents predominantly with parkinsonism. Diagnostic criteria were established in 1998 and then subsequently revised in 2008. Our objective was to compare the sensitivity and specificity of the 2008 MSA-C diagnostic criteria with the 1998 criteria. *Methods:* A retrospective medical chart review was performed on all patients with cerebellar manifestations presenting to the UBC Ataxia Clinic. We applied the 1998 and the 2008 diagnostic criteria to this cohort to compare their diagnostic sensitivity and specificity. We also compared the ability of both sets of criteria to predict progression from Possible to Probable MSA-C. *Results:* Our data shows that an increased number of patients fulfill the Possible MSA-C category at preliminary neurological assessment using the Revised 2008 Criteria compared to the 1998 version. In addition, there is greater progression from Possible MSA-C to Probable MSA-C with longitudinal follow-up using the 2008 criteria. *Conclusions:* When compared to the 1998 criteria, the 2008 MSA-C criteria have greater diagnostic sensitivity at initial neurological assessment and are more predictive of progression from Possible to Probable MSA-C.

C-09

Prevalence of overweight in patients with migraine: a population base study with a control group of healthy patients

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Background: Previous studies support the concept that obesity is an exacerbating factor for migraine. Also, some studies have found an increased frequency of obesity and overweight in migraine patients compared to the normal population. *Methods:* We studied 1379 patients with migraine and 610 controls. The migraine population was paired by gender with a healthy control group. Using a standardized interview –according to the criteria of the International Headache Society (IHS) the presence of migraine was evaluated. We used the MIDAS questionnaire to evaluate headache-related disability. *Results:* Mean age of patients with migraines was 38 + 13.4 and 35 + 12 in the controls. The percentage of females in both groups was similar (migraine 82% vs. control 83%, $p>0.05$). The severity of migraine was as follows: 2.5% mild, 39.4% moderated and 58% severe migraine. 53% had migraines with aura and 47% without aura. The BMI in patients with migraines was 25.31+ 4.4 and 25.6+ 4.4 in controls ($p<0.05$).The distribution of the BMI in migraine patients vs controls was the following: underweight (BMI <18.5) 3.1% vs. 1.5%, normal(BMI 18.5-24.9) 45% vs.47%; overweight (BMI 25-29.9) 38% vs. 33%; obese (BMI 30-34.5) 10% vs. 13.6%; morbid obese (BMI 35) 3.4% vs. 4.3% . Only overweight was statistically significant ($p< 0.03$). No association relation was found between disability and severity of migraine with overweight or obesity. *Conclusions/Relevance:* This study did not find an increased prevalence of obesity in patients with migraine. However, being overweight was slightly increased in migraine patients.

Neuromuscular and Neuro-oncology

D-01

Case series: vestibular schwannoma resection after radiation treatment

CC Gillis (Vancouver), R Akagami (Vancouver)*

The “gold standard” for treatment of Vestibular Schwannomas is microsurgical resection. Radiation treatment options include Stereotactic Radiosurgery (SRS) and Stereotactic Radiotherapy (SRT). The follow up in the literature for SRT is shorter than available for the other two methods. A major criticism of radiation treatment is that failure leads to increased morbidity in salvage surgery. A recent study by Roche et al. showed that in surgery for failed Gamma Knife (SRS) ½ of their cases had compromised facial nerve preservation. The study group consisted of a retrospective chart review of 7 patients operated on by the senior author from January 2001- June 2009 who failed radiation treatment. 5/7 of the patients received SRT at British Columbia Cancer Agency (BCCA), 1 received Gamma Knife Surgery in Seattle and 1 SRS at BCCA.

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There was an average of 6.4 y delay from radiation treatment to surgery (5.2 y in SRT only). The arachnoid adhesions were thickened and there was increased tumor adherence to the facial nerve. Facial nerve morbidity was 2/7 with House-Brackmann grade 2 and 1/7 grade 3. Gross total resection was achieved in 6/7 cases. This shows that gross total resection is achievable in post radiation patients. There is a significant time delay between radiation treatment and failure which may affect the results reported for SRT as many series do not have follow-up data for 6 years. Our facial nerve preservation rate was compromised in ½ of cases, comparable to the Roche et al study.

D-02

Ependymoma stratification according to expression of the epidermal growth factor and the Y-box binding protein-1

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Background: At this time there are limited molecular biomarkers to stratify patients into high versus low risk ependymoma. Furthermore there is grading discordance between neuropathologists with the current WHO stratification system. We hypothesised that signalling components of the epidermal growth factor receptor (EGFR and/or Her-2) and Y-box binding protein-1 (YB-1) signalling pathway will improve risk stratification given that they lead to uncontrolled tumour cell growth and drug resistance. *Methods:* We performed a retrospective review of all children under 18 years old, diagnosed with ependymoma in British Columbia between 1982 and 2004. Tissue microarray slides were constructed and immunostained for EGFR, Her-2, and YB-1. Patient survival was assessed over 5-years. *Results:* Reviewer discrepancy between WHO Grade II and III was evident. No correlation was found relating Her-2 to OS. High EGFR staining was associated with poor (OS) (45% vs 84%, p=0.004). Patients with tumours expressing high levels of EGFR and YB-1 had far worse survival (17% vs 85% OS, p<0.0001) than if the levels were both low. *Conclusion:* This is the first pilot study on a population-based cohort to demonstrate that EGFR and YB-1 are features of high-risk childhood ependymoma suggesting that inhibitors to this pathway may be beneficial.

D-03

Role of bone marrow derived progenitor cells in intracranial tumor neovascularization

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Background: Recent data suggests that tumor vascularization can occur through differentiation of bone marrow derived progenitor cells (BMDCs) into new vessels, a process known as vasculogenesis. Contribution of vasculogenesis to brain tumor neo-vascularization is poorly understood. Furthermore, impact of ionizing radiation (IR) on this process remains unexplored. *Methods:* We use chimeric NOD/SCID mice that have bone marrow (BM) reconstituted with BM derived from GFP transgenic mice and create an intracranial window chamber model (ICW) at the center of which U87 glioma cells stably expressing mCherry fluorochrome are implanted. Two-photon laser capture microscopy (2PLM) allows real-time in-vivo longitudinal images of tumor cells, tumor vasculature and tracing of the circulating GFP+BM cells. In order to examine effects of IR, U87-mCherry tumors were treated with hemicranial irradiation at two regimens, 3x2Gy or 3x5Gy and compared to IR alone or U87-mCherry alone as controls. *Results:* Within 24 hours following tumor cell implantation GFP+ BMDCs can be seen circulating intravascularly and lining the vessel wall. After 7d post implantation number of GFP+BMDCs within vessels decreases whilst cells migrating, differentiating and integrating outside the vessel lumen increases. These cells are macrophage/monocytes lineages that support tumor growth. Intriguing observation is that IR increases macrophage differentiation. *Conclusion:* Our results are the first to examine the dynamic evolution of BMDC in glioma vasculature in real-time. We demonstrate that BMDC do not directly contribute to endothelial cells but differentiate to form macrophages and vascular support structures. Ongoing work focuses on understanding specific alterations in response to IR.

D-04

Hearing preservation following microsurgical resection of large vestibular schwannomas

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Although contemporary surgical series of large (≥3 cm diameter) vestibular schwannomas (VSs) document low morbidity and excellent facial nerve preservation rates, hearing preservation has been infrequently reported. We present the possible predictors of hearing preservation from a single center series of large vestibular schwannomas. 192 patients underwent surgical resection of a vestibular schwannoma. These included 46 large tumors. The quality of preoperative hearing, presence of a CSF cleft in the internal auditory canal (IAC), longitudinal extent of IAC filling, and proportion of tumor anterior to the longitudinal axis of the IAC were compared between hearing groups. Mean maximum tumor diameter for the entire cohort of large VSs was 3.6 cm and mean volume was 17.2 cc. The hearing preservation rate was 4/11 (36.4%). Complete resection was achieved in 6/6 cases (41/47 for the entire cohort). Tumor volume, maximal diameter, and longitudinal extent of IAC filling was equivalent between groups. 6/6 patients with preserved hearing had a CSF cleft, versus 9/16 patients without pre-operative hearing and 9/20 for patients with serviceable hearing but lost post-operatively. 6/6 patients with preserved hearing had <35% of the tumor anterior to the longitudinal axis of the IAC, compared with 13/20 in the serviceable hearing but lost group. Our series demonstrates that hearing preservation is possible for large vestibular schwannomas. The quality of pre-operative hearing, presence of a CSF cleft at the apex of the IAC, and a smaller proportion of tumor anterior to the axis of the IAC were positively associated with hearing preservation.

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D-05

Defining the optimal management of os odontoideum: results of a systematic review

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Introduction: Os-odontoideum is a rare spinal disorder with patients existing on a spectrum of symptom severity from completely asymptomatic to severely myelopathic. Due to the paucity of cases and the poorly understood natural history of this condition it is difficult for clinicians to predict which patients require treatment to prevent symptomatic progression and potentially devastating neurologic injury. To augment our understanding of this condition we have undertaken a systematic review of the literature to evaluate outcomes in the treatment of os-odontoideum. *Methods:* We searched Pubmed, EMBASE, Cochrane, National Guideline Clearinghouse Databases and bibliographies of key articles from 1970 to August 2009 for cases of symptomatic and asymptomatic os-odontoideum. Each individual study was rated by two different investigators against pre-set criteria that resulted in an evidence rating. *Results:* We identified 11 articles meeting our inclusion criteria. Seven studies included patients with asymptomatic os-odontoideum discovered incidentally from which it was possible to examine data on 18 individuals. Six studies were identified containing more than 15 patients with symptomatic os odontoideum. Of the 18 asymptomatic patients, 9 were treated with surgical fusion, via C1/2 transarticular fixation, while the remaining 9 were treated conservatively. All 18 patients remained asymptomatic at follow-up. Three hundred forty four patients with symptomatic os-odontoideum were identified. All but 19 patients were treated surgically with a fusion rate of 99% at a mean of 1 year. Symptom resolution was variable and depended on preoperative symptomatology. *Conclusion:* Based on this systematic review we will offer evidence based treatment recommendations for os-odontoideum

D-06

Four cases of anti-N-methyl-D-aspartate receptor limbic encephalitis

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Background: Anti-N-Methyl-D-Aspartate (NDMA) receptor limbic encephalitis is a recently described paraneoplastic syndrome associated with psychiatric symptoms, seizures, movement abnormalities and ovarian teratoma. *Methods:* We report 4 cases of Anti-NMDA receptor encephalitis diagnosed within the McGill University Health Care network between May and September 2009. *Results:* All four patients, females ranging from 8- to 29-years-old, initially presented with behavioural abnormalities. Concomitant manifestations included convulsions and movement abnormalities such as dystonia. Investigations showed CSF lymphocytic pleocytosis in all patients, mesial temporal lobe hyperintensities on MRI and epileptiform activity on EEG in three of the four patients. Screening autoimmune serologies was unremarkable in all patients. Routine paraneoplastic antineuronal nuclear antibody panel performed in two of the four patients was negative. Detection of NMDA receptor antibodies in serum and CSF confirmed the diagnosis in all four patients. Time from symptom onset to treatment ranged from four weeks to four years. An ovarian teratoma was discovered in two patients and promptly resected. Immunotherapy included combinations of steroids (n=4), IVIg (n=4), plasmapheresis (n=3), and rituximab (n=2). The two patients with the shortest time interval from symptom onset to adequate treatment (four weeks and six weeks) demonstrated marked clinical improvement with return to baseline functional status following teratoma resection and/or immunotherapy. *Conclusion:* Anti-NMDA receptor encephalitis was until recently an under-recognized entity. This diagnosis should be suspected in young female patients presenting with acute behavioural changes, movement abnormalities and convulsions. Dramatic clinical response can be achieved with early resection of underlying ovarian teratoma and immunotherapy.

D-07

Longterm follow-up in three patients with severe generalized myasthenia gravis treated with autologous stem cell transplant

CE Pringle (Ottawa), HL Atkins (Ottawa)*

Background: The B-cell mediated, T-cell dependent nature of Myasthenia Gravis (MG) suggests that stem cell transplant would be a rational therapeutic strategy. Although the majority of patients with MG can be adequately managed with standard therapy, a small number of patients fail such therapy, either due to unacceptable side effects, inadequate symptomatic relief or the presence of a serious co-morbidity. We present longterm follow-up on 3 such patients treated with autologous stem cell transplant. *Methods:* Three myasthenic patients underwent immunoablative therapy with high dose chemotherapy and total body irradiation followed by hematopoietic 'rescue' with autologous stem cell transplantation: one was transplanted specifically because of repeated myasthenic crises, a second patient with severe MG underwent transplant as a therapy for recurrent intermediate grade non-Hodgkin's lymphoma, and a third patient chose transplantation because of a combination of unacceptable side effects of standard medications, inadequate symptomatic response and the development of disabling inflammatory arthritis. *Results:* Patients were followed 30 to 103 months. Patient 2 died of recurrent lymphoma 30 months after transplant but was asymptomatic from her MG and on no myasthenia-related medications at the time of her death. The remaining patients were symptom-free and off all myasthenia-related medications at 36 and 103 months of follow-up, respectively. None displayed clinical or electrophysiologic evidence of defective neuromuscular transmission. *Conclusions:* Stem cell transplant appears to be an effective treatment for selected cases of severe MG.

D-08

The Canadian Neuromuscular Disease Registry (CNDR): study design and methodology

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The CNDR is a new Canadian nationwide registry-database of patients with specific neuromuscular diseases (NMD). The primary objective is to facilitate design and execution of clinical research. We will discuss the CNDR study design, informatics, administrative structure, disease clinical data sets, and procedures for submission of study proposals. The CNDR National Steering Committee (CNDR-NSC) consisting of NMD and methodology experts from across Canada provides oversight and guidance for the CNDR. The CNDR

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consists of affiliated regional co-investigators and their respective neuromuscular clinics serving as clinical data collection centres. The CNDR is administered centrally through the national office at the University of Calgary via a secure web server providing logistical and administrative support. Currently the CNDR consists of three index diseases: myotonic dystrophy, Duchenne muscular dystrophy and Guillain-Barre syndrome. Clinical research project proposals can be submitted to the CNDR-NSC. Successful applicants will receive the appropriate de-identified clinical data for research purposes. Investigators seeking subjects for recruitment into a clinical trial can apply to the CNDR-NSC and upon approval the appropriate subjects will be contacted by the CNDR with details of the clinical trial and investigators' contact information. The CNDR is financially supported by the Marigold Foundation and Jesse's Journey.

D-09

A snapshot of an academic neuromuscular clinic

SL Venance (London), E Lopes (London), J Verheyden (London), WJ Koopman (London), MW Nicolle (London)*

Background: The LHSC Neuromuscular Clinic serves a population of ~2.5 million for consultation and/or management of individuals with nerve, neuromuscular junction (NMJ) or muscle (excluding motor neuron disease) disorders. Fourteen Local Health Integration Networks (LHINs) were introduced by government in 2006 on the premise that care is best coordinated and funded in an integrated manner at the community level. *Methods:* A retrospective chart review of 1493 patients seen during 2007 was undertaken to begin to define the role of the NMC to stakeholders. *Results:* 1336 charts were available for review; 33% were new referrals. 43% were females; 71% of patients were 15 - 64 years and 29% over 65 years. While 90% of patients lived within four contiguous LHINs, referrals came from all. Referrals originated with family physicians (45%) and specialists (55%; 63% of which were from neurologists). Diagnoses included acquired (46%) and hereditary (18%) neuromuscular disorders, central nervous system disease (CNS) (4%), motor neuron disease (2%) and unknown diagnosis (30%). Of the latter, the top considerations were acquired neuropathy (29%), acquired muscle (20%), CNS (16%) and hereditary muscle (11%). *Conclusions:* Next steps in defining the role of the LHSC NMC to our stakeholders will include assessment of the needs and expectations of patients and families.

Pediatric Neurology

E-01

Radial columnar cortical architecture: maturational arrest or cortical dysplasia?

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

Introduction: The fetal cerebral cortical plate at mid-gestation exhibits radial columnar architecture rather than histological layering. Lamination is superimposed later in gestation, but traces of the residual columnar pattern may persist postnatally at the crowns of gyri and the depths of sulci. In mature brain, prominent columnar architecture is abnormal. Standard classifications of focal cortical dysplasias in epileptic patients do not include this as one of several patterns described. We frequently find it in epilepsy surgery resections in children, in certain genetic malformations and some chromosomopathies. *Materials and Methods:* Neuropathological examination was performed in 48 resections of epileptogenic neocortex in children and postmortem in chromosomal disorders and genetic malformations. *Results:* Radial columnar architecture was a component of 32 focal cortical dysplasias. Inhibitory interneurons by tangential migration were abnormally distributed. An infant with DiGeorge syndrome exhibited columnar architecture in all cortical regions. In hemimegalencephaly the pattern was both in the dysplastic enlarged hemisphere and in contralateral cortex. In polymicrogyria and pachygyria it was mixed with other patterns of dysgenesis. *Conclusions:* Columnar neocortical architecture may persist as a maturational arrest in development, but also is frequent in focal dysplasias and may be epileptogenic. We propose that it be classified as another distinct focal cortical dysplasia.

E-02

Survival curves in outcome of mild traumatic brain injury

KM Barlow (Calgary), S Sandhu (Calgary), S Crawford (Calgary), D Dewey (Calgary)*

We investigated the epidemiology and natural history of PCS symptoms in a large cohort of children with a mild traumatic brain injury (mTBI) in comparison to children with an extra-cranial injury. *Methods:* This was a prospective consecutive controlled cohort study of 670 children presenting to a tertiary referral emergency department (ED) with mTBI and 197 controls with extra-cranial injury. All participants received a telephone interview 7-10 days post-injury. If a change from baseline symptoms was reported, follow-up continued monthly until symptom resolution. Outcome measures: Post-concussion symptom inventory; Rivermead Post-concussion symptom Questionnaire; *Results:* There was a significant difference between the mTBI group and the extra-cranial injury group in their survival curves for time to symptom resolution (log rank (Mantel-Cox) =11.15, p<.001). Symptoms were more likely to persist in more severe mTBI injury categories (log rank (Mantel-Cox) =85.88, p<.001). The trajectories will be demonstrated. *Conclusions:* Within the category of mild TBI symptoms are more likely to persist with more severe injuries especially were there is loss of consciousness. This is in keeping with a recent albeit smaller study by Yeates et al (1). This study provides further support for the validity of the diagnosis of PCS in children.

References:

1. Yeates KO, Taylor HG, Rusin J, Bangert B, Dietrich A, Nuss K et al. Longitudinal trajectories of postconcussive symptoms in children with mild traumatic brain injuries and their relationship to acute clinical status. Pediatrics. 2009; 123(3):735-43.

E-03

The role 5-HT1A gene promoter polymorphism in post-concussion syndrome in children

KM Barlow (Calgary), K Smith (Calgary), S Crawford (Calgary), S Sandhu (Calgary), D Dewey (Calgary), J Parboosingh (Calgary)*

Background: Depression may precede or follow mTBI and may also mimic post-concussion syndrome (PCS) in adult populations. We

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previously reported no association between depression and PCS in children. The purpose of this study is to investigate whether variance in the promoter region of the 5-HT1A gene (–1019 C>G) is related to the development of PCS. *Methods:* Population: A prospective longitudinal follow-up cohort of 671 children with mTBI presenting to a pediatric ER. Sample: 47 symptomatic children (cases) were compared to 42 asymptomatic children post-injury (controls). The cases and controls did not differ significantly in age or sex from the study population. Cytology brushes were used to obtain a sample of buccal cells from the subjects for DNA analysis. Outcome measures: Child Depression Inventory, Post-concussion symptom inventory. *Results:* Symptomatic children were significantly older, 12.40 ±4.50 cf. 9.373 ±5.63 years ($p < 0.01$) and had experienced more life stressors ($p<0.01$). There was no difference in depressive symptoms between groups, or in the allelic and genotypic frequencies for the HTR1A C(-1019)G , $p=0.52$. *Conclusions:* Children who developed PCS symptoms following mTBI did not differ in the frequency of 5-HT1A polymorphisms from children who were asymptomatic following a mTBI. This further supports our findings that depression is not associated with PCS in children.

E-04

A decade of dystrophin mutations: preliminary report from the Canadian Paediatric Neuromuscular Group

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Background: Duchenne and Becker muscular dystrophy (DBMD) are allelic disorders caused by dystrophin gene mutations on Xp21. This study describes the diagnostic methods and mutation frequency of the Canadian Paediatric Neuromuscular Group (CPNG). *Methods:* De-identified data containing the clinical phenotypes, diagnostic methods, and mutational reports from DBMD patients followed by CPNG centers during 2000-2009 were analyzed using descriptive statistics. *Results:* 774 DBMD patients had a confirmed diagnosis based on genetic testing (97%), muscle biopsy (2.3%), or family history (0.7%). 572/774 (73.9%) had complete deletion/duplication analysis of all 79 exons plus or minus whole gene sequencing resulting in 365 (63.8%) deletions, 63 (11.0%) duplications, and 144 (25.2%) point mutations. 246 (43.0%) mutations involved exons 45-53. The top ten deletions (147, 25.7%) were exons 45-47, 45-48, 45, 45-50, 45-55, 51, 45-49, 45-52, 49-50, and 46-47. 169 (29.5%) mutations involved exons 2-20. The most common duplications (29, 5.1%) were exons 2, 2-7, 2-17, 3-7, 8-11, 10, 10-11, and 12. *Conclusion:* This is the first comprehensive report of dystrophin mutations in Canada. It highlights the need for complete genetic testing in a substantial portion of Canadians with DBMD and collaboration among academic centers to ensure that patients are receiving optimal care and mutation-specific therapies.

E-05

Patterns of neuroinflammation and cortical astrocyte loss in Rasmussen's encephalitis

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Background and Objectives: Rasmussen's encephalitis is a progressive childhood epileptic encephalopathy characterized by medically refractory focal epilepsy, cognitive impairment, hemiplegia and inflammation. An autoimmune aetiology has been proposed based primarily on a limited clinical response to immune-modulatory therapies and inflammatory cell infiltration on pathological studies. We sought to characterize the pattern of inflammatory marker expression in the brain of patients with Rasmussen's encephalitis. *Methods:* Three patients with clinical histories and neuropathological findings consistent with Rasmussen's encephalitis were studied (ages 4, 11, 18). Two patients had left hemispherectomies and one patient with bilateral disease was studied at autopsy. Control brains were obtained at autopsy from subjects with various causes of death. mRNA expression profiles were determined using quantitative reverse transcriptase polymerase chain reaction (RT-PCR) from frozen tissue of both white matter and cortex. *Results:* mRNA expression profiles of CD3ε, CD8β, Granzyme A and HLA-DRA revealed upregulation in white matter but not in cortex relative to control brain samples. Furthermore, a marker of T-regulatory cells, FoxP3 was suppressed in white matter and in cortex relative to CD3ε in Rasmussen's samples but not control brains. Markers of astrocyte activation, Aquaporin-4 and GFAP were downregulated in cortex but not in white matter of Rasmussen's samples. Immunohistochemistry confirmed the mRNA expression findings. *Conclusions:* These results suggest that white matter inflammation predominates in Rasmussen's encephalitis with cortical astrocyte loss and T-regulatory cell loss playing an important role in its pathogenesis.

E-06

DLX transcriptional regulation of GABaergic interneuron migration – relevance to neuronal migration disorders

*TN Le (Winnipeg), DD Eisenstat (Winnipeg)**

Background: Despite progress in our understanding of forebrain development, the molecular mechanisms of neurodevelopmental disorders remain relatively unexplored. The distal-less (DLX) homeobox genes Dlx1 and Dlx2 are expressed in the basal (ventral) telencephalon in the ganglionic eminences (GE) and regulate tangential GABAergic interneuron migration to the (dorsal) neocortex in mouse and humans. The Dlx1/Dlx2 double knockout (DKO) mouse, which dies at birth, has a cleft palate and near absence of neocortical GABA. Using chromatin immunoprecipitation of embryonic GE, we previously identified Neuropilin-2 (NRP2) as a direct transcriptional target whose expression is repressed by DLX1 and DLX2. NRP2 is the receptor for Semaphorin-3A/3F (Sema3A/F) secreted ligands that inhibit neuronal migration. *Hypothesis:* Removal of Nrp2 expression in the Dlx1/Dlx2 DKO will partially restore tangential interneuron migration to the neocortex. *Results:* There is aberrant expression of NRP2 as interneurons accumulate as periventricular heterotopias in

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the Dlx1/Dlx2 DKO; this is consistent with de-repression of NRP2 in the absence of Dlx1/Dlx2 gene function. We generated a Dlx1/Dlx2/Nrp2 triple knockout (TKO) mouse, which also dies at birth. Of significance, there is partial restoration of GABAergic tangential interneuron migration in the TKO compared to the DKO. We then determined that of all the inhibitory interneurons that express GABA, there was complete rescue of those interneurons co-expressing somatostatin. *Conclusions:* DLX1/DLX2 mediated repression of Sema3A/F-NRP2 signaling is responsible for tangential migration of GABA/somatostatin co-expressing inhibitory interneurons to the neocortex. This discovery may help us to unravel the neurodevelopmental basis for some neuronal migration disorders, including those underlying congenital epilepsies.

E-07

Functional magnetic resonance imaging (fMRI) in the localization of atypical language networks in pediatric epilepsy surgery candidates

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Background: Functional MRI (fMRI) is increasingly used to assess language networks non-invasively prior to surgery for epilepsy, tumors and vascular lesions. The prevalence of atypical language networks is increased with epilepsy; hence, the importance of pre-surgical language studies in children. *Methods:* 35 children with refractory epilepsy, aged 4-19 years, underwent pre-surgical fMRI language studies. 32 studies were successful; 3 failed (2 with excess head motion; 1 with scanner artifact). Language dominance was determined by calculating the cerebral laterality index (LI) on one or more language tasks, and classifying each as having typical (left) or atypical (bilateral or right) language dominance. *Results:* Atypical language dominance was observed in 28% (9/32) patients, all of which had an epileptogenic focus in the left hemisphere. 55% (5/9) of patients with atypical language dominance were right handed. The etiology of the epilepsy was infarction (n=3), cortical malformation (n=2), tumor (n=2), and focal atrophy (n=1). One patient with atypical language had normal MRI at 1.5T and 3.0T. 17 patients underwent surgery (13 resections, 2 corpus callosotomies, and 2 vagal stimulators). At follow-up, 2 patients (1 left, 1 bilateral) had worsening of word finding defects following left temporal lobe resection. There were no adverse effects of fMRI. *Conclusions:* fMRI to assess language networks can be performed safely and effectively in children. Atypical language is common in children with refractory epilepsy.

E-08

Fetal hippocampal development: analysis by magnetic resonance imaging volumetry

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Background: The hippocampal formation plays an important role in learning and memory, however we have limited data on its development in utero. This study was performed to evaluate fetal hippocampal development in healthy fetuses of varying gestational ages using 3D reconstructed magnetic resonance imaging (MRI). *Methods:* A cohort of 20 healthy pregnant women (Median gestational age 25.1 (21-36) weeks) underwent prenatal MRI. Images were reconstructed using an automated intersection-based motion correction algorithm. Manual segmentation of the hippocampal formation was subsequently performed based on adult hippocampal volumetry methodology adapted to the fetal anatomy. Right, left, and total hippocampal volume (HV) were calculated for each subject. Intracranial volumes (ICV) were calculated for 12 subjects (mean GA 23 weeks, range: 21.28-26.1 weeks) using automated segmentation methods, and we calculated the correlation coefficient between ICV and HV. *Results:* There was no significant difference between right and left HV (P=0.1). Total HV as a function of gestational age revealed a linear increase between 21 and 36 gestational weeks (P<0.001). For all subjects scanned at two time points, there was an increase in size of the hippocampus on the second fetal MRI. There was 0.82 correlation of HV with ICV for fetuses aged 21-26 gestational weeks. Intra-observer variability for manual hippocampal segmentation was 4.1%. *Conclusions:* This represents the first volumetric study of fetal hippocampal development in vivo. This normative volumetric data will be helpful for future comparison studies of suspected developmental abnormalities of hippocampal structure and function.

E-09

Ketogenic diet is associated with a reduction in neutrophil count

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Background: A 6 year old boy with schizencephaly whose seizures were controlled on the ketogenic diet (KD) died of overwhelming Group A Streptococcus sepsis in the absence of fever or rise in neutrophil count. He had no history of serious infection. Impaired immune function and serious infection have been described in patients on KD. We retrospectively examined serial neutrophil counts before and after treatment with KD. Methods: Patients started on KD between 2004 and 2008 were identified using the KD database. Neutrophil counts (at diet initiation and at 3, 6, 12, and 18 months thereafter) were collected by a retrospective chart review. Counts were compared to baseline values by means of a paired two-tailed t-test. *Results:* Neutrophil counts were available for 57 children (29 males) at baseline. Counts were available at 3, 6, 12, and 18 months in 31, 29, 28 and 14 children, respectively. The mean neutrophil count 1) at 3 months was 2.36 +/- 1.23 v 3.1 +/- 1.86 at baseline (p=0.01); 2) at 6 months was 2.05 +/- 0.88 vs. 3.48 +/- 1.94 (p=0.0002); 3) at 12 months was 2.55 +/- 2.07 vs. 3.42 +/-2.13 (p=0.09); and 4) at 18 months was 2.29 +/- 1.64 vs. 4.78 +/- 4.44 (p=0.05). *Discussion:* Treatment with the KD was associated with a reduction in the neutrophil count, which was most striking at 6 months after initiation but still evident at 18 months. The ketogenic diet may have effects on immune function. Functional immunologic studies may help to characterize this relationship.

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Stroke Prevention and Treatment 1

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F-01

Effectiveness of NA-1, a PSD-95 Inhibitor, in a non-human primate model of embolic stroke

DJ Cook (Toronto), L Teves (Toronto), M Tymianski (Toronto)*

NA-1 is an inhibitor of the interactions of NMDA glutamate receptors with the submembrane scaffolding protein PSD-95. Treatment with NA-1 decreases stroke volume and improves functional recovery in rodent models of stroke and is being evaluated in a Phase II human trial for efficacy in reducing the burden of embolic strokes incurred during endovascular aneurysm repair (ENACT trial). To test whether NA-1 is neuroprotective in embolic strokes in a gyrencephalic non-human primate species we undertook a randomized, blinded, crossover trial of NA-1 vs placebo in a paradigm that simulates the ENACT trial. *Methods:* Ten cynomolgus macaques(2.25-4.0kg) underwent right intracarotid injection of twenty 100um polystyrene spheres followed by treatment with placebo(saline) or NA-1 infused intravenously 1 hour following the embolic procedure. MRI T2 and diffusion weighted imaging(7 Tesla, Bruker Biospin) was obtained at 4, 24 hours and 4 weeks post-stroke. Raw counts and volumetric measurement of diffusion lesions were collected. Primate Stroke Scale scoring was obtained serially for 2 weeks following recovery. Following a 4-week washout period each animal was crossed over to the other treatment group and the procedure was repeated. *Results:* There were no differences in physiologic parameters or neurobehavioural outcomes between groups. Animals treated with NA-1 exhibited markedly reduced stroke numbers and volume as compared with placebo-treated animals with the greatest difference observed in the cortex. *Conclusion:* NA-1 significantly reduced embolic stroke number and volume in gyrencephalic primates. This result supports the ongoing ENACT trial.

F-02

Public health surveillance of stroke in Canada: an overview

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Background: Stroke is a leading cause of death and disability in Canada. The Public Health Agency of Canada, together with stakeholders, monitors stroke using the Hospital Morbidity Database and Mortality Database. *Methods:* Hospitalization and mortality due to stroke over 20 years were examined using ICD-10 codes: I60, I61, I63 and I64. Self-reported lifestyle risk factors were analysed from the 2007-08 Canadian Community Health Survey. *Results:* The age-sex standardized mortality rate for stroke decreased from 63.6 to 26.4 per 100,000 between 1979 and 2005. The total number of deaths due to acute stroke was 11,317 in 2005, which was slightly lower than that in 2004 (11,668), and much lower than that in 1993 (13,064). The age-sex standardized hospitalization rate for stroke was 155.5 per 100,000 in 1993/94 and 94.8 in 2005/06, a decrease of 39%. The total number of hospitalizations for stroke decreased from 46,343 to 38,341 between 1993/94 and 2005/06. The proportion of Canadians at risk for stroke remained high. In 2007-08, approximately one in five adults reported having high blood pressure. Between 2000-01 and 2007-08, the prevalence of self-reported overweight and obesity increased from 47.0% to 51.0%, while smoking decreased from 27.0% to 23.0%. In 2007-08, 14.4% of adults had all three risk factors. *Conclusion:* Hospitalization and mortality due to stroke has decreased over the past two decades, likely due to improved control of hypertension and decreased smoking rates in the population. However, the rising prevalence of obesity combined with an aging population may result in increasing incidence of stroke in the future.

F-03

Outcomes after carotid angioplasty and stenting in symptomatic octogenarians: the Calgary experience

MA Almekhlafi (Calgary), PL Couillard (Calgary)*, A Pandya (Calgary), N Shobha (Calgary)*, W Morrish (Calgary), J Wong (Calgary), MD Hill (Calgary)*

Objective: Octogenarians were excluded from participation in many carotid endarterectomy trials due to the high complication rates observed in past studies. However, stroke resulting from carotid stenosis is expected to increase with the aging population. Moreover, advances in Carotid Angioplasty and Stenting (CAS) techniques have resulted in perceived improved safety of this procedure. We sought to review our experience with carotid stenting in symptomatic octogenarians with an emphasis on short-term outcomes and complications. *Methods:* This is a retrospective longitudinal cohort study of all symptomatic patients who underwent CAS in our center between 1997 and 2007. Thirty-day stroke and death rates, and length of hospitalization were compared between the symptomatic octogenarians and non-octogenarians. *Results:* A total of 214 procedures were performed on 211 symptomatic patients (56 females). Fifty nine patients (14 females) were octogenarians. The median (interquartile range) age on procedure date for the octogenarian cohort was 83(4) years. Periprocedural death occurred in 2 (3.3 %) octogenarians and 6 (3.1 %) non-octogenarians (p = 0.96). At 30 days from the procedure, stroke occurred in 4 (7 %) octogenarians and 9 (6 %) non-octogenarians (p= 0.7). The mean hospital stay (4.8 days) was similar in the two cohorts. Age was not a predictor of the 30-day risk of composite stroke or death. *Conclusion:* The complications rate observed in octogenarians was not significantly higher than nonoctogenarians. Our findings suggest that octogenarians should be included in randomized trials examining CAS to better define the risk-benefit profile of this procedure in the elderly.

F-04

Stroke mortaltiy: derivation and validation of a clinical risk score

G Saposnik (Toronto), M Mamdani (Toronto), R Raptis (Toronto), M O'Donnell (Hamilton), R Hall (Toronto), Y Liu (Toronto), J Tu (Toronto), P Austin (Toronto), MK Kapral (Toronto)*

Background: A predictive score of mortality in ischemic stroke may aid clinicians' decision making and help improving communication with and care of hospitalized patients. *Objectives:* To identify predictors of mortality and to develop and to validate a risk score model. *Methods:* Retrospective study of 12262 patients with an acute ischemic stroke in the Registry of the Canadian Stroke Network (RCSN) (8223 patients in the derivation cohort and 4039

patients in the validation cohort) from 2003-2007. Score for mortality was developed by using a regression coefficient-based scoring system. Integer scores were assigned by dividing risk-factor coefficients by the age coefficient. *Results:* The mortality rates for the derivation cohort and validation cohort, respectively, were 12.2% and 12.6% at 30 days, and 22.5% and 22.9% at 1 year. Multivariable predictors of mortality at both 30 days and 1 year included older age, stroke severity, stroke subtype, history of atrial fibrillation, myocardial infarction, cancer or renal failure, preadmission status and hyperglycemia on admission (all p<.001). Patients with very high-risk scores had a mortality rate of 39.1% at 30 days and 58.9% at 1 year. For the derivation cohort, c-statistics was 0.85 for 30-day mortality and 0.81 for 1-year mortality. Predicted mortality rates in the validation cohort closely matched observed rates across the entire spectrum of risk. *Conclusions:* Among patients with an acute ischemic stroke, factors identifiable within hours of hospital presentation predicted mortality risk at 30-days and 1-year. This information may assist clinicians in estimating stroke mortality risk and policymakers in providing quantitative guidance for comparing facilities.

F-05

Regional leptomeningeal collateral (rLMC) score on CT angiography: good inter-rater reliability and independent predictive utility in patients with acute ischemic strokes

BK Menon (Calgary), EE Smith (Calgary), J Modi (Calgary), R Bhatia (Calgary), TW Watson (Calgary), AM Demchuk (Calgary), M Goyal (Calgary)*

Introduction: Viability of brain distal to arterial occlusions is dependent on presence of leptomeningeal collaterals. We developed a rLMC score and correlate it with clinical outcomes. *Methods:* This was a retrospective study of 214 patients with M1 MCA+/- intracranial ICA occlusion with acute ischemic strokes at our centre from 2003-09. The rLMC score(20 points) is based on scoring a) pial and lenticulostriate arteries (0-not seen, 1-less, 2-same or prominent when compared to matching region in opposite hemisphere) in the ASPECTS regions (M1-6 + ACA) and in the basal ganglia. Pial arteries in the sylvian sulcus are scored 0, 2 , 4. Primary clinical outcome was mRS≤2 at 90 days. *Results:* Excluding patients without optimal imaging (n=72) and missing data(n=4) , 138 patients(64 male, median baseline NIHSS 16) were included in the analysis. 37.6% had excellent LMC score (17-20), 40.5% had good (11-16) and 21.7% had poor (0-10) scores. Inter-rater reliability determined on 15 scans by 2 independent raters was excellent (intra-class correlation coefficient 0.87, 95% CI (0.77-0.95). In univariate analysis, age, baseline ASPECTS, CTASI ASPECTS, clot burden score(CBS),any IA treatment and LMC score were associated with good outcome (mRS 0-2). In multivariate analysis, controlling for age, baseline NIHSS, any IA treatment and imaging characteristics, excellent (OR 13.9 95%CI 2.6-76.1) and good rLMC score (OR 8.2 95%CI 1.5-44) were very strong independent predictors of good clinical outcome. *Conclusions:* The regional leptomeningeal collateral score is a good, easy to use and reliable imaging parameter on CTA for predicting clinical outcomes in acute ischemic strokes.

F-06

The ASPIRE approach for TIA risk stratification

SB Coutts (Calgary), T Jeerakathill (Edmonton), PN Sylaja (Calgary), MD Hill (Calgary)*

Background: The risk of stroke after transient ischemic attack (TIA) is elevated in the days to weeks after TIA. A variety of prediction rules to predict stroke risk have been suggested. In Alberta a triage algorithm was agreed upon for the province: patients with ABCD2 score ≥4, or motor/ speech symptoms greater than 5 minutes, or with atrial fibrillation were considered high risk (the ASPIRE approach). We assessed the ability of the ASPIRE approach to identify patients at risk for stroke. *Methods:* We retrospectively reviewed charts from 573 consecutive TIA patients referred to the stroke team either in the ED or in the stroke prevention clinic from 2002 through 2005. We recorded clinical and event details and identified the risk of stroke at 3 months. *Results:* Among 573 patients the 90-day risk of stroke was 4.7% (95% CI 3.0%, 6.4%). 80% of the patients were identified as high risk using this approach. In patients defined as high risk on the ASPIRE approach there was a 5.9% (95% CI 3.7%, 8.0%) risk of stroke. In patients defined as low risk using the ASPIRE approach there were no recurrent strokes (100% negative predictive value). In contrast, 2 patients with low ABCD2 scores suffered recurrent strokes. *Conclusion:* The ASPIRE approach has a perfect negative predictive value in the population in predicting stroke. However, this high sensitivity comes at a cost including 80% of patients as high risk.

F-07

Final 2-year results of the Vascular Imaging of acute Stroke for Identifying predictors of clinical Outcome and recurrent ischemic eveNts (VISION) study

SB Coutts (Calgary), MD Hill (Calgary), M Eliasziw (Calgary), K Fischer (Calgary), AM Demchuk (Calgary)*

MRI can identify early ischemia more accurately than CT, particularly with small volume ischemia. We evaluated the role of MR imaging in predicting outcome within 2 years in ischemic stroke or transient ischemic attack (TIA) patients. *Methods:* 334 ischemic stroke or TIA patients were prospectively enrolled; examined within 12 hours and had a stroke MR within 24 hours of onset. The effect of baseline clinical and imaging parameters on symptom progression and recurrent stroke within 2 years was assessed. We examined for effect modification based on baseline stroke severity; comparing minor stroke or TIA (NIHSS 0-5) and moderate/severe strokes (NIHSS>5). *Results:* Both severity groups had similar rates of progression (8.3% versus 9.5%, p=0.68) and recurrent stroke (6.6% versus 7.6%, p=0.82). The effect of baseline glucose>8mmol/l was consistent in predicting symptom progression and recurrent stroke within 2 years, in both severity strata. In the multivariable analysis in the minor stroke/TIA group, DWI lesion and intracranial occlusion were associated with stroke progression; microbleeds and symptomatic ICA stenosis were associated with recurrent stroke within 2 years. No clinical or imaging parameter was associated with progression or recurrent stroke in the moderate/severe group. *Conclusions:* We have found that the factors predicting progression and recurrent stroke within 2 years are different. Baseline

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hyperglycemia, a potentially modifiable factor, was associated with progression, recurrent stroke and death within 2 years.

F-08

Sleep apnea in patients with transient ischemic attack (TIA) and minor stroke

W Chan (Calgary), SB Coutts (Calgary), PJ Hanly (Calgary)*

Background: Patients with TIA and minor stroke are at high risk for recurrent stroke and disability. Obstructive sleep apnea (OSA) is associated with an increased risk of stroke and may therefore contribute to the pathogenesis of these complications, possibly mediated through intermittent hypoxemia. Our objective was to determine the prevalence and clinical features of OSA in this population. *Methods:* Patients who presented with TIA and minor stroke (NIHSS < 6) had nocturnal cardio-pulmonary monitoring to diagnose OSA and associated nocturnal hypoxemia. The clinical features of OSA were assessed by a sleep history questionnaire which included the Epworth Sleepiness Scale (ESS). *Results:* Sixty-six patients were recruited, of whom 40 (61%) had OSA (respiratory disturbance index 19.9 ± 15.5 /hr), associated with nocturnal hypoxemia (lowest nocturnal oxygen saturation 80.2 ± 9.41%). OSA patients were more commonly male, heavier, and reported a higher frequency of witnessed apneas during sleep. However, only 18% reported significant daytime sleepiness (ESS > 10). *Conclusions:* OSA is common in patients with TIA and minor stroke which may increase the long term risk of stroke recurrence. The lack of subjective daytime sleepiness could lead to under-recognition of OSA in this patient population without the assistance of objective monitoring.

F-09

Stroke prevention clinic referrals are associated with reduced mortality after stroke

F Webster (Toronto), G Saposnik (Toronto), M Kapral (Toronto), J Fang (toronto), V Hachinski (London), C O'Callaghan (Toronto), R Lyons (Toronto), A Dishaw (Toronto)*

Background: Stroke Prevention Clinics (SPCs) were established in Ontario with the goal of reducing stroke risk through evidence-based interventions. Our study evaluated the effectiveness of secondary prevention clinic referrals on mortality and readmissions after an initial stroke admission. *Methods:* We used clinical data from the Registry of the Canadian Stroke Network and linked this to administrative databases to determine readmissions and mortality. For the primary analysis, we included all patients with ischemic stroke or transient ischemic attack (TIA) seen in the emergency department or admitted to hospital between 2003 and 2008. Our primary outcome was all-cause mortality at one year after the index hospital visit for stroke or TIA. *Results:* Crude 1-year mortality rates were lower in those referred to stroke prevention clinics compared to those who were not, and this was true even after adjustment for age, sex, ethnic origin, income, comorbid conditions, stroke symptoms and severity, receipt of thrombolysis or stroke unit care, discharge destination and functional status at discharge and held true in multiple sensitivity analyses with stratification for various prognostic factors. Compared to those who were not referred, patients referred to SPCs were more likely to be younger, male, Caucasian, and to reside in higher income neighbourhoods and urban areas and to undergo more interventions. *Conclusions:* Referral to an SPC is associated with reduced mortality following stroke and with improved delivery of interventions. The basic underlying principle of our study is that ambulatory organized care, even with staggered models, makes a positive difference at all levels.

Stroke Recovery and Rehabilitation

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G-01

Hypothermic neuroprotection after global ischemia is not associated with neurogenesis in the CA1 of the hippocampus

G Silasi (Edmonton), F Colbourne (Edmonton)*

Background: Global ischemia kills hippocampal CA1 neurons while stimulating neurogenesis in the dentate gyrus. Intra- and post-ischemic hypothermia lessens CA1 injury. Therefore, we asked if such treatments influence neurogenesis in the dentate gyrus and CA1 zone after global ischemia. *Methods:* Adult rats received either 8 minutes of ischemia (2VO model) or a sham surgery. Systemic hypothermia (32˚C) was induced intra-operatively or starting from 1 to 24 hr after surgery. Following 2 weeks of recovery rats received daily BrdU injections for 7 days. At 6 weeks postischemia, hippocampal sections were stained with H&E (to assess injury) and immunolabeled with BrdU, NeuN, GFAP and Ki67. *Results:* Hypothermia treatment was highly neuroprotective when initiated intra-operatively, or at 1 and 4 hrs (>90% protection). Treatment efficacy diminished in the 12 and 24 hr groups (70%, 53% respectively), but was still significant at 12 hrs. Our preliminary BrdU labeling shows elevated cellular proliferation in the CA1 region following ischemia; however none of the hypothermia treatment protocols induced differentiation into a neuronal phenotype. *Conclusions:* CA1 neurogenesis appears to be minimal in this global ischemia model, and is not enhanced with immediate or delayed hypothermia. Thus, it does not appear that neurogenesis is contributing to the robust neuroprotective effect of hypothermia.

G-02

Cognitive changes in patients with metabolic syndrome after ischemic stroke

T Nasonova (Kyiv), V Krylova (Kyiv)*

Background: Metabolic syndrome (arterial hypertension, abdominal obesity, hypertriglyceridemia, and glucose intolerance) is one of the most important etiological components causing disruption of brain circulation and eventually stroke. Aim of current study was evaluation of cognitive functioning in patient with metabolic syndrome after ischemic stroke. *Methods:* We analyzed 92 patients (age 45 – 70 years), who were treated for ischemic stroke (with metabolic syndrome 71 patients, and without – 21). We performed clinical and neuropsychological assessment including Mini Mental Status Exam (MMSE), Schulte's tables for assessment of attention, and test of "Memorizing 10 words". *Results:* All patients showed different neurological symptoms (upper motor neuron, cortical and subcortical lesions, pseudobulbar syndrome), decreased attention and memory, increased level of LDLs and glucose, arterial

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hypertension and obesity. MMSE in metabolic syndrome was 17.5±2.1 points (control group 19.9±1.7). Impairment of verbal memory (3.8±1.2), calculation (2.7±1.1), and cognition (7.3±0.6) dominated among patients with metabolic syndrome. We identified a group of patients with more than 10 years history of diabetes mellitus, whose cognitive impairment was accompanied by severe depression. *Conclusion:* Cognitive disorders accompanied by metabolic syndromes correlates with the prevalence and progression of the degree of dementia.

G-03

Pontocerebellar diffusion MRI and cerebellar diaschisis in childhood stroke

A Kirton (Calgary), S Mah (Calgary), T Domi (Toronto), R Chen (Toronto), B O'Brien (Calgary), G deVeber (Toronto)*

Background: Crossed cerebellar diaschisis is unstudied in childhood arterial ischemic stroke (AIS). Acute corticospinal diffusion signal (CST-DWI) occurs in stroke at all ages but contralesional brainstem CST-DWI is unexplained and associated with poor outcome. We hypothesized that cerebellar diaschisis occurs in childhood AIS and correlates with contralesional CST-DWI. *Methods:* Consectutive children (>28d–18yrs) had: (1) acute, unilateral middle cerebral artery AIS, (2) DWI at <72hrs, (3) anatomical MRI (T1/T2) at >6mos, and (4) Pediatric Stroke Outcome Measure >12mos. Blinded scorers measured brainstem and cerebellar volumes (CV, left/right/hemisphere/vermis) using Osirix software. CV ratios (nonstroke/stroke) generated an asymmetry index (AI: chronic ratio/acute ratio, <1.0 suggesting diaschisis). Brainstem CST-DWI was scored by validated methods. Bilateral CST integrity was evaluated with transcranial magnetic stimulation (TMS). Associations between AI, motor outcome, and CST-DWI were sought (t-test). *Results:* Twenty-nine children (mean age 6.0±4.5years, 62% male) had comparable baseline mean CV (right=56.9cm3, left=57.1cm3). Cerebellar diaschisis was suggested overall (AI:0.973±0.05, p=0.12). Children with poor motor outcome (16/29, 55%) did not have lower AI (0.965±0.68/0.984±0.03, p=0.44) but those with contralesional CST-DWI did (0.928±0.07/0.986±0.03, p=0.03). Contralesional brainstem atrophy occurred but CST integrity appeared normal. Rater reliabilities were excellent (>0.92). *Conclusions:* Cerebellar diaschisis occurs in childhood AIS. Association with acute contralesional CST-DWI suggests this represents early corticopontocerebellar pathway degeneration.

G-04

The involvement of superior colliculi in post-stroke unilateral spatial neglect: a pilot project

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Background: The neural mechanism of unilateral spatial neglect (USN) is unclear. The superior colliculi (SC) are suggested to be involved in USN presentation. The spatial summation effect (SSE), where reaction times to bilateral stimuli are faster than to unilateral, is a behavioral index of SC function. We determined the feasibility of investigating SC contribution in post-stroke USN using SSE in three groups. *Methods:* Seven participants with left near-extrapersonal space USN (USN+) following right hemisphere stroke, 10 without (USN-) and 10 controls were tested under binocular/ monocular (right eye patched) conditions while responding to unilateral/bilateral stimuli. *Results:* Control and USN- groups completed the SSE paradigm. Most USN+ participants were unable to initiate the SSE paradigm due to poor visual fixation and demonstrated higher contrast sensitivity for left-sided stimuli. Controls showed SSE (under both viewing conditions), the USN- showed abnormal SSE: reaction times to bilateral stimuli were faster than to unilateral-left, but not to unilateral-right, stimulus (under both binocular/monocular conditions). *Conclusion:* This first study investigating SC contribution in post-stroke USN using the SSE identified higher contrast sensitivity to left-sided stimuli and poor fixation in the USN+ group. These findings suggest avenues for future research leading to novel interventions.

G-05

Independence of limb position sense and motor impairments following stroke

SP Dukelow (Calgary), TM Herter (Kingston), SH Scott (Kingston)*

Background: Several studies have found correlations between position sense and motor function during stroke recovery. However, most of these studies have been conducted with clinical assessments of sensation that are observer-based and have poor reliability. We have recently developed a new test to assess position sense using robotic technology. The present study reassesses the relationship between position sense and upper limb movement following stroke. *Methods:* We prospectively assessed position sense and motor impairment in 54 inpatient stroke rehabilitation subjects and 81 age-matched control subjects. All subjects completed quantitative assessments of position sense and visually-guided reaching using the KINARM robotic device (BKIN technologies Ltd. Kingston, Ontario). Subjects also completed clinical assessments including: handedness, vision, Purdue Peg Board, Chedoke McMaster Stroke Impairment Scale and FIM. Stroke subjects underwent neuroimaging for lesion localization. *Results:* Performance on the robotic position sense and reaching tasks was essentially unrelated. Importantly performance on both of these sensory and motor tasks were found to have a relationship with FIM (Fisher's test and Spearman's correlation). *Conclusions:* Our data support the concept that sensory deficits are functionally relevant and points to the importance of assessing sensory and motor impairments independently when planning treatment strategies.

G-06

Effectiveness of Virtual Reality using Wii Gaming technology in STroke Rehabilitation (EVREST): a randomized clinical trial and proof of principle

G Saposnik (Toronto), T Robert (London), M Mamdani (Toronto), D Cheung (Toronto), KE Thorpe (Toronto), B McIlroy (Waterloo), J Willems (Toronto), J Hall (Toronto), LG Cohen (Bethesda), M Bayley (Toronto)*

Context: Most stroke survivors experience hemiparesis, resulting in functional limitation of an upper extremity. Limited evidence is available on Virtual reality (VR) use for stroke rehabilitation. *Objective:* To evaluate the feasibility, safety and efficacy of virtual reality using Nintendo Wii© gaming technology(VRWii) to improve

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arm recovery in stroke patients. *Design:* Prospective, single-blinded, pilot, randomized, controlled trial including stroke patients within 2 months from onset with a Chedoke-McMaster Scale (arm)≥3. *Interventions:* Participants were assigned to VRWii versus recreational therapy (RT) while receiving usual care (standard rehabilitation). *Outcomes:* The primary feasibility outcome was the total time receiving the intervention. The primary safety outcome was the proportion of patients experiencing intervention-related adverse events. Efficacy, a secondary outcome measure, was measured by the Wolf Motor Function Test (WMFT), Box and Block Test, and Stroke Impact Scale at 4 week post-intervention follow-up visit. *Results:* Overall, 22/110 (20%) of screened patients were randomized. The interventions were successfully delivered in 9 of 10 participants in the VRWii and 8 out of 10 in the RT arm (0.1; 95%CI -0.21, 0.41). There were no serious adverse events in any group. For the main secondary efficacy end-point, participants in the VRWii arm had a significant average motor function improvement of 7 seconds (WMFT -7.4 seconds; 95%CI -14.5, - 0.2) after adjustment for age, baseline functional status (WMFT) and stroke severity. *Conclusions:* Virtual reality using Wii gaming technology represents a safe, feasible, and potentially effective alternative to facilitate rehabilitation therapy and promote motor recovery after stroke. ClinicalTrials.gov registration # NTC692523

G-07

Mini-Mental Status Exam lacks sensitivity to cognitive impairment associated with TIA and minor ischemic stroke

M Harnadek (London), R Chan (London), C Mayer (London), V Hachinski (London)*

Background: The MMSE is a popular mental status test used to screen for cognitive impairment. Following transient ischemic attack (TIA) or minor stroke, difficulties with executive function skills are common. The sensitivity of the MMSE in detecting cognitive impairment following TIA or minor stroke was examined. *Method:* Patients were 140 consecutive referrals to an outpatient TIA clinic. The predominantly female (61%) sample had a mean age of 67.3 years. Tests were administered within 1 week of symptom onset. Executive dysfunction was identified by impaired performance on the Trail Making Test (TMT). Test sensitivity using various MMSE cut-off scores (29 to <24) was examined. *Results:* Frequency of impairment on the TMT (<9th percentile) was 49.3 percent. Impairment on the MMSE was 5.0 percent, a frequency that did not differ from community base rates [χ^2 (1, N=139) = 0.15; p = 0.70]. No optimum cut-off score was identified that had acceptable sensitivity (>80%) and specificity (>60%). Using the common clinical MMSE cut-off score of 24, sensitivity was only 8.7 percent. *Conclusions:* Executive dysfunction is common following TIA/minor stroke. The MMSE lacks sensitivity in detecting cognitive impairment in patients who have a TIA or minor stroke. Clinicians should employ cognitive measures which emphasize executive functioning when screening in this population.

G-08

Promoting health and enhancing recovery in stroke survivors using home care services: the effects and costs of a specialized interprofessional team approach to community-based stroke rehabilitation

MF Markle-Reid (Hamilton), C Orridge (Toronto), R Weir (Hamilton), G Browne (Hamilton), A Gafni (Hamilton), M Lewis (Toronto), M Walsh (Toronto), C Levy (Toronto), S Daub (Toronto), H Brien (Toronto), J Roberts (Hamilton), L Thabane (Hamilton)*

Objective: To determine the effects and costs of a specialized, interprofessional team approach to community-based stroke rehabilitation for stroke survivors using home care services. *Methods:* Randomized controlled trial of 101 community-living stroke survivors (<18 months post-stroke) using home care services. Subjects were randomized to intervention (n=52) or control (n=49) groups. The intervention was a 12-month specialized, evidence-based rehabilitation strategy involving an interprofessional team. The primary outcome was change in quality of life and functioning from baseline to 12 months. Secondary outcomes were number of strokes, community reintegration, perceived social support, anxiety and depressive symptoms, cognitive function, and costs of use of health services. *Results:* A total of 82 subjects completed the 12-month follow-up. Compared with the usual care group, stroke survivors in the intervention group showed clinically important (although not statistically significant) greater improvements from baseline in mean SF-36 physical functioning and social functioning scores. The groups did not differ for any of the secondary outcomes. These benefits were achieved at no additional cost to society than that of usual home care. *Conclusions:* A 12-month specialized, interprofessional team approach to community-based stroke rehabilitation enhanced quality of life without increasing the overall costs of health care. Trial Registration: clinicaltrials.gov identifier: NCT00463

G-09

Effects of inspiratory muscular training in chronic stroke survivors

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Background: The observed decreases in the strength of the respiratory muscles suggested that the inclusion of respiratory muscular training might be beneficial for stroke survivors. This randomized, double-blinded, controlled trial aimed to investigate the effects of an inspiratory muscular training (IMT) program on measures of strength and resistence, as well as the quality of life and functional performance with chronic stroke survivors. *Methods:* Eighteen subjects with maximal inspiratory pressure (MIP) lower than 90% of the predicted values, were randomly allocated in the control and treatment groups. The intervention was based upon threshold training, which was bi-weekly adjusted to 30% of the MIP. The control group underwent the same protocol, without the threshold resistence valve. Both groups received home training 30 minutes daily, five times/week, during eight weeks. MIP, inspiratory

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muscular endurance (IME), quality of life, and functional performance measures were obtained before and after the interventions. *Results:* ANOVA revealed significant changes only for the treatment group, for the MIP (F=4.86;p=0.004) and IEM (F=5.88;p=0.02). No changes were observed on measures of functional performance. *Conclusions:* The results indicated that an eight-week IMT, resulted in improvements of strength and IME and, therefore, might be included in rehabititation interventions with stroke individuals.

SPINE

H-01

Spinal cord stimulation is effective in management of complex regional pain syndrome (CRPS) I: fact or fiction

K Kumar (Regina), S Rizvi (Regina)*

Introduction: Complex regional pain syndrome (CRPS) I is a debilitating neuropathic pain disorder of unknown aetiology associated with burning pain and allodynia. Spinal cord stimulation (SCS) has proven effective in the treatment of CRPS I in the medium-term but its long-term efficacy and ability to improve functional status remains controversial. *Materials and Methods:* We retrospectively analyzed 25 patients with CRPS I treated by SCS over a mean follow-up period of 87.9 months. The parameters utilized for their evaluation were: visual analogue scale (VAS), Oswestry disability index (ODI), Beck depression inventory (BDI), EuroQoL-5D (EQ-5D) and Short-form 36 (SF-36), and drug consumption. Evaluations were conducted at point of entry, 3 months, 1 year, and last follow-up. *Results:* At baseline, mean VAS, ODI, BDI, EQ-5D, and SF-36 scores were 8.4, 70%, 28, 0.31, and 24. Maximum improvement was recorded at 3 months (VAS 4.8, ODI 44%, BDI 14, EQ-5D 0.66, and SF-36 45). At last follow-up scores were 5.6, 51%, 19, 0.57 and 39, respectively. Despite the regression noted at 1 year and last-follow-up benefits were maintained compared to baseline (p-value baseline vs. last follow-up: 0.001 VAS, 0.003 ODI, 0.001 BDI, 0.003 EQ-5D, 0.001 SF-36). Medication usage declined. SCS did not prevent disease spreading to other limbs. Best results were achieved in stage I CRPS I, patients under 40 years of age, and those receiving SCS within 1 year of disease onset. *Conclusions:* SCS improves pain, depression, quality of life, and functional status over the long-term. To achieve this goal SCS should be considered early in the treatment continuum.

H-02

Early experience with a novel percutaneous method of lumbar decompression

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Introduction: Minimally invasive lumbar decompression (MILD) is a novel percutaneous technique to treat neurogenic claudication by decompressing hypertrophied ligamentum flavum. Visualization is achieved with fluoroscopy and epidural contrast (epidurography). *Methods:* We performed a prospective, single-center functional outcomes-based trial. Inclusion criteria included failure of conservative therapy for neurogenic claudication and central canal cross sectional area < 100mm^2 due primarily to hypertrophied ligamentum flavum. Primary outcomes were Oswestry Disability Index (ODI), Short-Form 12 questionnaire (SF-12), and visual analog pain scale (VAS). Follow-up was to 26-weeks; secondary outcomes extended to 18 months. Secondary outcomes included analgesic use and treatment failure. *Results:* Ten subjects (8 males and 2 females) were enrolled and treated. Pre-operative VAS was 7.3. At discharge, VAS had decreased to 3.6 (p=0.002). After 26 weeks, it was 4.2 (p=0.01). ODI decreased from 49.4 to 30.0 (p=0.02) at 26 weeks. There were no significant adverse events. 7 out of 10 patients developed recurrent symptoms requiring open laminectomy within 18 months. *Conclusion:* Throughout 26 weeks, pain and disability scores were significantly decreased in most patients. In 70% of patients, recurrent symptoms required laminectomy within 18 months. Although MILD appears to be safe in this small cohort of patients, the long-term failure rate is high.

H-03

Comparison of minimally-invasive lumbar interbody fusion for primary and revision surgery

MF Shamji (Ottawa), RE Isaacs (Durham)*

Introduction: Lumbar interbody fusion as revision surgery may be used for recurrent disc herniation and post-laminectomy instability. Techniques of minimally invasive surgery (MIS) reduce perioperative pain and shorten recovery time while maintaining clinical outcomes. We evaluated clinical outcomes following MIS lumbar interbody fusion in revision surgery. *Methods:* Consecutive MIS lumbar interbody fusion patients (2002-2006) underwent prospective collection of demographic data, radiographs, and Oswestry Disability Index (ODI) scores at consultation and longitudinal follow-up. Two-factor ANOVA compared ODI scores using primary/revision status and time as discrete factors. *Results:* Sixty-two patients underwent MIS lumbar interbody fusion, 40 primary operations and 22 revision procedures. Groups were similar for age, ethnicity, and number of levels, although revision patients were more frequently male. Preoperative ODI scores for primary surgery group (46±2) and revision surgery group (47±3) were similar, and both exhibited early improvements persisting through two years follow-up (Table 1). Incidental durotomy occurred more frequently among revision patients, although without clinical consequence.

	Primary Surgery	**Revision Surgery**
Number in Group	40	22
Preoperative ODI	46 ± 2	47 ± 3
Early Post. ODI	29 ± 3	28 ± 3
Medium Post. ODI	25 ± 2	25 ± 3
Long Post. ODI	t31 ± 2	t30 ± 3
Very Long Post. ODI	20 ± 5	21 ± 7
tp-value (time)	< 0.01	< 0.01

Conclusion: Trepidation exists regarding MIS technology for revision lumbar spine surgery, with a challenging technique complicated by altered surgical anatomy and absent conventional bony landmarks. While more minor complications may occur, this study suggests that long-term clinical outcomes among revision patients may be satisfactory.

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H-04

Local anticytokine therapy reverses sensory and gait abnormalities in experimental disc herniation radiculopathy

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Objective: Intervertebral disc herniation may irritate nearby neural structures by inflammatory activation. This study evaluated effects of local anticytokine treatment on gait and behavioral abnormalities in an animal model of disc-herniation radiculopathy. Treatment was a cytokine decoy receptor (sTNFRII), delivered by itself or with an in situ forming chitosan carrier to sustain drug release. *Methods:* Thirty rats had surgical exposure of the L5 dorsal root ganglion (DRG) and nucleus pulposus (NP) removal from tail intervertebral disc. Control animals underwent exposure only, and experimental animals received NP placement onto the DRG with no treatment, local sTNFRII delivery, local chitosan placement, or combined delivery of sTNFRII with chitosan. At one week, animals were tested for mechanical allodynia, stance symmetry, and gait. *Results:* Rats subjected to NP-stimulation exhibited mechanical allodynia, with 50% withdrawal threshold dropping from 15g preoperatively to 3g postoperatively. Stance was asymmetric in the injured group, preferentially loading the contralateral hindlimb. Treatment with sTNFRII alone or with chitosan reversed mechanical allodynia and restored normal stance. *Conclusion:* Mechanical allodynia and stance asymmetry occur in animals subjected to non-compressive NP-herniation. Local immunomodulators administered alone or with a carrier reverses such effects, further implicating the role of pro-inflammatory cytokines in this phenotype.

H-05

Randomized trial of bracing for stable thoracolumbar burst fractures

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Objective: Management of thoracolumbar burst fractures depends on clinical presentation of neurological deficit and radiographic fracture features suggesting instability. Neurologically intact patients with mild deformity may undergo conservative bracing to permit fracture stabilization. We investigated the utility of this bracing management. *Methods:* Patients with stable, single-level thoracolumbar burst fractures with no neurological deficit or lower extremity injury were randomized. Outcomes at presentation and at 6-months included radiographic outcomes of kyphosis and loss of vertebral height and clinical outcomes of self-reported pain and disability. Continuous variables were analyzed by two-factor ANOVA for time and treatment. *Results:* Patients were similar at time of randomization, including level of injury (p=0.18), extent of fragment retropulsion (p=0.97), anterior loss of height (p=0.56), or Cobb angle (p=0.26). Progressive loss of height occurred to additional 17±4% in both groups (p=0.96) and degree of kyphotic progression was no different by treatment (brace 6±2, no brace 8±2, p=0.59). Self-reported pain and disability scores were similarly improved in both treatment groups (p=0.40). *Conclusion:* Patients with stable thoracolumbar burst fractures had similar six-month clinical and radiographic outcomes with or without bracing. These patients may benefit from conservative therapy involving sequential imaging without brace immobilization, although larger series of patients are required.

H-06

Minimally invasive approach for the resection of spinal neoplasm

FA Haji (London), A Cenic (Hamilton), L Crevier (Hamilton), N Murty (Hamilton), K Reddy (Hamilton)*

Background: Minimally invasive techniques are being increasingly utilized by spinal surgeons in an attempt to reduce operative time, length of stay, post-operative pain and surgical complications. Recently, these techniques have been described for the resection of select intradural, tumors with results comparable to traditional 'open' approaches. The purpose of this retrospective case series is to determine if this approach can be extended to a variety of extradural, intradural extramedullary and intramedullary spinal tumors. *Methods:* A retrospective review of patients that underwent a minimally invasive resection of spinal neoplasm using the METRx MAST QUADRANT Retractor System (Medtronics, Memphis TN) at our centre revealed twenty eligible patients. Completeness of resection, neurological outcome, operative time, blood loss, narcotic use, length of hospitalization and surgical complications were assessed. *Results:* Seven extradural, thirteen intradural extra-medullary and two intramedullary neoplasms resected between September 2005 and May 2009 were included for analysis. Mean operative time (210 min), length of hospitalization (3 days), complication rate (10%) and post-operative narcotic use were similar to that reported for traditional approaches. Blood loss (428mL) was slightly higher than other series. Total resection was achieved for fifteen tumors (68%), with only one patient requiring re-operation. All but one patient improved neurologically by six months. *Conclusion:* A variety of spinal neoplasms can be safely resected through a minimally invasive corridor. This technique may be an alternative to an open approach for one or two level lesions and may result in reduced operative time, complication rate, length of stay, post-operative pain and spinal instability.

H-07

Normal computed tomography measurements of the upper cervical spine in the pediatric population

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Background: Measurements used to diagnose upper cervical (c) -spine injuries are largely based on adult values and inappropriately applied to children. We attempt to develop normal values for several pediatric upper cervical spine measurements. *Methods:* Reformatted coronal and sagittal CT scans were retrospectively reviewed in 42 consecutive children (mean age 101 months, 25 males) over three months. Most CTs were performed following trauma. No patients showed any clinical evidence of c-spine injury. All scans were reported as normal by a pediatric neuroradiologist. Measurements obtained were: atlanto-dental interval (ADI), basion-dental interval (BDI), posterior atlanto-dental interval (PADI), bilateral craniocervical interval (CCI) and lateral mass index (LMI), and prevertebral soft tissue width at C2. Mean values and tolerance intervals (estimating the upper normal limit) were calculated. Age

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and gender effects were evaluated using linear regression analysis. *Results:* The mean (upper tolerance limit) values for ADI, PADI, BDI, LMI, CCI, and soft tissue width were 2.3mm (2.8mm), 18.3mm (18.5mm), 7.3mm (7.5mm), 2.9mm (4.0mm), 2.4mm (3.4mm), and 4.5mm (5.5mm) respectively. PADI significantly increased with age, while BDI and CCI decreased. Females had significantly smaller PADI and CCI. *Conclusions:* We present preliminary estimates of normal pediatric upper c-spine measurements. Further study must validate the ability of these values to diagnose pediatric upper cervical spine injuries.

H-08

Anterior craniospinal reconstruction and stabilization: technical note and review of the literature

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

Anterior surgical approaches to the craniospinal junction (CSJ) often pose significant challenges owing to the close proximity of critical neurovascular structures as well as the unique biomechanical constraints of this region. The available literature on the anterior decompression, instrumentation and stabilization of the CSJ is sparse and predonminantly case specific. We present two cases of severe craniospinal instability, secondary to pathologic destruction of the C2 vertebrate. Following anterior decompression, the patients were instrumented with an anteriorly placed expandable titanium cage, with an integrated flang/plate construct. The strategy for anterior stabilization and reconstruction, as well as the available implant options are also described.

H-09

Proton magnetic resonance spectroscopy of the motor cortex in cervical spondylotic myelopathy

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Background: This prospective study will characterize changes in metabolite levels, specifically N-Acetyl Aspartate (NAA), creatine (Cr), choline (Cho), myo-inositol (Myo), glutamate and glutamine (Glx), due to alterations in cortical function in cervical spondylotic myelopathy (CSM) patients using proton-magnetic resonance spectroscopy (1H-MRS). *Methods:* Ten CSM patients and ten healthy controls underwent two 1H-MRS sessions 6 months apart on a 3.0 T Siemens Magnetom Tim Trio (Erlangen, Germany). Only the CSM group received decompressive surgery after their initial scan. Areas of activation from functional MRI scans of a finger-tapping paradigm were used to place a voxel on the greater deficit side in CSM group and each side of motor cortex in controls. Functional assessment was measured by NDI, ASIA and JOA questionnaires. *Results:* No differences were detected between the right side (RSC) and left side (LSC) of motor cortex in controls. CSM group increased in the pre-operative Myo/NAA and Myo/Cho ratios compared to RSC ($p=0.04$ and $p=0.04$). Post-operatively, CSM group decreased in NAA/Cr ratio compared to LSC ($p=0.02$). Within CSM group comparison found decreased Myo/Cr and Myo/Cho ratios ($p=0.02$ and $p=0.004$). Post-operatively CSM group improved in the NDI score, ASIA motor score and JOA lower motor score. Pre-operatively, the NDI score was correlated with Myo/NAA in the CSM group ($r=0.57$, $p<0.05$). Post-operatively, there were correlations between the change in (Δ) Myo/Cho and ΔASIA scores ($r=-0.66$, $p=0.05$), and ΔMyo/Cr with ΔNDI scores ($r=0.82$, $p=0.01$). *Conclusions:* Myo may be a meaningful biomarker for early stages of CSM suggesting early increases in glial activity.

H-10

The use of heat sensation to detect neuronal activity in the dorsal horn of the human spinal cord at 3T with novel fMRI methods – a proof-of-concept pilot study

DW Cadotte (Toronto), MG Fehlings (Toronto)*

*Introduction:*The application of heat sensation to the body surface activates the well known anterolateral pathway. We propose that with the use of novel MRI methods activity within the dorsal horn can be detected following heat sensation. *Methods:*A group of healthy subjects were asked to participate in this, REB approved, proof-of-concept pilot project. Each was screened for safety to undergo an MRI. The subjects were positioned in a 3T General Electric MRI with the use of an 8-channel HD Neurovascular array coil. Thermodes that heat to 44 degrees Celsius were positioned on the C5 and C8 dematomes on both the right and left side of the body. Functional time course data were obtained using a single-shot fast spin-echo sequence with an echo time of 35.8 msec and 9 slices of 2 mm each to span the entire sagittal plane of the cervical spinal cord. The data was analyzed using custom-made software in Matlab (The Mathworks, Inc. Version 7.9.0.529). *Results:*This preliminary proof-of-concept study demonstrates the feasibility of adopting a novel MRI method, SEEP (signal enhancement by extravascular protons), for use in a 3T GE MRI system. We were able to record neural activity in the dorsal horn of the spinal cord in response to thermal stimulation of the C5 and C8 dermatome. *Conclusions:*The detection of neural activity in the spinal cord is a promising technique to measure either favorable or aberrant plasticity that may occur in the setting of regenerative techniques following spinal cord injury or neuropathic pain, respectively.

EPILEPSY

I-01

Molecular mechanisms associated with an increased seizure susceptibility in adults after experimental febrile seizures in juveniles

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Background: Prolonged febrile seizures (FSs) are associated with the development of epilepsy, however the molecular mechanisms behind this are still largely unknown. We have utilized an ethologically relevant animal FS model to test the hypothesis that FSs cause long-term molecular and synaptic alterations leading to increased neuronal excitability in the adult brain. *Methods:* FSs were induced in ~50% of 14 day old rats receiving the bacterial endotoxin lipopolysaccharide and subthreshold kainic acid. Adult rats then underwent one of the following: 1) continuous video-EEG monitoring; 2) seizure threshold testing with chemical convulsants; 3) hippocampal slice recordings to evaluate neuronal excitability and synaptic strength; 4) polymerase chain reaction for specific glutamate and GABA receptor subunits and cation-chloride co-

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transporters (CCCs); 5) application of the CCC blocker bumetanide to determine its effect on reversing seizure thresholds in vivo and in vitro. *Results:* Seizure thresholds post-FS were lower in vivo and in vitro, but no animals developed spontaneous seizures. Reduced GABA(A) and increased AMPA receptor subunits, and elevated levels of the juvenile CCC (NKCC1) were observed, and are in keeping with a more excitable state. Bumetanide blocked the increased seizure susceptibility found both in vivo and in vitro. *Discussion:* An increased level of excitability in the brain post-FS, as measured by altered expression of receptors and transporters and by electrophysiology, is associated with an increased susceptibility to subsequent seizures. Enhanced seizure susceptibility can be blocked, in part, by application of the drug bumetanide, which may prove useful for patients with epilepsy that had a previous FS.

I-02

Source localization of neuromagnetic spike-locked high frequency oscillations (40-120 Hz) in pediatric neocortical epilepsy

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Background: High frequency oscillations (HFOs) are often recorded from implanted intra-cranial electrodes during epilepsy surgery and occur frequently at the time of interictal spikes. The spatial distribution of the interictal HFOs shows strong correlations with the epileptogenic zone. *Methods:* We analyzed interictal magneto-encephalography (MEG) recordings in 43 children with neocortical epilepsy who subsequently underwent invasive EEG. Age at MEG recording ranged from 3-17 years. MEG was performed using a 151-channel axial gradiometer system. The data were band-pass filtered at 40-120Hz offline and then visually inspected for the presence of HFOs. The earliest onset peak of each identified focal spike was marked within the MEG data set. The sources of the individual interictal spikes were localized utilizing an event-related beamformer (1). These beamformer source locations were then compared to the ictal onset zone identified by intracranial recording. *Results:* HFOs (40-120Hz) were identified at the time of interictal spikes in 20/43 (46 %) patients. Beamformer localization was concordant with the ictal onset zone determined by intra-cranial EEG in 19 patients and discordant in one patient with tuberous sclerosis. *Conclusion:* Neuromagnetic beamformer source localization of interictal spike-locked HFOs is a reliable predictor of the ictal onset zone in most cases of medication-resistant neocortical epilepsy.

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I-03

Transition to seizure: a synaptic crescendo

PL Carlen (Toronto), ZJ Zhang (Toronto), H Ye (Toronto), L Zhang (Toronto), D Shin (Albany), A Tonkikh (Toronto), D Serletis (Toronto), Valiante (Toronto)*

The underlying dynamical cellular mechanisms leading to ictogenesis are still unclear. The hippocampal CA3 region in the low magnesium recurrent seizure model, drives the CA1 region during the preictal and ictal states. Glutamatergic and GABAergic synaptic inputs to CA3 pyramidal cells, and fast- and non-fast-spiking interneurons in the stratum oriens layer in the isolated immature intact mouse hippocampus (P8-12) were investigated. During the transition from the interictal to ictal states, both evoked and spontaneous inhibitory and excitatory postsynaptic currents (IPSCs and EPSCs) became greatly enhanced with increased asynchronous release. Only a small increase was found in the reversal potential of the muscimol-induced IPSCs during the transition period, suggesting that GABAergic excitation via reversed IPSPs may not be the major excitatory drive. Instead, increased intracellular presynaptic Ca2+ during the seizure transition, which was measured in mossy fibre terminals, may contribute to the build-up of evoked synchronous and asynchronous release of excitatory and inhibitory neurotransmitters. However, during the ictus, the IPSCs were markedly decreased or abolished whereas the postsynaptic inhibitory receptor responses persisted, as did the evoked and spontaneous EPSCs. Possible explanations for the inhibition of presynaptic inhibitory neurotransmitter release are the depletion of GABA neurotransmitter release, an abrupt drop in extracellular Ca2+, or an increased presynaptic Ca2+ to the point of Ca current inactivation. The onset of the higher frequency seizure activity associated with an abrupt cessation of inhibitory responses, could be a major factor for the abrupt generation of the most profound ictal activity. Supported by the CIHR

I-04

Characterization of hippocampal atrophy in a rodent model of complex febrile seizure

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Background: Complex febrile seizures can produce deleterious long-term effects on the developing hippocampus and have been linked to mesial temporal lobe epilepsy. This study aimed to characterize pathological hippocampal changes underlying epileptogenesis in a rodent model of hyperthermic seizure (HS). *Methods:* A cortical freeze lesion at postnatal day (P) 1 predisposes to a prolonged HS at P10 and spontaneous limbic seizures in the adult rat. Using a combination of stereological and MRI-imaging techniques, diolistic transfection and western blots, we characterized region-specific volume changes, evaluated dendritic spine density and measured synaptic protein levels in the rat hippocampus. *Results:* Lesioned rats with hyperthermic seizure exhibited hippocampal atrophy ipsilateral to the lesioned cortex observed using both MRI imaging and stereological tissue analysis. Volume loss was maximal in the CA1 and CA3 regions. By labeling CA1 pyramidal neurons, we also found a significant decrease in spine density in the abnormal hippocampus. Finally, an increase in NR2A but not NR2B NMDA receptor subunit levels accompanied these changes. *Conclusion:* Complex febrile seizure in the lesioned brain produces hippocampal atrophy accompanied by changes in dendritic spine density and receptor reorganization. These abnormalities might underlie the epileptogenesis process in this animal model.

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I-05

Safety and efficacy of depth electrode recording (SEEG) in epilepsy surgery: a five year review

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Background: Depth electrode recording (SEEG) may be required as part of the presurgical workup of epilepsy patients. In this study we report our safety and efficacy profile for depth electrode insertion and recording. *Methods:* A prospective database was used to review all patients implanted over a 5 year period ending January 2010. Only patients who had depth electrodes inserted for extraoperative recording were included in this report. Grid, strip and intraoperative depth electrode recordings were not included in the analysis. *Results:* For the 5 year period reviewed, 51 patients had a total of 375 depth electrodes inserted as part of their epilepsy evaluation. The average age of the patients was 33 years (range 5 – 55). On average 8 electrodes (range 2 – 16) were inserted for an average of 10 days (range 2 -19). Surgical complications were infrequent (n=3). One patient pulled the electrodes out prematurely without consequence. One patient had a superficial skin infection requiring oral antibiotics. One patient had pulmonary edema post operatively requiring ICU admission. This patient recovered completely. The etiology of the pulmonary edema was unknown. Of the 51 patients implanted, 40 went on to have resective surgery (79%). With respect to outcome, 13/23 (56%) had an Engel I, 5/23 (21%) were Engel II, and 5/23 (21%) were Engel III. *Conclusions:* Invasive depth electrode recording (SEEG) is safe. In properly selected patient populations almost 80% of patients can expect some surgical solution with an Engel I outcome expected in 56% of patients.

I-06

Continuous EEG monitoring in a paediatric intensive care unit

B Mc Coy (Toronto), R Sharma (Toronto), A Ochi (Toronto), C Go (Toronto), H Otsubo (Toronto), JS Hutchison (Toronto), CD Hahn (Toronto)*

Background: Continuous EEG monitoring (cEEG) is a valuable tool for the detection of seizures and status epilepticus (SE) among children in the intensive care unit (ICU). *Methods:* Retrospective review of cEEG performed in a paediatric ICU between 2004 and 2009. We examined the indications for cEEG, the clinical characteristics of monitored patients, and the incidence and timing of seizures. *Results:* 267 cEEG studies were performed over a 70-month period on 201 patients, 28% of which were neonates. Indications for cEEG monitoring were to guide treatment of seizures or SE (49%), to characterize clinical events suspected to be seizures (24%), to evaluate an unexplained alteration in consciousness (18%), and to monitor for seizures in paralyzed patients (5%). Prior in-hospital clinical seizures occurred in 21% of patients, 28% had pre-existing epilepsy whereas 50% had no history of seizures prior to cEEG monitoring. Seizures were detected in 44% of cEEG recordings, of which 47% captured only subclinical seizures, 31% captured both clinical and subclinical seizures, and 15% captured only clinical seizures. *Conclusions:* Subclinical seizures are common among critically ill children in the ICU. cEEG allows accurate detection of these seizures and enables timely appropriate seizure management.

I-07

Epilepsy: when to think surgery?

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Background: Our objective was to develop a user-friendly tool to assist clinicians to identify patients of any age who should be referred for an epilepsy surgery evaluation. *Methods:* The RAND appropriateness methodology was followed, by first performing systematic reviews of the surgical outcomes of partial epilepsy, and literature reviews of the epidemiology, natural history and predictors of intractability. Clinical scenarios were created based on age, epilepsy duration, seizure type, frequency and severity, number of antiepileptic drug (AED) trials, EEG and MRI findings. Twelve experts (neurologists, epileptologists, epilepsy neurosurgeons) rated the scenarios from 1-9 (9=most appropriate) for their appropriateness for an epilepsy surgery evaluation. All scenarios were re-rated after a face-to-face meeting. All appropriate scenarios were rated for necessity (to determine referral priority). *Results:* Systematic reviews: 5061 abstracts screened, 763 articles selected for full review. 15 topics summarized, 7 as systematic reviews. First round of rating included 3072 indications for a surgical referral (2646 for second round). 20.6% of scenarios were rated as appropriate, 17.2% as uncertain, and 61.5% as inappropriate for a surgical evaluation. Of the 544 appropriate cases, 56% were rated as high priority, 41.6% as moderate priority and 1.8% as low priority. Failure of 1 AED only was always rated as inappropriate for a referral. Failure of 2 AEDs was usually rated as appropriate especially if the MRI/EEG were abnormal. Examples of appropriate/inappropriate scenarios will be presented. *Conclusions:* Our decision support tool with website provides a comprehensive guide for determining candidacy for an epilepsy surgery evaluation.

I-08

Electrocorticography and seizure outcomes in children with lesional epilepsy

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Background: The use of electrocorticographically (ECoG) – guided cortical resection in children with lesional epilepsy is controversial. Given the important developmental issues associated with seizures in children, we evaluated the effect of the decision to perform lesionectomy or ECoG-guided cortical resection on seizure outcome, seizure recurrence, and surgical morbidity in this population. *Methods:* We retrospectively analyzed seizure outcomes in 67 patients between the ages of 3 months and 16 years who underwent surgery for lesional epilepsy at British Columbia Children's Hospital. Thirty-four patients underwent ECoG, and 33 patients had lesionectomy without ECoG. *Results:* One year post-operatively, approximately 80% of patients who had ECoG-guided cortical resection or lesionectomy were seizure free. However, there was a trend toward improved seizure freedom in patients who had ECoG at most recent follow-up (79% patients with ECoG seizure free, vs. 61% with lesionectomy only; mean follow-up time 5.8yrs, p = 0.078). There was no increase in neurological morbidity in

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patients who had ECoG-guided cortical resection, and these patients were less likely to experience repeat epilepsy surgery. *Conclusions:* Overall, using ECoG to guide additional cortical resection may lead to more robust seizure freedom in children with lesional epilepsy without increasing their risk of surgical morbidity.

I-09

Neuropsychological outcome following selective amygdalo-hippocampectomy: a single Canadian center cohort of 82 patients

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Background: Selective amygdalohippocampectomy (SAH) is an accepted alternative for the surgical treatment of mesial temporal lobe epilepsy (MTLE). Reports suggest a potential cognitive benefit of SAH over standard temporal lobectomy. We present the cognitive outcome after SAH performed on a consecutive cohort of patients at the Calgary Epilepsy Program. *Methods:* Retrospective analysis of all adult patients who underwent SAH. Kaplan-Meier curve was plotted for seizure freedom. Pre- and post-operative cognitive performances were compared using reliable change index values. *Results:* 82 SAH patients (45 left and 37 right) were followed for an average of 38 months (SD= 18 months), with seizure freedom at 6, 12 and 24 months is 86%, 78% and 69% respectively. Complete pre- and post-operative neuropsychological evaluations were available for 56 patients. There was no significant post-operative change in IQ, working memory or language (Boston Naming Test, Word Fluency). Verbal memory (CVLT) remained stable in 74% and declined in 26% of patients. Rates of verbal memory decline was higher in left vs. right side operations (31% vs. 20%). Visual memory (WMS III Delayed Visual Index) remained stable in 81% and declined in 19% of patients, with a higher rate of decline in right vs. left side operations (28% vs. 13%). *Conclusions:* Selective amygdalohippocampectomy is an effective treatment for the long term control of intractable MTLE. Verbal memory decline was more common following left operation, and visual memory declines were more common following right operations. Overall, memory changes were equivalent to or lower than rates reported for standard temporal lobectomy

I-10

A descriptive analysis of prognostic indicators in patients with non-convulsive status epilepticus in a tertiary hospital population

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Background: Non-convulsive status epilepticus (NCSE) is defined as a change in mental state of at least 30 minutes associated with continuous or nearly continuous epileptiform discharges. Identification of prognostic indicators can guide decision making surrounding the use of poorly established treatment interventions in this heterogeneous population. *Methods:* We identified 66 consecutive inpatients with NCSE. Data surrounding clinical, electrographic, and treatment factors were collected via a retrospective systematic review of medical records and electronic EEGs, and were correlated with discharge outcome (return to baseline, new disability, or death). *Results:* Of all subjects, 21% returned to baseline, 26% acquired new disability, and 53% died, of whom half had anoxic encephalopathy. On univariate analysis, seventeen variables correlated significantly with death, although multivariate logistic regression analysis subsequently identified only comatose state and number of life threatening comorbidities as independent predictors of mortality. Of survivors, comatose state, critical care environment, length of hospital stay, and acute symptomatic seizures predicted new disability, with the latter two showing independent significance. *Conclusions:* NCSE is associated with variable morbidity and mortality. While one fifth of our NCSE patients returned to baseline, those comatose with acute symptomatic seizures and life threatening comorbidities were unlikely to survive without disability at discharge.

General Neurosurgery and Neuroradiology

J-01

Risks and benefits of increased sample size in frameless stereotactic brain biopsy

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Background: Increasing the number of samples obtained during a frameless stereotactic brain biopsy procedure is believed to increase the diagnostic yield, but potentially also the hemorrhage risk. The objective of this study was to determine the number of specimen samples for which the benefit exceeds the risk. *Methods:* Patient charts and imaging in biopsies performed during a five-year interval were retrospectively reviewed. Results leading to a repeat biopsy procedure were considered "non-diagnostic". Post-operative CT scans demonstrating needle tract hemorrhage were identified. Charts were reviewed for neurologic deficit attributable to acute intracerebral hemorrhage. *Results:* Ninety-nine biopsy procedures were performed; sample numbers were documented in 80 cases. In 73 cases, four or fewer samples were obtained, and in seven cases, five or more samples were obtained. There were 10 non-diagnostic results, all in the four-or-fewer group (13.7% vs. 0%, p=0.377). Four symptomatic hemorrhages occurred, two in each group (2.7% vs. 28.6%, p=0.037). *Conclusion:* Increasing the number of biopsy samples did not significantly improve the diagnostic yield, but did increase the incidence of symptomatic hemorrhage. These results indicate that no more than four samples should be obtained in a frameless stereotactic needle biopsy procedure.

J-02

Patterns of tumor response and nonauditory morbidity following radiosurgery for vestibular schwannoma

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Background: The concept of initial increase in tumor size after radiosurgery (pseudoprogression) is increasingly recognised, but the association with symptoms is not well defined. We aim to define patterns of tumor response with a 12Gy prescription dose and assess

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the impact of dosimetry characteristics on tumor control and complications. *Methods:* We retrospectively reviewed our experience of vestibular schwannoma patients treated between September 2005 and December 2009. A total of 200 patients were treated at a 12Gy prescription dose. 80 have complete clinical and radiological follow-up for at least 24 months (median 28.5 months). Tumor response is classified as stable, initial increase then stable and growth requiring intervention. All treatment plans were reviewed for dosimetry characteristics; including 12Gy volume, conformality index, brainstem and trigeminal nerve dose. *Results:* 60 patients (75%) have stable tumors. 16 (20%) show initial increase in size, which then stabilized. 4 patients (5%) required salvage due to progression. 27 (33.8%) developed adverse events, 5 (6%) developed hydrocephalus, 10 (12.5%) reported new ataxia, 17 (21%) trigeminal dysfunction, 3 (3.75%) facial weakness and 1 patient developed hemifacial spasm. Tumour volume and brainstem radiation dose were significant predictors of complications ($p \leq 0.001$). The development of oedema within the pons was significantly associated with adverse events ($p=0.004$). Tumor response (stable or pseudoprogression) was not predictive of morbidity. *Conclusions:* Initial treatment volume is the most important predictor of adverse radiation effects. Although pseudoprogression is common it does not appear to be independently linked to post-treatment morbidity.

J-03

Augmenting adult hippocampal neurogenesis using targeted brain stimulation: implications for memory networks

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Background: New neurons are continually generated in the adult hippocampal dentate gyrus (DG) and can incorporate into circuits supporting hippocampus-dependent memories. Factors can increase neurogenesis, including targeted limbic electrical stimulation. DBS could theoretically accomplish this; however, it is not known if this could add functional neurons capable of network integration at the cellular level. Using immediate-early gene expression as a surrogate for neuronal activation, we evaluate the participation of an entorhinal cortex (EC) stimulation-induced neuron population in hippocampal memory networks. *Methods:* Adult male mice underwent stereotactic EC stimulation. New cells were labeled with thymidine analogues or retroviral-expressed GFP, and examined for Fos expression following Morris water maze testing. *Results:* DG proliferation nearly doubled 3-5 days after surgery without altering apoptosis. New neurons displayed normal morphology at 1, 6, and 10 weeks of age. Two 6 week-old cohorts of neurons, induced by stimulation and born at baseline, were examined. Neurons from both cohorts were equally likely to recruit into networks, and as their availability increased, they accounted for a greater proportion of neurons within networks. *Conclusions:* Electrically stimulating DG inputs creates a larger pool of new neurons capable of memory network integration, potentially of functional benefit as a hippocampal regenerative therapy.

J-04

Neuromodulation for cranio-facial pain syndromes: results of a Canadian referral centre

KW MacDougall (London), AG Parrent (London)*

Background: With the exception of trigeminal neuralgia, cranio-facial pain syndromes can be difficult to treat using standard neurosurgical techniques. *Methods:* We reviewed all patients implanted for cranio-facial pain from November, 2005 to January 2010 at London Health Sciences Centre. We defined treatment success as greater than fifty percent pain relief. *Results:* Twenty-six patients had implantations of electrodes for treatment of chronic cranio-facial pain (9 males). Pain syndromes treated included neuropathic trigeminal pain, neuropathic occipital pain, atypical trigeminal neuralgia (Burchiel type II), occipital neuralgia, and chronic headaches. Ten patients had motor cortex stimulators implanted and the other sixteen had either occipital nerve stimulation, supra-orbital nerve stimulation or both in one patient. Trial stimulation was performed in 17 patients and was successful in 11. Long-term implantation has been successful in 6 of ten patients with successful trials (1 permanent implant pending). All patients implanted without trials had motor cortex stimulators and only 2/9 have had more than 50% improvement in pain long-term. Average follow-up was 19.2 + 15.2 months for permanently implanted patients. *Conclusions:* Cranial stimulation techniques can improve chronic cranio-facial pain in some patients. Trials of stimulation can be carried out in order to help determine which patients will most likely benefit. Further studies including quality of life assessments are needed.

J-05

Warfarin anticoagulation following surgical evacuation of chronic subdural hematoma

KH Au (Edmonton), C Poon (Edmonton), K Butcher (Edmonton), M Chow (Edmonton)*

Background: An occurrence of subdural hematoma requiring surgical evacuation is often cited as a contraindication to warfarin anticoagulation, but the increased risk of recurrence due to re-anticoagulation is not known. *Methods:* Patient charts and imaging for cases of surgical evacuation of chronic subdural hematoma during a five-year period were retrospectively reviewed. Data were collected on warfarin use at presentation and following hematoma drainage, and also on hematoma recurrence requiring repeat evacuation. Complications resulting from holding anticoagulation were noted (e.g. stroke, venous thromboembolism). *Results:* In five years, 306 patients underwent operative evacuation of chronic/subacute subdural hematomas. There was one recurrent hematoma among the 18 patients who resumed post-operative anticoagulation (5.6%). Recurrence rate was not significantly higher in this group compared to the patients who did not resume anticoagulation (21.4%, $p=0.22$), or the patients who had not been anticoagulated on presentation (10.8%, $p=0.70$). Six adverse events resulted from holding anticoagulation. *Conclusions:* The rate of subdural hematoma recurrence is not increased among patients who resume warfarin anticoagulation following surgical hematoma evacuation, while they remain at risk for thromboembolic complications. Neurosurgeons should not routinely advise patients

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or other physicians to indefinitely hold anticoagulation following treatment of subdural hematoma.

J-06

Management of maternal hydrocephalus

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Objectives: Advances in neurosurgical care now allow patients with hydrocephalus to routinely reach reproductive age. As a result, neurosurgeons and obstetricians are increasingly frequently called upon to manage pregnant women with hydrocephalus. Despite this, the collective experience around maternal hydrocephalus consists largely of isolated case reports or very small series of cases. The purpose of this paper is to provide a systematic review regarding the management of such patients. *Methods:* MEDLINE search from 1966 to June 2009 using key words: maternal hydrocephalus, pregnancy, shunt, and hydrocephalus. *Results:* The search yielded 25 articles, accounting for 50 patients with 69 pregnancies. The management of maternal hydrocephalus can be classified into preconception, antenatal, and perinatal phases. Preconception management includes genetic investigations, patient counseling, and testing of shunt patency. Antenatal care focuses on identifying fetal abnormalities, and observing for signs of raised intracranial pressure. Perinatal management focuses on obstetrical indications for natural labor and delivery with some authors advocating for interventions aimed at reducing the duration of the second stage of labor. Shunt complications are most often identified in the third trimester as uterine size reaches its zenith and can most often be managed conservatively. Those women managed with endoscopic third ventriculostomy prior to pregnancy may experience lower fertility rates and are prone to the same potential complications as any ETV patient. Maternal and fetal outcome were uniformly reported as favorable. *Conclusion:* Contemporary management of maternal hydrocephalus by a multidisciplinary team that includes obstetricians and neurosurgeons optimizes maternal and fetal outcomes.

J-07

Treatment of positional plagiocephaly – survey of cosmetic and cognitive outcomes

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Background: Positional plagiocephaly is an acquired deformation when an intrinsically normal infant skull is exposed to sustained or excessive extrinsic forces. Non-surgical therapy includes counter-positioning, supervised prone time, and orthotic molding, although the long-term effects of positional plagiocephaly on development remain undefined. *Methods:* Surveys were administered to parents of patients treated for positional plagiocephaly through Children's Hospital of Eastern Ontario. The questionnaire interrogated cosmetic outcome, school performance, language skills, cognitive development, and societal function. Pearson coefficient analysis tested categorical outcome dependency on gender, age, and plagiocephaly side. *Results:* Eighty respondents (Table 1, 58 right- and 22 left-sided pathology) uniformly underwent positional therapy, with helmet orthosis utilized in 36% of cases. Followup at median age of 9 years stated subjectively normal head appearance in 75% with no variance by gender, age, or side of disease. Left-sided disease did associate with abnormality of expressive speech (36% versus 16%, p=0.04) and fine motor function and heightened special education requirements (23% versus 7%, p=0.04).

Feature	Overall	Male	Female	Left	Right
N	80	51	29	22	58
Age (med, IQR)	6 (4 - 9)	6 (5 - 8)	7 (4 - 20)	7 (5 - 9)	6 (4 - 9)
Side (R)	73%	75%	69%		
Torticollis (yes)	30%	33%	24%	27%	31%
Dev. Delay (yes)	18%	22%	10%	32%	12%

Conclusions: Non-surgical management achieved good cosmetic outcome among plagiocephaly patients in this study. Children with left-sided disease frequently encountered difficulties with cognitive and scholastic endeavors, although the roles of underlying disease and treatment measures in this cognitive delay remain unclear.

J-08

Symptomatic retethering of the spinal cord following section of a tight filum terminale

RL Yong (Vancouver), T Habrock-Bach (Salt Lake City), M Vaughan (Vancouver), JR Kestle (Salt Lake City), P Steinbok (Vancouver)*

	N	Median age at	Median preoperative level of conus	Initial OR complicated by arachnoiditis, n (%)	Re-presentation with pain, n (%)	Underwent >2 untethering procedures, n (%)
Did not retether	139	4.5	L2/L3	2 (1.5)		
Retethered early (<2 yrs)	8	0.4	L1/L2	3 (38)	8 (100)	4 (50)
Retethered late (>7 yrs)	5	0.9	L3/L4	0 (0)	0 (0)	0 (0)
p value (Kruskal-Wallis test)		0.069	0.04			

Background: Section of a tight filum terminale is a minimally invasive procedure compared to cord untethering procedures used for more complex spinal abnormalities. Anecdotal evidence suggests, however, that the risk of symptomatic retethering due to scarring might be higher than previously thought. Our purpose was to determine the frequency of symptomatic retethering after section of a tight filum terminale and to explore possible risk factors. *Methods:* We reviewed databases at two pediatric neurosurgery centres for all patients who had surgery for a suspected tight filum terminale between January 1982 and June 2009. *Results:* 152 patients were identified. The median length of follow-up was 78 months. Thirteen patients (9%) went on to retether symptomatically at a median time of 23.4 months after the initial procedure. Retethering occurred either early (within 2 years) or late (after 7 years). Early and late retetherers differed in age, preoperative level of the conus, complications, symptoms, and need for further procedures. *Conclusions:* Symptomatic retethering is not uncommon after a simple filum snip and long-term follow-up is warranted. Two distinct patterns of retethering were observed. Arachnoiditis due to infection or a CSF fistula may predispose to early retethering, whereas early surgery in asymptomatic patients may predispose to late retethering.

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J-09

Internal cerebral vein sign on CT angiography as a marker of ipsilateral cerebral hypoperfusion in carotid occlusions

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Introduction: We describe decreased contrast opacity of internal cerebral vein, the "ICV" sign on CT Angiography (CTA), as a marker of carotid occlusion and insufficient Willisian collaterals to the ipsilesional cerebral hemisphere. *Methods:* 239 patients with acute ICA+/-M1 occlusions in CTA database at our centre from 2002-08 were included in study. OSIRIX Version 3.5 was used to reconstruct 2D MPR images in 3 planes. Degree of contrast opacity of the internal cerebral vein on the side of occlusion was compared to the normal side. *Results:* Of 239 patients, 153 were included in study. Of 135 patients with M1+/-ICA occlusions, 57/65(87.7%) with ICA+/-proximal M1 MCA occlusions had ICV sign when compared to 7/70(10%) with isolated distal M1 occlusions ($p<0.001$). In 8 patients without ICV sign in ICA+/-proximal M1 occlusions, 6 had prominent lenticulostriate arteries arising from the non-occluded M1 segment, 1 had prominent recurrent artery of Huebner and 1 had filling of distal ICA/M1 segment through prominent willisian collaterals. All 7 patients with distal M1 occlusion with the sign had reduced lenticulostriate arteries. 8/18 patients with isolated extracranial carotid occlusion had ICV sign. All 8 with ICV sign had poor willisian collaterals when compared to 10 patients without the sign in whom willisian collaterals were good. *Conclusion:* ICV sign on CTA correlates with presence of ICA+/-proximal M1 MCA occlusions and reduced lenticulostriate arteries and/or willisian collaterals. In patients with isolated carotid occlusions, the sign correlates with reduced willisian collaterals and is possibly a marker of ipsilateral cerebral hypoperfusion.

J-10

Visual functional MRI in premature infants

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Background: Functional MRI (fMRI) in infants has demonstrated a negative BOLD response, postulated to be related to the increased neuronal density of the young brain. There is little literature on the BOLD response in premature infants. Premature infants have longer T2* values than adults, suggesting that longer TE values may improve signal detection. The objective of this study is to optimize fMRI data acquisition in premature infants using visual stimuli. *Methods:* 66 fMRI datasets were acquired in 35 infants (mean gestational age at birth 28.9±2.1 weeks, at fMRI 30.63±2.9 weeks) using a neonatal head coil and MR-compatible incubator in a 1.5T MR scanner. Data were collected at TE=60ms and TE=130ms. The task consisted of eight 20 or 30 second blocks alternating between 1 Hz visual flashes and darkness. *Results:* 12 datasets were discarded due to motion. In the remaining 54 datasets, task-related BOLD response ($p<10e-5$ uncorrected) was found in only 4 of 54 datasets. One of 41 datasets acquired at TE=60ms and 3 of 13 datasets acquired at TE=130ms demonstrated task related BOLD signal. Significant signal dropout due to subject induced field inhomogeneities was seen with TE=130ms. *Conclusion:* Visual stimuli do not elicit a reliable BOLD response in premature infants. Factors influencing this negative finding may include factors of cerebral blood volume and flow in premature infants. Novel techniques, including higher field strengths and lower T2* values, allowing for shorter TE values, may improve the signal to noise ratios and allow for detection of a BOLD response.

Trauma, Critical Care and Neurosurgery

K-01

An fMRI study of the default mode network connectivity in comatose survivors of cardiac arrest

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Introduction: Functional connectivity within a resting state network, termed the default mode network (DMN), has been suggested to represent the neural correlate of the stream of consciousness. Altered states of consciousness where awareness is thought to be absent could provide insight into the function of the DMN. Here we examine the functional connectivity in the DMN in reversible and irreversible coma using fMRI. *Methods:* Thirteen comatose patients following cardiac arrest (2 with reversible coma) and twelve healthy controls were included in the study. The DMN component in each individual was identified using independent component analysis (ICA). A two-sample t-test compared the DMN of controls to irreversible coma patients. *Results:* DMN connectivity was observed in healthy controls and two patients who regained consciousness but was disrupted in the eleven patients who failed to regain consciousness (controls> irreversible coma: posterior cingulate cortex/precuneus Zpeak= 5.63, medial prefrontal cortex Zpeak = 5.32, and L and R temporoparietal junctions Zpeak = 4.31, 4.10; $p=0.01$). *Conclusions:* Functional connectivity within the DMN is disrupted in patients with irreversible coma while preserved in those who had reversible coma. This suggests that the DMN is necessary but not sufficient to support consciousness.

K-02

Acute management of acquired brain injury: an evidence-based review

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Background: A wide variety of acute interventions are used to manage elevated intracranial pressure (ICP) and minimize cerebral damage in patients with acquired brain injury (ABI). This review was designed to provide a synthesis of the evidence available for the most common of these measures. *Methods:* We performed a literature search of CINAHL, EMBASE, MEDLINE, PSYCHINFO, and hand searched articles published between 1980 and 2008. Articles were assessed for methodological quality using the PEDro scoring system for randomized controlled trials (RCTs) and the Downs and Black tool for RCTs and non-randomized trials. Levels of evidence were assigned and recommendations were made. *Results:* In total, 11 pharmacological interventions, five non-invasive interventions, and two invasive interventions were

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evaluated. Pharmacological interventions included propofol, barbiturates, opioids, midazolam, mannitol, hypertonic saline, corticosteroids, progesterone, bradykinin antagonists, dimethyl sulphoxide, and cannabinoids. Non-invasive interventions included adjusting head posture, body rotation (continuous rotational therapy and prone positioning), hyperventilation, hypothermia, and hyperbaric oxygen. The invasive interventions were cerebrospinal fluid (CSF) drainage and decompressive craniectomy (DC). Of these, corticosteroids were found to be contraindicated and cannabinoids were reported as ineffective. The other 16 interventions demonstrated benefit for treatment in some aspect of acute ABI care. *Conclusions:* Substantial research has been devoted to evaluating acute interventions for management of ABI. However, much of this research has focused on the application of individual interventions in small single-site trials. Larger, more methodologically sound trials are necessary to better evaluate the benefits of both single and combined interventions.

K-03

A critical look at phenytoin use for early post-traumatic seizure prophylaxis

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Background: In 2003, the American Academy of Neurology recommended using phenytoin to prevent early post-traumatic seizures (PTS) for all significant traumatic brain injuries (TBI). The goal of this study is to determine 1) the proportion of TBI patients admitted to a tertiary trauma center receiving phenytoin prophylaxis; 2) which parameters physicians used to decide when to administer phenytoin; 3) the efficacy and complication rate associated with the prophylaxis. To date, there are no similar studies reported. *Methods:* We retrospectively analyzed the use of phenytoin in all admitted TBI patients (930) over a two-year period. Using a logistic regression, the relationship between initial GCS, CT results, Marshall Scale and phenytoin administration was determined. The incidence of early PTS was recorded, along with associated complications. *Results*: 45.7% of patients received phenytoin. The primary parameter used to decide when to administer phenytoin was CT scan results ($p<.001$), rather than initial GCS or Marshall Scale ($p>.05$), with 100% compliance with current guidelines. 3.08% experienced early post-traumatic seizures despite prophylaxis. Phenytoin levels were toxic in 13.9% of patients, but there were no significant adverse reactions. *Conclusion:* Current decision-making parameters and recommendations are efficient in preventing early PTS, with high compliance rate and minimal side effects.

K-04

Monitoring of cerebral oxygenation in traumatic brain injury (TBI) using Licox catheter in a tertiary trauma center: major therapeutic implications

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Background: The mainstay of management of elevated intra-cranial pressure (ICP) after brain injury is limited to control ICP and maintain adequate cerebral perfusion pressure (CPP). This therapeutic strategy aims at maintaining cerebral oxygenation. However, cerebral hypoxemia can occur even in the face of normal ICP and CPP. Direct measurement of brain tissue O_2 ($PbrO_2$) offers the possibility of fine tuning our current ICP/CPP management and could alert the clinician of unsuspected desaturations. We report our experience with the Licox catheter to monitor $PbrO^2$ in 10 severe TBI patients between October 2008 and August 2009. *Method:* Retrospective chart review. *Results:* mean duration of use was 6.4 days. No complication occurred except enlargement of a SDH in one case. 28 significant desaturations were observed. Only 16 could be attributed to anomalies in ICP/CPP. Other causes of desaturation were hypoglycemia, non convulsive seizure and atelectasis/pneumonia not reflected on the bedside saturometer. These latter were all reversable with appropriate measures. Finally, in one case, the CPP was dropped to 50 mmHg in accordance with the Lund protocol to achieve control of high ICP with excellent result. *Conclusion:* Measurement of $PbrO_2$ allows detection of significant secondary brain injury that would otherwise be overlook. Furthermore, it makes the detection of hyperemia and its treatment (with the Lund therapy) easier.

K-05

Surgical activity of first year Canadian neurosurgical trainees: a cohort study

FA Haji (London), S Ebrahim (Toronto), A Fallah (Toronto)*

Background: Although surgical activity is an essential component of surgical training, no published guidelines exist that quantify the number of cases required to achieve surgical competency. The aim of this study was to describe the current trends in surgical activity in a recent cohort of first-year Canadian neurosurgical trainees. *Methods:* This study utilized retrospective database review and survey methodology to describe the current state of surgical training for first-year neurosurgical trainees. A committee of 5 residents designed this survey in an effort to capture the most important confounding factors that would influence the operative activity of trainees. *Results:* Nine of twenty (45%) first year Canadian neurosurgical trainees participated in the study. A total of 595 operations were included for review. On average, 66 cases were completed during the initial neurosurgical rotation. Trainees were primary surgeon on an average of 11 cases (17%), most commonly intracranial hemorrhage and cerebrospinal fluid diversion procedures. There appears to be a paucity of exposure to peripheral nerve surgery with almost all cases being represented by a single participant. More than half the respondents voluntarily stay 'post-call' to enhance their operative experience. *Conclusion:* Based on this limited study, it appears the surgical activity of first-year Canadian neurosurgical residents is equivalent to other studied programs with respect to volume and diversity of operative cases. This paper highlights the need for a standardized tool to track operative activity across Canada.

K-06

Reducing radiation exposure to children with shunt treated hydrocephalus: follow-up CT scans with limited axial cuts

B Yarascavitch (Hamilton), T Gunnarsson (Hamilton)*

Background: Children with shunt-treated hydrocephalus are routinely followed with CT imaging of the head to assess ventricular size. Children often present multiple times to the emergency department and have emergent head CT and can result in numerous

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CT-scans, increasing their cumulative dose of radiation. *Methods:* Five-slice limited axial cut CT head scans from twenty recent cases querying shunt malfunction were compared to previous full axial reference studies by means of an electronic survey. Respondents were asked to evaluate a change in ventricular size between the reference study and the new limited study. Responses were compared to the reported full study result from which the five cuts were taken. *Results:* An increase, decrease or no change in ventricular size was correctly identified in 87% of responses. Nine percent were incorrect and 4% responded the limited cuts were inadequate for evaluation. A modified Fleiss' Kappa of 0.83 was calculated demonstrating very good inter-rater reliability between survey respondents. *Conclusions:* Reducing the number of axial cuts may be an effective and viable method for reducing the exposure to ionizing radiation in the shunt-treated hydrocephalic pediatric population. Further technical considerations for obtaining the limited cuts in a prospective manner at the appropriate levels need to be addressed.

K-07

Establishing a high-resolution in-vivo imaging technique to examine the dynamic contribution of bone marrow derived endothelial progenitor cells to intracranial tumor vasculature

G Zadeh (Toronto), K Burrell (Toronto), A Guha (Toronto), R Hill (Toronto)*

Introduction: One of the challenges in studying brain tumor vascular biology, is the ability to study the temporal evolution and dynamic progression of vessel formation in response to oncogenic signals. We introduce a novel strategy that couples powerful optical imaging technqiue, two-photon excitation laser microscopy (2PLM), with glioma xenograft model in an intracranial window chamber (ICW) to obtain high-resolution (e.g. single cell) longitudinal real-time imaging of bone marrow derived progenitor cells (BMDC) and examine their migration, differentiation and integration into intracranial tumor vasculature. *Methods:* Bone marrow (BM) of NODSCID mice is reconstituted with BM harvested from GFP+transgenic mice. U87 glioma cells stably transfected to express m-Cherry are implanted in an ICW in these chimeric mice. *Results:* We are able to reproducibly obtain longitudinal imaging upto 7 weeks following glioma cell implantation with no evidence of intracranial infection or inflammation in the xenograft. High-resolution images of tumor cells, tumor vasculature and single cell resolution of the GFP+BM cells can be obtained. The dynamic flow of GFP+BM within tumor vasculature can be visualized and quantified in 3D. Longitudinal differentiation of BMDCs can be readily traced by following the migration and integration of the GFP+BM cells into the glioma tumor microenvironment over time. *Conclusion:* We have established a novel and invaluable experimental approach for examining the intracranial brain tumor microenvironment, its vascular progression and more precisely understanding at a single-cell level the contribution of BMDC brain tumor vascularity.

K-08

Neurosurgery 2.0: the use of Web 2.0 applications in Neurosurgery

KH AalAli (Halifax), MA Alolama (Gothenburg), SD Christie (Halifax)*

Web 2.0 is a term that is currently used to describe a series of web sites and internet applications that are meant to increase global interactions, collaborations and information sharing. Popular Web 2.0 applications include podcasts, Wikis and social networking sites, such as Facebook. Over the past few years medical applications and usage has increased, however, many practicing physicians still do not have a good understanding of how these applications can positively impact their practice. Neurosurgery has a tradition of embracing new and emerging technologies to improve the delivery of care. Neurosurgery web communities have now been developed to take advantage of Web 2.0 technologies to enhance teaching and knowledge sharing experiences. Examples include neurosurgical portals, neuro-wikis and the use of Really Simple Syndication (RSS) feeds for access to the leading neurosurgical journals. This presentation will review the current Web 2.0 applications and how each could be used by neurosurgeons and residents to improve the efficiency of their practices and enhance collaborative learning. In addition, we will present our experience creating one of the first neurosurgery web portals (neurosurvival.com) using Web 2.0 applications.

K-09

Linear electrode for recording multiple high density local field potentials in the superior colliculus of monkey

R Levy (Calgary), DP Munoz (Kingston), RA Marino (Kingston)*

Background: Microelectrode and local field potential (LFP) recording techniques are separately used in electrophysiological research and functional neurosurgery. Here, we tested the feasibility of recording simultaneous LFPs from closely spaced multiple microelectrodes in a well recognized sensory-motor model in the monkey. *Methods:* A custom electrode was fabricated using 8 pairs of 25 um diameter microwires. The pairs were separated by 350 um and were linearly arranged over a distance of 2.45mm. The diameter of the electrode was 325 um. LFP activity was recorded through the layers of the superior colliculus (SC) of monkeys performing a visually guided saccade paradigm. *Results:* Current source density analysis demonstrated visual input or "target related" activity in the superficial (sensory) layer of the SC and motor output or "saccade related" activity in the intermediate (sensory-motor) layer of the SC. The timing and magnitude of the responses was modulated by task and varied appropriately within visual and motor response fields. There were no complications during the 10 recording sessions. *Conclusions:* This study demonstrates that such a technique may be employed to accurately locate and characterize deep brain and cortical areas in patients undergoing functional neurosurgery.

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K-10

World's first patient-specific virtual reality open brain surgery

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Background: The potential of virtual reality (VR) surgery is relevant to surgical training and patient safety; however, successfully developing patient-specific simulation has been challenging. We report on our experience in patient-specific rehearsal of a tumor-debulking procedure using NeuroTouch, a platform for surgical planning and VR simulation of neurosurgery *Methods:* Anatomical and functional brain imaging data for the simulation planner were obtained from a patient with a suspected left frontal meningioma. Using NeuroTouch, which provides both visual and haptic feedback, removal of the tumor in a VR environment was performed by the operating surgeon and several residents on the day before surgery. Residents completed a short questionnaire describing their experience with the system. *Results:* The operating surgeon reported that the simulation scenario was visually faithful to the real procedure; in terms of haptic feedback, surgical instrumentation was realistic whereas simulated tumour consistency was softer. Junior residents became convinced that simulation will play an important part of their surgical education; experienced residents provided valuable feedback for system improvement. *Conclusions:* We have successfully performed the first patient-specific preoperative rehearsal of an open neurosurgical procedure. We have demonstrated that VR neurosurgery is a viable technique, one that may fundamentally change how neurosurgeons of the future are trained.

Stroke Prevention and Treatment 2

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L-01

Silent brain infarcts and leukoaraiosis in young adults with first-ever ischemic stroke are associated with recurrent stroke

*LC Gioia (Montreal), V Dubuc (Montreal), S Lanthier (Montreal), AY Poppe (Montreal)**

Background: Silent brain infarcts and leukoaraiosis (SBIL) are common in older adults with acute ischemic stroke and predict recurrent stroke and cognitive decline. We sought to determine the association between SBIL and outcome in young adults with first-ever ischemic stroke. *Methods:* Single-centre retrospective chart and MRI review of consecutive adult patients <50 years admitted with ischemic stroke between 2002 and 2008 and investigated by brain MRI. SBIL were defined as focal T2-hyperintensities >3 mm or leukoaraiosis without corresponding focal symptoms. Outcome variables included recurrent stroke, transient ischemic attack (TIA) and cardiovascular events (acute coronary syndrome, angioplasty). *Results:* 190/207 (91.8%) patients had sufficient outcome data for inclusion. Mean follow-up duration was 26.98 ± 24.27 months. Stroke recurred in 19/190 (10.0%) after a mean interval of 11.04 ± 11.8 months. 11/61 (18.0%) patients with SBIL had a recurrent stroke versus 8/129 (6.2%) patients without SBIL (p=0.018). A trend existed between SBIL and cardiovascular events (p=0.095). Subsequent TIA was not associated with SBIL. After multivariable logistic regression, SBIL remained independently associated with recurrent stroke (OR 3.56, 1.36-9.48). *Conclusions:* SBIL in adults aged <50 years with first-ever ischemic stroke independently predict recurrent stroke.

L-02

Risk factors associated with silent brain infarcts and leukoaraiosis in young adults with first-ever ischemic stroke

*LC Gioia (Montreal), S Lanthier (Montreal), AY Poppe (Montreal)**

Background: Silent brain infarcts and leukoaraiosis (SBIL) have been reported in 17% of adults <50 years with first-ever ischemic stroke. SBIL were associated with type 1 diabetes, obesity, smoking, age, and female sex. We sought to validate the prevalence of SBIL in this population and to determine associated risk factors. *Methods:* Single-centre retrospective chart and MRI review of adult patients <50 years with first-ever ischemic stroke investigated by brain MRI. SBIL were defined as focal T2-hyperintensities >3 mm or leukoaraiosis without corresponding focal symptoms. *Results:* MRI showed SBIL in 66/207 (32%) patients. SBIL consisted of lacunar infarcts in 37/207 (17.9%), non-lacunar infarcts in 7/207 (3.4%), isolated leukoaraiosis in 15/207 (7.2%), mixed infarcts and leukoaraiosis in 6/207 (2.9%) and mixed lacunar and non-lacunar infarcts in 1/207 (0.5%). Arterial hypertension (p=0.02), coronary artery disease (CAD, p=0.002) and type 2 diabetes (p=0.03) were associated with SBIL. A trend existed between SBIL and migraine with aura (p=0.07). Age, sex, smoking, and type 1 diabetes were not associated with SBIL. After multivariate logistic regression, migraine with aura (OR=3.06, 1.15-8.12) and CAD (OR=4.31, 1.33-13.99) were independently associated with SBIL. *Conclusions:* In adults <50 years with first-ever ischemic stroke, SBIL are common (32%) and associated with CAD and migraine with aura.

L-03

Multiple Interventions for Neuroprotection Utilizing Thermal regulation in the Emergent treatment of Stroke: the MINUTES study

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Background: The MINUTES study is the first clinical trial utilizing combination therapy and pre-hospital administration (when possible), to address factors of lesion complexity and duration to treatment as important targets in neuroprotective treatment strategies. We present methodology and updated preliminary results from this Phase 1 study. *Methods:* Study Design- Open label randomized study, with regards to treatment allocation. A total of 70 patients will be enrolled. Follow-up is blinded to treatment. Inclusion- Cortical stroke, within 12 hours onset or 6 hours from awakening from sleep. Multi-treatment protocol- 1. Two 2g i.v. boluses of Magnesium Sulfate; 2. Albumin 1.75g per kg i.v as a single dose; 3. Minocycline 200 mg bid for 7 days; 4. Atorvastatin 80mg daily for 7 days; 5. 12h Local Cerebral Hypothermia. Outcome Assessments-NIHSS 48h, 1 wk and 90 days. Modified Rankin 1 wk, 30 and 90 days. Barthel Index, 30 and 90 days. *Results:* Thus far, n=24 (13 treatment, 11 control). Treatment components received in completion (10/13, 77%) or partial

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completion in all 13. No significant difference in mortality (22%treat./17%cont., p=.792). Poor outcome (MR90d>2) in controls/treatment; 100%/67%, p=0.1. *Conclusion:* Preliminary data suggests viability and safety of the MINUTES protocol with an early trend towards efficacy.

L-04

Management of pediatric intracranial arteriovenous malformations: experience with multimodality therapy

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Objective: Successful management of pediatric arteriovenous malformations (AVMs) often requires a balanced application of embolization, surgery, and radiosurgery. The authors describe their experience with multi-modality treatment for low and high-grade pediatric AVMs. *Methods:* 120 cases of pediatric (<18 years) AVM treated with various combinations of radiosurgery, surgery, and endovascular techniques were analyzed. *Results:* From 1985 to 2009, 76 children with low Spetzler-Martin grade (I-III) and 44 with high-grade (IV-V) AVMs were treated. Risk of hemorrhage from presentation to initial treatment was 4.6% /year, and 3.0% /year after treatment initiation until obliteration. Treatment results were available in 101 patients. Initial therapy led to AVM obliteration in 51/67 (76%) low-grade and 3/34 (9%) high-grade AVMs, improving to 58/67 (87%) and 9/34 (26%) with further treatment. Permanent neurological complications occurred in 10/67 (15%) low-grade and 19/34 (56%) high-grade AVMs. Change in mean mRS from baseline to final clinical follow-up (mean 9.2 yrs) improved for children with low-grade lesions by 0.24, but deteriorated for high-grade AVMs by 1.15. On multivariate analysis, significant risk factors for poor final clinical outcome (mRS ≥2) included baseline mRS ≥2 (OR 9.51 [95% CI: 3.31, 27.37] p<0.01), left-sided location (OR 3.03 [95% CI: 0.12, 0.90] p=0.04), and high AVM grade (OR 4.35 [95% CI: 1.28, 14.28] p=0.02). *Conclusions:* Treatment of pediatric AVMs with combinations of embolization, surgery, and radiosurgery can improve obliteration rates and decrease the incidence of AVM hemorrhage. The poor natural history as well as treatment risks must be carefully considered when deciding to treat high-grade AVMs.

L-05

Timing of re-canalization may permit decreased surveillance after one year

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Background: Aneurysm re-canalization remains a disadvantage of endovascular coiling for intracranial aneurysms and the duration of appropriate surveillance after treatment remains unclear. The goal of this study was to characterize the timing of aneurysm re-canalization in order to guide future surveillance strategies. *Methods:* A retrospective analysis of 348 aneurysms treated in 323 patients between 2001 and 2008 was conducted. Re-canalization was defined as any angiographic increased filling from baseline and stratified into minor or major re-canalization. Kaplan-Meier survival curves were used to examine the time to re-canalization characteristics. *Results:* 230 ruptured (66.1%) and 118 unruptured (33.9%) aneurysms were reviewed with a mean (± standard deviation) follow-up of 18 (median 13) months, mean size of 7.7 ± 4.6 mm, and mean age of 55 ± 12 years. Re-canalization occurred in 68 (19.5%) of coiled aneurysms, including 23 (6.6%) major and 31 (12.9%) minor cases. Median time to re-canalization was 182 days with a significant proportion of re-canalizations occurring within 400 days and no major re-canalization seen after this time. *Conclusions:* This study suggests that most major aneurysm re-canalization occurs with the first 12 months after endovascular coiling. A decreased frequency and vigilance of surveillance for patients with aneurysms not showing re-canalization after this time may be supported.

L-06

In-hospital strokes - the Calgary experience

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Background: Limited data are available on the characteristics of in-hospital stroke patients. We studied the incidence and characteristics of stroke among patients hospitalized for a non-stroke diagnosis. *Methods:* All patients admitted to three teaching hospitals from Calgary between April 2002 and March 2009 with a secondary diagnosis of stroke were identified from administrative databases. A type II diagnosis of stroke - strokes occurring after admission - defined by ICD10 codes was employed. *Results:* Among 1321 patients with in-hospital strokes between April 2002 and March 2009, 706(53%) were men. The mean age was 68 ±16.5 years. Strokes occurred most frequently on general medical units 372 (28.1%), cardiology 157 (11.1%) and cardiac surgery 139 (10.5%) units. The commonest non-stroke diagnosis in the admitted patients was ischemic heart disease 188 (14.2%). Stroke was largely ischemic: ischemic stroke 905 (68.5%), transient ischemic attack 194 (14.8%), intracerebral hemorrhage 180 (13.6%), subarachnoid hemorrhage 35 (2.6%) and cerebral venous sinus thrombosis 7 (0.5%). A minority, 70 (7.7%) of ischemic stroke patients received intravenous thrombolysis. 320 (24.2%) were discharged home, 137 (10.4%) were discharged home with support services, 324 (24.5%) were transferred to another hospital/acute care facility, 79(6%) were referred to long term care facility, 459 (34.7%) died in-hospital. *Conclusion:* Ischemic stroke is the commonest type of in-hospital stroke. Only a small proportion of patients are eligible for thrombolytic treatment. Mortality is more than double the average ischemic stroke case-fatality.

L-07

CTASI ASPECTS is superior to NCCT ASPECTS for predicting final infarct extent in patients with CT scans <90 minutes from onset

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Background: CT Angiography Source Image (CTA-SI) would better define the core of ischemia than NCCT at the earliest stages after stroke onset because of the time-independence of CTASI. We evaluated the differences between CT ASPECTS and CTASI ASPECTS scores based on time from symptom onset. *Methods:* Acute ischemic stroke patients with identified proximal anterior

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circulation occlusions (ICA,MCA M1,proximal M2) from Calgary CT Angiography database were studied. CT scans were read by two observers independently for baseline CT ASPECTS, CTASI and followup ASPECTS. Cohort was categorized in four groups based on time from stroke onset to NCCT/CTA: 0-90 min; 91-180 min; 181-360 min; > 360 min. Mean scores of NCCT-ASPECTS, CTASI-ASPECTS and follow-up ASPECTS among different time categories calculated. *Results:* 261 patients studied. The mean NCCT-ASPECTS, CTASI-ASPECTS, follow-up ASPECTS scores respectively in the different time strata are as follows: Group 0-90min (n=69): 7.62, 5.62, and 5.04; Group 91-180min (n=88) : 7.13, 6.45, 5.39; Group 180-360 min (n= 46): 7.37, 6.80, 5.04; Group >360 min (n= 58): 6.45, 6.47, 5.79 respectively. Mean difference between CTASI-ASPECTS and NCCT-ASPECTS were statistically higher in the early period from stroke onset ($p<0.001$) and became insignificant as time from stroke onset progresses. *Conclusion:* Using ASPECTS methodology CTASI is superior to NCCT for ischemic core determination particularly in the ultraearly phase of stroke (<90 min from onset). This reflects the nature of hypoattenuation to be time dependent which becomes more evident over time . NCCT and CTASI reveal similar extent of core in later time windows.

L-08

The "Track Sign": delayed blood-pool phase contrast-enhanced MR angiography shows acute large vessel occlusion

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Background: The prognosis and optimal management of patients with acute ischemic stroke/transient ischemic attack (TIA) associated with ipsilateral carotid occlusion is not known. Acute or chronic arterial occlusions cannot be differentiated by standard angiographic techniques. *Methods:* The Registry of the Canadian Stroke Network was used to identify patients from the Toronto Western Hospital with acute ischemic stroke/TIA and either severe stenosis or complete carotid occlusion on contrast-enhanced MR angiography (CE-MRA). Coronal slices from the delayed, blood-pool phase CE-MRA were inspected for the presence of enhancement of the carotid artery walls with dark central lumen representing acute thrombus, a finding named the "track sign". *Results:* 71 patients were identified, including those with ipsilateral occlusions (n=21), and control groups with: contralateral occlusions (n=7), severe ipsilateral stenosis (n=36) and severe contralateral stenosis (n=7). 27/28 (96%) occlusions and 28/43 (65%) severe stenosis were male. The "track sign" was present in 14/21 patients with ipsilateral occlusions, and none of the control groups ($p<0.001$). All track signs were found within 2 weeks of presentation. *Discussion:* The "track sign" on delayed blood-pool phase CE-MRA is a new finding representing acute extracranial arterial occlusion. This may help guide management and prognostication of patients with stroke and carotid disease.

L-09

Carotid angioplasty and stenting is safe in women

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Background: Randomized controlled trials have shown that carotid endarterectomy poses greater peri-operative risks to women than men. There are limited studies regarding sex differences in carotid angioplasty and stenting. *Objectives:* To compare male and female patients undergoing carotid stenting with regards to their intra procedural and 30-day outcome. *Methods:* We reviewed patients who underwent carotid stenting between 1997 and 2007 at the Foothills Medical Center, Calgary. *Results:* Among 243 patients who underwent 255 procedures, 67 (27.6%) were women. The mean age of the female patients was 72.2±8.4 yrs and that of the male patients was 72.0±9.6 yrs ($p=0.83$). There were no significant differences in risk factors between the groups. A majority of patients 214(83.9 %) had symptomatic carotid artery disease; 11 (16.4%) women and 30 (16.0%) men were asymptomatic. The following intra procedural complications were noted in female versus male patients – asymptomatic carotid/iliac dissections 7.5% (5/67) vs. 0% (0/188) ($p=0.001$), TIA/minor stroke 1.5% (1/67) vs.1.6 %(3/188) ($p=1.00$), major stroke 0%(0/67) vs. 0.5%(1/188) ($p=1.00$) and cardiac dysrrhythmias 3.0%(2/67) vs. 2.7%(5/188) ($p=1.00$). At 30-days, the outcomes in female vs. male were as follows: mortality 3.0% (2/67) vs. 3.2% (6/188) ($p=1.00$), major stroke 3.0%(2/67) vs. 2.1 %(4/188) ($p=0.66$), minor stroke 3.0%(2/67) vs. 3.2%(6/188) ($p=1.00$), and myocardial infarction 0%(0/67) vs. 1.1%(2/188) ($p=1.00$). *Conclusion:* In this cohort, we did not find any impact of sex on 30-day outcome. Minor asymptomatic intraprocedural dissections were more common in women. Carotid stenting can be performed as safely in women as in men.

L-10

Risk of carotid endarterectomy as it relates to patient presentation

JM Findlay (Edmonton), M Jacka (Edmonton)*

Introduction: The risk of stroke and death following carotid endarterectomy (CEA) was assessed according to clinical presentation. *Patient population:* 940 patients who underwent CEA between 1996 and 2009 were divided as follows: 376 patients (40%) with asymptomatic stenosis, 332 (35%) with transient ischemic attack(s) (TIAs), 105 (11%) with non-disabling stroke which occurred more than two weeks before surgery, 81 (9%) with non-disabling strokes which occurred within two weeks of surgery, 26 (3%) with "crescendo transient ischemic attacks (TIAs)" (TIAs of increased frequency and/or severity within a 48 hour period before surgery) and 20 (2%) with stroke-in-evolution (worsening stroke at the time of surgery). *Results:* 30-day new or worse stroke and death rates were as follows: asymptomatic patients 2%, TIAs 2.5%, minor stroke > 2 weeks before CEA 3%, minor stroke < 2 weeks before CEA 2.4%, crescendo TIAs 12% and stroke-in-evolution 40%. When the 26 patients in the crescendo TIA group were combined with the 20 patients in the stroke-in-evolution group (creating an "evolving stroke" group), and compared to all other patients they had a highly significant increased risk ($P < 0.0000005$, Fisher's exact test). *Conclusion:* Evolving stroke including crescendo TIAs

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and stroke-in-evolution was associated with the majority of morbidity and mortality detected. When evolving stroke was excluded, the presence of TIA(s) or a non-disabling stroke of any age was not associated with higher risk. We cannot rule out the possibility that patients with evolving stroke benefit from CEA, but if any do it is accompanied with a high risk of postoperative worsening.

Stroke Health Services Research and Acute Treatment

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M-01

Stroke and aphasia; overcoming the challenges of capacity evaluation

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Background: Approximately 35% of people who sustain a stroke experience aphasia. Aphasia can affect understanding of treatment, rehabilitation and have an impact on expressing decisions regarding discharge. Despite these deficits, critical thinking and competency can be preserved. Healthcare professionals and patients with aphasia need an accessible capacity evaluation process. *Methods:* The Communication Aid to Capacity Evaluation (CACE) has been developed. CACE has undergone a face and content validity process. A Randomised Control Trial (RCT) is underway to measure the reliability, validity and effectiveness of CACE. Five Ontario hospital sites and four Aphasia Centres are involved in the Trial. *Results:* The Panel of Experts drawn from medical and social science academia rated the face/content validity of CACE highly (4.38/5.0). Early results of the RCT are showing that CACE is effective and that its use increases evaluators' confidence when determining capacity in this challenging population. Results also show the need for training in specific communication skills. *Conclusions:* The Health Care Consent Act protects the rights of competent patients to consent to proposed medical treatment and discharge destination. The idea that a person's right to decide might be taken away because of a language barrier is a grave ethical concern. CACE will provide a just capacity evaluation process.

M-02

Factors predicting discharge home from inpatient rehabilitation after stroke

*N Damiano (Ottawa)**

Background: This study explored factors associated with discharge destination following stroke rehabilitation in facilities participating in Canada's National Rehabilitation Reporting System (NRS). The ability to predict client outcomes following stroke is of value to practitioners and managers working in stroke care, as well as system planners examining care needs across the continuum. *Methods:* Over 3,700 stroke inpatient rehabilitation episodes from 2007-2008 were included. A framework of factors, known at admission to rehabilitation, were analyzed using logistic regression to determine which were related to a higher likelihood of being discharged home versus residential care. *Results:* Clients with higher physical function on admission to inpatient rehabilitation had a six-fold increase in the likelihood of being discharged home. Clients who lived with a spouse or family member prior to the stroke were four times more likely to be discharged home. Other factors associated with increased odds of being discharged home included higher cognitive function at admission, younger age, and a shorter time between onset of stroke and admission to rehabilitation. *Conclusions:* The results suggest that a number of factors, known when a client is first admitted to rehabilitation, may help predict if the client will be discharged home, as compared to residential care.

M-03

Establishing best-practice for speech-language pathology in aphasia and cognitive communication rehabilitation post-stroke

R Graham (London), R Teasell (London), J Orange (London), N Korner-Bitensky (Montreal)*

Background: Similar to other professions, Speech-Language Pathologists (SLP) ideally combine evidence with clinical expertise and client values when making decisions regarding patient care. However, the degree to which common assessment and treatment practices are supported by the evidence and best-practice guidelines is unclear. Furthermore, SLPs in particular, have difficulty responding to and employing the best and most evidence-supported tools and techniques. This project will establish best-practice for SLP assessment and treatment of aphasia and cognitive communication impairment (CCI) rehabilitation post-stroke in acute care, inpatient and community rehabilitation. *Methods:* Building upon data from a previously completed national survey of SLP practice, this project will combine the consensus of an expert panel with aggregated data from the Evidence-Based Review of Stroke Rehabilitation 12th edition. Clinical experts will use patient vignettes as a basis for combining expertise with evidence to establish best-practice for SLP assessment and treatment of aphasia and CCI. *Results:* This project is in progress and will be completed in May 2010. Project results and best-practices will be reported and discussed. *Conclusions:* TBA. *Acknowledgment:* This work is being funded by a Stroke Recovery Association studentship and in partnership with the Southwestern Ontario Stroke Strategy.

M-04

The development of an e-collaborative platform to accelerate application of stroke best practices

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Background: The Montreal Stroke Network (MSN) brings together various stakeholders including: patients; caregivers; clinicians; managers; voluntary organisations and researchers. Through community of practice (CoP) activities, members engaged, learned, shared and grew together to intentionally create new knowledge that led to practice changes. The launch of the provincial stroke strategy based on national stroke best practices is adding pressure to adopt relevant structural and process-related innovations. This research project proposes to examine how an e-collaborative platform will leverage on stroke best practices to mobilize knowledge towards development of innovative, evidence-informed projects. *Methods:* Following a needs assessment of MSN members, an e-collaborative

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platform was developed to capture and build knowledge around members interactions on stroke best practice recommendations and on practice changes to be implemented. Timely analysis of e-communications allows for rapid feedback to members to help them identify priority areas for practice change. *Results:* Functionalities of the e-collaborative platform will be demonstrated. Utilization rates will be presented as well as preliminary data on e-communication patterns. *Conclusions:* This project is expected to enhance our understanding of CoPs in accelerating implementation of best practices and how an e-collaborative platform, influences access, sharing, creation and application of knowledge in the area of stroke.

M-05

CTA source images are flow weighted

M Sharma (Toronto), AJ Fox (Toronto), S Symons (Toronto), A Jairath (Toronto), RI Aviv (Toronto)*

Background: CT Angiography Source Images (CTA-SI) were correlated closely with cerebral blood volume, however this no longer appears true with new faster scanning protocols. We aim to correlate CTA-SI and post-Contrast CT (PCCT) hypodensity with CT perfusion (CTP) flow and volume abnormalities. We hypothesized that CTA-SI correlate more closely with CTP flow than volume abnormality. *Methods:* Anonymized random order of CTA-SI and PCCT images of 64 patients with anterior circulation stroke were reviewed by a reader, blinded to all other data, who manually traced and calculated volumes of abnormality. Spearman correlation performed with CBF and CBV CTP lesion volumes calculated independently by another blinded reviewer. PCCT and CBV volumes normalized by log transformation. Linear regression analysis performed to look for factors associated with flow or volume weighting. *Results:* Median (IQR) CTA-SI, PCCT, CBF and CBV volumes of abnormality were 81.84 (47.74-124.06) cm^3, 35.3 (15.21-46.47) cm^3, 93.15 (55.37-133.08) cm^3, 37.52 (7.57-40.96) cm^3 respectively. Strong positive correlation was found between CTA with CBF ($r = 0.89$; $p < 0.0001$) and between PCCT and CBV ($r = 0.79$; $p < 0.0001$), with poorer CTA to CBV (r=0.5) and PCCT to CBF (r=0.52) correlations. Comparison of baseline demographics between residual values divergent from expected abnormality, considered outliers, and expected values for CTA/CBF correlation confirmed that outliers were more likely to have higher NIHSS(p=0.01), lower ASPECTS(p=0.01), larger baseline CTA(118±51cm3 vs 78±42cm3;p=0.002) and final infarct (177±105cm3 vs 86±80cm3;p=0.09) volumes than non outliers. *Conclusion:* Our results indicate that currently acquired CTA-SI are blood flow- rather than blood volume weighted.

M-06

Anesthetic considerations and the role of blood pressure management in the endovascular treatment of acute ischemic stroke

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Introduction: We sought to identify role of anesthesia and associated peri-procedural factors in determining clinical outcomes in patients undergoing endovascular procedures for acute ischemic stroke. *Methods:* We retrospectively studied patients who underwent open label IA procedures for stroke from 2003-2009 in our IA database. Data were collected from chart reviews and anesthesia records. We used the Houston Intra-arterial Therapy (HIAT) score (1 point for age >75 years; 1 for NIHSS score >18, and 1 for glucose >150 mg/dL) for adjusting for baseline differences. Primary clinical outcome was mRS 0-2 at 3 months. *Results:* 96 patients (67 males, median age 65) with median NIHSS 17 (Range 12-20) were included in the study. The distribution of type of anesthesia was as follows: 48/96 general anesthesia (GA), 44/96 conscious sedation (14) or local anesthesia only (30) and 4/96 undetermined. 7/48 (15%) in the GA group had good clinical outcome when compared to 29/44 (66%) in the local anesthesia/conscious sedation group (RR 0.22 95% CI 0.11-0.45). After adjusting for HIAT score and presence or absence of any major anesthetic co-morbidities, the GA group had worse clinical outcome (p value 0.001). Lower blood pressure correlated with poorer clinical outcomes in both anesthesia groups. The lowest mean systolic blood pressure in the GA group was 104 mm Hg compared to 135 mm Hg in the local anesthesia/conscious sedation group (p value 0.0001). *Conclusion:* The use of GA during endovascular procedures in acute ischemic strokes is associated with poorer clinical outcomes at 3 months. This could be because of lower peri-procedural blood pressures.

M-07

Recanalization rate and outcome based on site and severity of cerebrovascular dissection

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Background: Acute Cervical artery dissections (CAD) have a good prognosis but variable recanalization rates.We studied the follow-up recanalization status, neurological outcomes, and factors influencing it in carotid and vertebral artery dissections. *Methods:* Patients from the Calgary CT Angiography database presenting with acute stroke due to carotid and vertebral artery dissections from Aug 2002 to Nov 2009 were reviewed. Follow up status of the original vessel involved was studied between 3-6 months, by CT-angio or MRangiogram (MRA). Good outcome at 3 months was assessed using MRS (≤2). *Results:* A total of 34 patients(20 males and 14 females, mean age 39.5) with acute stroke due to carotid (n=16) and vertebral artery dissections (n=18) with follow up imaging were studied. Complete recanalization was observed in 76.5% of patients. 73% (n=19/26) of vessels with initial irregular narrowing or incomplete occlusions at baseline recanalised in comparison to 27 % (n =7/26)vessels with initial complete occlusion. Absence of hypertension was the only factor favouring recanalization in both carotid and vertebral artery (p=0.001) on multivariate analysis. Good neurological outcome was observed irrespective of recanalisation status (82.5% versus 62%). Patients with supratentorial infarcts had poorer neurological outcomes as compared to infratentorial infarcts (p≤0.007). Cervical segment carotid artery dissection origin had less disabling strokes (≤0.027) than involvement of skull base or distal ICA. *Conclusions:* Recanalization was seen in long term followup even in patients with initial complete occlusion of carotid or vertebral dissection. In carotid dissection good neurological outcome was observed more frequently in more proximal dissection origins.

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M-08

CTASI-ASPECTS is more predictive of final ASPECTS and neurological outcome than NCCT-ASPECTS in acute ischemic stroke caused by proximal vessel occlusions

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Background and Purpose: Alberta Stroke Programme Early CT Score (ASPECTS) is a widely used score for assessment of ischemic changes in acute stroke. We examined whether CTAngiogram source image ASPECTS (CTA-SI ASPECTS) correlates better with baseline NIHSS, Final ASPECTS and neurological outcomes when compared to NCCT ASPECTS. *Methods:* Patients presenting with acute ischemic stroke and identified proximal occlusions (ICA, M1-MCA and proximal M2-MCA) from the Calgary CT Angiography database were studied. CT scans were read by two observers independently for baseline CT ASPECTS, CTASI and follow-up ASPECTS. Details of demographics and risk factors were noted. An MRS≤2 at 3 months was considered as a favourable outcome. *Results:* 261 patients with proximal occlusions were identified and included in this analysis. There was a better agreement between CTA-SI ASPECTS and follow-Up CT ASPECTS [Pearson correlation coefficient 0.57 (95% CI 0.48-0.64), p<0.001] than between NCCT ASPECTS and follow-up CT ASPECTS [Pearson correlation coefficient 0.47 (95% CI 0.37-0.56), p<0.001]. CTA-SI ASPECTS correlated better with baseline NIHSS and 24 hr NIHSS when compared to NCCT ASPECTS (P<0.001). There was a stronger association of a good scan (ASPECTS 8-10) on CTASI to good outcome (OR 2.63, 95% CI 1.54-4.52) than NCCT ASPECTS (OR 1.86, 95% CI 1.54-4.52). Among this cohort, CTASI ASPECTS, rather than NCCT ASPECTS was an independent predictor of good outcome (OR 2.29, 95% CI 1.16-4.53) *Conclusion:* CTA-SI ASPECTS is more informative in predicting final ASPECTS and neurological outcome.

M-09

Canadian unruptured aneurysm endovascular vs. surgery: the CURES trial

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Background: The best treatment for patients with unruptured intracranial aneurysms is uncertain. Surgical clipping is widely considered to provide more consistent and permanent aneurysm exclusion and better long-term protection from hemorrhage but is likely associated with greater morbidity than endovascular treatment. A direct comparison of the two treatments has not yet been carried out. *Purpose:* To compare anatomical results, treatment morbidity & mortality, and long-term clinical outcome of surgical clipping versus endovascular coiling of intracranial aneurysms in a randomized controlled trial. *Methods:* Eligible patients will have at least 10 years of life expectancy and at least one unruptured saccular aneurysm between 3 and 25 mm in size considered treatable by either surgery or coiling. The outcome of intervention (mRS score and vascular imaging) will be monitored for up to 5 years. *Conclusion:* CURES is a two-phase Randomized controlled trial (RTC) comparing angiographic and clinical outcomes. The lead-in phase aims to verify superior anatomical results of clipping and determine its risks. If treatment risks are feasible Phase II will compare clinical outcomes including overall re-treatments and bleeding at 5 years.

M-10

Cost analysis and clinical outcomes for coiling versus clipping of intracranial aneurysms: two years of follow-up data

CB Martin-Gaspar (Hamilton), T Gunnarsson (Hamilton), P Klurfan (Hamilton)*

Objective: To compare case costing, clinical outcomes and length of stay between patients who underwent neurosurgical clipping versus endovascular coiling of ruptured and unruptured aneurysms. *Methods:* A retrospective review of hospital databases, radiological films and patient charts. Length of stay, modified Rankin, Fischer Grading, initial Glascow coma score and Hunt/ Hess Grading were collect for each patient and compared. The cost of treatment was abstracted. *Results:* Two fiscal years of case costing data was analyzed. In the first year, 43 patients with SAH (subarachnoid hemorrhage) aneurysms and 52 with unruptured aneurysms were treated. In second fiscal year, 48 patients with SAH aneurysms and 50 patients with unruptured aneurysms were treated. The cost associated with treatment of SAH aneurysm was greater in the surgical clipping group by an average of $20,000/ patient in the first fiscal year and $35,000 / patient in the second fiscal year. The severity gradings of the SAH and clinical presentations were comparable between groups. Initially, unruptured aneurysms care cost was the same between both treatment groups. However, second fiscal year was $10,000/patient more in surgical clipping procedure. *Conclusions:* With fiscal challenges in health care and the need to implement evidence based care, analyzes and monitoring of new technology is necessary to ensure cost efficacy and comparable clinical outcomes to sustain availability of services. Even with the high procedural cost of endovascular coiling, the overall cost per patient has be demonstrated to be less than surgical clipping treatment with similar clinical patient presentations.

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Poster Presentations

General Neuroradiology

P-001

Intracranial blister aneurysms: ambiguity awaited truth. Report of two cases and review of literature

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Introduction: Intracranial blister aneurysms are rare finding after spontaneous subarachnoid haemorrhage. They can be easily misdiagnosed in high resolution CT and even with digital subtraction angiogram. Few case series had shown the malicious behaviour of such aneurysms. The higher mortality rate compared to side wall saccular aneurysms could probably be related to their fragility and difficult diagnosis. *Methodology:* Three patients presented with SAH and they were harbouring blister aneurysms. The first patient had a dorsal blister aneurysm at the basilar apex that had grown significantly within one week of the initial angiogram. The second patient had left paraophthalmic aneurysm and the third patient had a right paraophthalmic internal carotid artery blister aneurysm. All patients were treated with endovascular approach. *Results:* Due to the small size of aneurysms, selective catheterisation of aneurysms was not feasible for coiling of aneurysms. In all patients, we had successfully deployed self-expanding nitinol stent across the neck of the aneurysms. All patients tolerated the procedure very well with no perioperative complications. One patient was followed up for two years with complete obliteration of the blister aneurysm. *Conclusion:* Endovascular treatment using stent is feasible and successful in treating blister aneurysms both in anterior and posterior circulation.

P-002

Cerebral blood volume reversibility within tissue that progresses to infarction in patients with ischemic stroke: a CT perfusion study

CD d'Esterre (London), TY Lee (London)*

Background: This study examined the temporal profile of CT perfusion (CTP) derived cerebral blood volume (CBV) within tissue that progresses to infarction at admission, 24 hours and 5-7 days post stroke to determine if reduced CBV could normalize. *Method:* Twelve patients underwent a NCCT, CTP/CTA scan within 6 hours of stroke onset, CTP/CTA at 24 hours, and CTP, NCCT at 5 to 7 days post stroke. Final infarct volumes were traced on 5 to 7 day NCCT images. These regions were superimposed onto admission, 24 hour and 5 to 7 day post CTP-derived perfusion weighted (PW), cerebral blood flow (CBF) and cerebral blood volume (CBV) functional maps. Average CBV for gray and white matter within each infarct region of interest at all time points was determined. *Results:* CBV (mean ± stdev; ml/100g) for gray and white matter within infarcts at admission and 24 hours and 5 to 7 days were 1.8 ± 0.71, 1.6 ± 0.27, 1.8 ± 0.51 and 1.1 ± 0.47, 1.2 ± 0.46, 1.2 ± 0.44, respectively when averaged over all patients. One way ANOVA showed no significant differences in CBV between time points for both brain tissue types ($P > 0.05$). *Conclusion:* Within tissue that progressed to infarction, we showed that CTP derived CBV, remained consistently low throughout the acute and sub-acute stages of ischemic stroke. CBV defects that correlate to infarct, unlike DWI abnormalities, do not normalize and may be a more reliable indicator of infarction in acute stroke.

P-003

Decreased internal cerebral vein filling in acute ischemic stroke

E Klourfeld (Kingston), AY Jin (Kingston)*

Background: Hemodynamic compromise underlies the pathophysiology of stroke. CT radiographic signs of cerebral infarction have focused mainly on parenchymal changes and arterial occlusion. Little is known about alteration of venous flow in acute stroke. *Methods:* In this retrospective study, 92 patients had multimodal CT as part of the initial workup for acute stroke at Kingston General Hospital between January and September 2009. Scans were reviewed for arterial occlusion and early cerebral ischemia. CTA source images were analyzed for decreased contrast within the internal cerebral vein (ICV) ipsilateral to the suspected site of infarct using the contralateral internal cerebral vein for qualitative comparison. Final discharge diagnosis was recorded. *Results:* Decreased ICV contrast was seen in 26 of 92 patients; inter-rater agreement was excellent. Decreased ICV contrast was strongly associated with stroke in the ipsilateral hemisphere ($p=0.004$, Fisher's exact test). The sensitivity, specificity and positive predictive value for acute ipsilateral stroke was 43%, 90% and 85% respectively. The odds ratio for acute stroke in patients with decreased ICV contrast was 5.1 (95% confidence interval 2.1 – 12.6). *Conclusion:* The finding of decreased internal cerebral vein filling on CT angiography may be a useful radiographic sign of acute infarction.

P-004

Role of CT in assessment of traumatic cereberal hemorrhage

A Rana (Toronto), B Al-Enazi (Toronto), S Zia (Toronto)*

Objective: To discuss the role of computed tomography (CT) in evolution of trumatic cereberal hemorrhage. *Background:* The use of CT is standard of care for the initial evaluation of head trauma. About 50% of the patients deteriorate after the initial CT scan, although only a fraction of these will need delayed surgical intervention. The indications for repeat CT scanning are not clearly defined. Routine follow-up CT in all patients could expose patients to unnecessary risks and further over burden the limited resources. *Methods:* A 76 year old male had a fall due to bradycardia, resulting in a hematoma around his right eye and mild headache. The hemorrhagic lesions seen on initial CT scan evolved over the next 48 hours as shown in the repeat CT scans, and he also became very agitated and confused. This was treated conservatively and hemorrhagic lesions resolved over few weeks time. *Results:* Initial CT, 48 hours, 96 hours, one week, two weeks and 4 weeks CT scans

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showed progression and then resolution of hemorrhage. *Conclusion:* Although still controversial, most of the recent studies seem to conclude that a repeat CT is not mandatory for patients in the absence of clinical indicators, because it does not influence the outcome in such cases. Thus rather than routinely performing early follow-up CT imaging, it is recommended that an assessment based on the severity of the initial CT and serial clinical examinations should guide the need for follow-up imaging.

P-005

Neurological and radiological manifestations of alkaptonuria

A Rana (Toronto), B Alenazi (Toronto), S Naqvi (Toronto), A Al-Shahrani (Toronto)*

Objective: To discuss the neurological and radiological manifestations of alkaptonuria with a case report. *Background:* Alkaptonuria was first described by Archibald Edward Garrod in 1908. Alkaptonuria is a rare autosomal recessive disorder of phenylalanine and tyrosine metabolism due to a defect in the enzyme homogentisate 1,2-dioxygenase. A toxic byproduct of tyrosine called homogentisic acid accumulates in the blood and is excreted in urine.It also accumulates in cartilage particularly in the spine causing back pain at a younger age. Cartilage damage may also occur in the hip and shoulder. Treatments includes dietary restriction of phenylalanine and tyrosine and large doses of ascorbic acid. The disease is common in Slovakia and occurs in 1:19,000 individuals. It is also frequently seen in the Dominican Republic although the exact incidence and prevalence remains unknown. Otherwise its prevalence is between 1:100,000 and 1:250,000. *Methods:* Our patient was diagnosed with alkaptonuria in childhood and had severe back, shoulder and hip pain.He had extremely severe degenerative disc disease, required shoulder repalcement and had deposits in the external ear cartilage. *Results:* CT san and X-rays of spine, and shoulder were done. *Conclusion:* Alkaptonuria is rare disease with neurological manifestations of back pain and radiological manifestations of spine deformities

P-006

Vessel wall imaging in patients with middle cerebral artery stenosis

MD Vergouwen (Toronto), FL Silver (Toronto), DJ Mikulis (Toronto), RH Swartz (Toronto)*

Background: 3 Tesla contrast-enhanced MRI reveals intracranial vessel wall abnormalities. Initial experience showed atherosclerosis is associated with eccentric wall thickening and enhancement. Our aim was to further characterize the vessel wall imaging findings in the middle cerebral artery (MCA) in patients with presumed atherosclerotic disease. *Methods:* We identified patients with an acute cerebral infarct in the territory of an MCA stenosis who had vessel wall imaging of the affected MCA. Patients with complete MCA occlusion, Moya-Moya disease, or with poor images secondary to motion artefacts were excluded. *Results:* We identified 11 previously unreported patients. Median age was 66 years, 45% were male. All patients had at least 1 risk factor for atherosclerosis. Nine patients had an eccentric M1 stenosis; two patients had an M2 stenosis with inconclusive eccentricity. All 9 patients scanned within 2 months of index event had enhancement of the stenosis. The 2 patients without enhancement were scanned after 2.5 and 5 months. In one patient with enhancement on day 6, it resolved by follow-up at 5 months. *Conclusion:* We confirm the hypothesis that enhancing, eccentric MCA stenosis is likely related to atherosclerosis. Enhancement may represent acutely unstable plaque that resolves 2-5 months after the index event.

P-007

Mapping brain pH and brain ATP using multivoxel 31P MR spectroscopy: a preliminary study

R Wu (Shantou), Y Chen (Shantou), W Liu (Shantou), Q Qiu (Shantou), KG terBrugge (Toronto), D Mikulis (Toronto)*

Although brain adenosinetriphosphate (ATP) studies can be found in multi-voxel 31P MR spectroscopy, previous studies of intracellular brain "potential of hydrogen" (pH) was conducted in single-voxel 31P MR spectroscopy. The hypothesis of this study was that if multivoxel 31P MR spectroscopy could be used to measure brain metabolites directly, we should be able to generate brain pH map indirectly. Many available sequences were tested using phantom and the 2D PRESSCSI sequence was selected because of better signal to noise ratio. TR was 1000 msec and TE 144 msec with 128 scan averages. The acquisition matrix was 16 x 16 phase encodings over a 24-cm FOV. Then two healthy volunteers from MR research team were studied. Data were processed offline using the SAGE/IDL software. Brain pH values were calculated from the difference in chemical shifts between inorganic phosphate (Pi) and phosphocreatine (PCr) resonances. Color scaling map was generated using MatLab software.

At this moment, there was noise for multivoxel 31P spectra in volunteer studies. Roughly, phosphomonoester (PME) peak, inorganic phosphate (Pi) peak, phosphodiester (PDE) peak, phosphocreatine (PCr) peak, γATP peak, αATP peak, and βATP peak could be identified. The individual spectra were with similar quality. The results of rough brain pH calculation based on multivoxel 31P data of the volunteer scans were mapped. What multivoxel 31P MR spectroscopy measures at this time is limited in quality, but it does provide a window to noninvasively measure ATP and pH in small structure of brain tissue.

P-008

Vision and oxygen inhalation affect mitochontrial activity: a 31p magnetic resonance spectroscopy study

R Wu (Shantou), H Wang (Shantou), KG terBrugge (Toronto), D Mikulis (Toronto)*

Brain energy metabolism can be assessed by using 31P magnetic resonance spectroscopy (MRS) to measure changes in the intracellular pH and relative concentrations of adenosinetriphosphate (ATP). Eleven healthy volunteers underwent 31P MRS examination. Seven volunteers took part in the first stage, before and after breathing hyperoxic air (100% O_2) only, with eyes closed. Four volunteers participated in the second stage, 2 scans with eyes closed same as the first stage, and the 3rd scan breathing hyperoxic air (100% O_2) with eyes opening. The studies were performed on a 3-T GE scanner. A spin echo MRS sequence was utilized. TR was 2000 msec and TE 35 msec. The voxel size was 4x4x4 cm^3 placed in the occipital lobes. Data were processed offline using the SAGE/IDL software. Decreased Pi peak integral values and increased peak integral values of γATP, αATP, and βATP can be measured using SAGE/IDL software, after 100% oxygen inhalation

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with eye closed. Compared with first scans, peak integral values of γATPs were increased from 0.75 % to 15.97 % (5.76±4.03) on second scans; αATP from 1.21% to 16.05% (6.23±5.35); βATP from 1.01% to 7.12% (2.67±2.04). Compared with second scans, peak integral values of γATPs were increased from 3.53 % to 9.12 % on third scans of 4 volunteers; αATP from 3.65% to 10.72%; βATP from 2.45% to 8.82%. The pH values among 3 scans were not changed obviously. Brain mitochondrial activities were increased and more ATPs were produced after oxygen inhalation. More energy is needed in visual status.

DEMENTIA

P-009

An investigation into the role of P-glycoprotein in Alzheimer's disease lesion pathogenesis

B Jeynes (Hamilton), J Provias (Hamilton)*

Background: The pathogenesis of Alzheimer disease [AD] senile plaque [SP] and neurofibrillary tangle [NFT] lesions putatively involves a compromised blood-brain barrier [BBB]. P-glycoprotein [P-gp] is a recognized BBB-related efflux transporter protein. *Methods:* In this investigation we determined the density of SP and NFT lesions, and capillary densities stained positively for endothelial BBB-associated vasoregulatory (vascular endothelial growth factor [VEGF], endothelial nitric oxide synthase [eNOS] and inducible nitric oxide synthase [iNOS]) and trans-BBB transport proteins (lipoprotein receptor-related protein[LRP] and receptor for advanced glycation end-products [RAGE]) in AD and control group [CG] brain samples, and compared these densities with the density of capillaries stained positively for P-gp. *Results:* Our results indicate that there are significant negative correlations ($p < .01$) between the densities of NFT and SPβ40 lesions and P-gp positive capillaries in AD but not CG brain samples. Significant positive correlations ($p < .01$) were observed between the densities of P-gp, LRP and RAGE positive capillaries in both AD and CG brains. *Conclusions:* These results suggest that a reduction or absence of capillary P-gp may result in AD lesion development and that P-gp's role is associated with that of LRP and RAGE.

P-010

The value of PET in mild cognitive impairment, typical and atypical/unclear dementias: a retrospective memory clinic study

R Laforce (Quebec), JP Buteau (Quebec), N Paquet (Sherbrooke), L Verret (Quebec), M Houde (Quebec), RW Bouchard (Quebec)*

Background: Several studies have shown that adding positron emission tomography (PET) to the investigation of dementia increases diagnostic sensitivity and accuracy. However, most research has been conducted on typical Alzheimer's Disease (AD) and frontotemporal (FTD) dementias where routine functional neuroimaging is not recommended. The goal of this retrospective study was to examine the value of PET in the diagnosis of atypical/unclear dementias where it may be most useful to clinicians. *Methods:* We selected 94 patients from our database using the following criteria: 1) a clinical diagnosis of Mild Cognitive Impairment (MCI), typical AD or FTD, or atypical/unclear dementia, 2) a PET scan within 2 months of diagnosis and 3) clinical re-evaluation 1.5 years later. *Results:* Overall, PET led to a change in diagnosis in 29% of patients. PET significantly lowered the number of atypical/unclear diagnoses from 39.4% to 16% and almost 30% of the atypical/unclear cases showed a typical AD pattern of hypometabolism. Interestingly, PET was associated with a 64% increase in use of cholinesterase inhibitors. *Conclusions:* The addition of PET to the investigation of atypical/unclear cases of dementia helped generating a more accurate diagnosis and initiating earlier treatment while it was of limited contribution to typical AD and FTD cases.

P-011

The impact of the anticholinergic load on development of delirium in elderly

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Background: Delirium occurs in 11-40% of hospitalized individuals >65 year-old and is associated with anticholinergic medications. *Objective:* To assess the anticholinergic load in elderly inpatients developing delirium and a potential protective effect of cholinesterase inhibitors (ChEI) against delirium in the subgroup of demented patients. *Methods:* Retrospective cohort study of consecutive patients admitted to our geriatric unit during 2008. The anticholinergic load measured by the Anticholinergic Risk Scale (ARS) was compared between cases with, and controls without, a clinical diagnosis of delirium established within 7 days of admission. In the subgroup with dementia clinically diagnosed, the prevalence of delirium was compared between patients treated versus not treated with ChEI. *Results:* Delirium was present in 69/252 (27.4%) patients (cases). Age, sex, and comorbidities measured by the Charlson score were comparable between case and control groups. ARS score was greater in cases (1.52) than controls (0.96; p=0,0018). In demented patients (n=142), the prevalence of delirium did not differ between those treated (n=40; 27.5%) versus not treated with ChEI (n=102; 30.4%). *Conclusions:* Inpatients with higher ARS scores have a significantly greater risk of delirium. There was not apparent protective effect of ChEI against delirium in demented patients.

P-012

A subacute amnestic syndrome caused by spontaneous intracranial hypotension successfully treated with prednisone

*Y Nadeau (Toronto)**

Background: Spontaneous intracranial hypotension (SIH) usually presents with orthostatic headache. Subtle cognitive deficits are not uncommon in SIH. However, the clinical picture can occasionally be dominated by amnesia or by a frontal syndrome with changes in personality and behaviour. *Methods:* This is the case report of a 48 year old man with a two month history of headache independent of posture and a two week history of amnesia. Examination revealed severe anterograde amnesia without other focal abnormalities. SIH was diagnosed after the brain MRI showed bilateral hygromas, effacement of prepontine and perichiasmatic cisterns, bilateral uncal herniation, descent of cerebellar tonsils and enhancement of the pachymeninges. Epidural blood patch was relatively contraindicated because of abnormal coagulation secondary to a factor VII

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deficiency. The patient was treated with bed rest, oral hydration, and eventually prednisone 50 mg po for seven days, followed by a taper. Five days after initiation of prednisone, the amnesia and the headache rapidly improved. Prednisone was discontinued after fourteen days and the patient remained well. *Results:* The mechanisms of action of corticosteroids in SIH are unknown. Hypothesized mechanisms include a stabilizing effect on the dural vasculature, alteration in flow dynamics within the subarachnoid space or facilitation of repair of a dural leak by fibroblasts. *Conclusions:* SIH should be suspected in cases of headache and amnesia, even in the absence of classical orthostatic features. Recognition of this disorder is important because of the potential for complete resolution with treatment.

General Neurology

P-013

The utility of a customized application for a handheld device in training neurology residents: a proof of concept study

JE Alfonsi (Toronto), L Lee (Toronto)*

Background: The use of handheld devices in medicine has become increasingly prevalent, especially for residency training. One limitation of handheld devices has been usability. Apple Inc.'s iPhone Software Development Kit (SDK) allow users to design their own, user-friendly, applications. The objective of this study was to utilize the SDK to develop a low-cost medical application with both utility and usability. *Methods:* An application was coded that allowed residents to log cases and access medical resources such as journals, videos, and hospital protocol. Entered cases could be uploaded to a website. All residents rotating through neurology were given the device for 30 days, after which they completed a mandatory survey. *Results:* A total of 27 residents have used the application. All twenty residents with past logging experience felt this application was the same or better than previous logging experiences. The commonest reason cited was how quickly data could be entered (85% could log a case in under 1 minute). Overall, 56% of residents said the application made quite a bit to a significant difference to their education. The cost of the system was $8000. *Conclusion:* Apple's iPhone SDK allows for the creation of cost effective and user-friendly medical applications.

P-014

Susac syndrome: a rare cause of simultaneous subacute hearing loss, encephalopathy and visual disturbance

R Altman (Montreal), A Al Salti (Montreal), J Jirsch (Montreal)*

Background: Susac's syndrome (SS) is a clinical triad consisting of encephalopathy, branch retinal artery occlusions (BRAO) and sensorineural hearing loss. The pathogenesis is thought to be a microvascular autoimmune endotheliopathy similar to dermatomyositis but with different end organ damage. Diagnosis is elusive and commonly delayed as all three elements rarely occur simultaneously at presentation. *Methods:* Case report. *Results:* A previously healthy 34-year-old woman developed progressive vertigo, nausea, headache, and visual field obscurations over 2 weeks. She then presented to the Montreal General Hospital in a profound encephalopathic state with a fluctuating level of arousal, inappropriate laughter and apathy. When lucid, the patient complained of severe bilateral hearing loss. CSF exam revealed a lymphocytic pleocytosis (10 WBC) with elevated protein (2.58 g/L). MRI revealed central callosal lesions with multiple cortical and brainstem T2 and FLAIR hyperintensities. Initially these were thought to be consistent with multiple sclerosis, but reassessment in light of the clinical findings led to the suggestion of SS. Pure-tone audiometry comfirmed low-to-medium-frequency hearing loss and fluorescein retinal angiography demonstrated BRAO's. The patient was treated with intravenous solumedrol, immunoglobulins, cyclophosphamide and aspirin with excellent outcome. She was discharged to rehabilitation with minimal sequelae. *Conclusions:* This patient with SS is unusual for the simultaneous presentation of all 3 elements of the clinical triad. Acute hearing loss in an encephalopathic patient is an important feature suggesting this rare, but treatable syndrome. The basis of the syndrome's retinocochleocerebral localization remains enigmatic, although a role for anti-endothelial antibodies has been suggested.

P-015

Type 2 diabetes mellitus exacerbates neuropathy in patients with CMT1a

S Arora (Hamilton), S Baker (Hamilton)**

Background: CMT1a is the most common inherited disorder of the peripheral nervous system and accounts for approximately 70% of all CMT1 cases. T2DM is the most common cause of neuropathy in the Western world. Common symptoms of both neuropathies include acroparesthesia and distal limb weakness. *Methods:* This retrospective chart review compared non-diabetic versus diabetic CMT1a patients. Eighty CMT1a cases were identified—10% of whom had co-existent T2DM. A control group of 20 non-diabetic CMT1a patients were randomly selected and age-controlled. Nerve conduction parameters and isometric muscle strength were evaluated. *Results:* Patients with CMT1a and T2DM had significantly slower median mCVs (13.3±2.6 vs 23.4±2.2m/s; $p<0.02$) and prolonged median TML (17.4±1.9 vs 10.1±0.9mV; $p<0.001$). CMAPs were reduced in the T2DM group (2.4±0.9 vs 5.9±1.0mV; $p<0.06$). Alternatively, measures of grip strength, dorsiflexion, elbow flexion and knee extension were not significantly different between groups. *Conclusions:* This study demonstrated that the presence of T2DM in CMT1a patients is associated with slower median mCV and prolonged TML. The lack of difference in strength measures may be explained by the inherent variability in strength testing and the small sample size. The observed values for mCV and TML are robust, which indicates that patients should be educated about the risks and impairments associated with the concomitant neuropathies. Given that axonal atrophy accounts for the progressive sensorimotor loss in both CMT1a and T2DM patients, it is crucial that vigilant clinical surveillance diagnose and manage the early signs of dysglycemia in this population.

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P-016

Migraine-related disability, work impact, and quality of life (QOL) among Canadians with chronic migraine (CM) and episodic migraine (EM)

WJ Becker (Calgary), TK Wilcox (Bethesda), L Wells (Markham), A Blumenfeld (Encinitas), AK Kawata (Bethesda), SF Varon (Irvine), RB Lipton (Bronx)*

Background: Previous studies have shown significant impact of migraine on patient disability and functioning. A Canadian sample was studied to evaluate impact of migraine in Canada. *Methods:* Cross-sectional data were collected via web-based survey. Respondents were classified as CM or EM (ICHD-2 diagnosis of migraine and ≥ 15 headache days/month or ≤14 headache days/month, respectively). Migraine Disability Assessment Questionnaire (MIDAS) and Migraine-specific Quality of Life Questionnaire v2.1 (MSQ) assessed disability and QOL, respectively, and work absenteeism/presenteeism items were administered. Data were analyzed descriptively and analysis of covariance (ANCOVA) models predicted absenteeism/presenteeism by migraine group, adjusting for covariates. *Results:* Of 3,923 panelists contacted, 681 (17.4%) responders met migraine criteria; 8.1% (n=55) CM; 91.9% (n=626) EM. Respondents were largely female (86.6%); average age 47 (SD=11.1). The CM group had higher MIDAS scores than EM (76.8 vs. 13.9, p<0.0001), indicating greater migraine-related disability. CM missed more days of work/school per month due to headache than EM (13.2±2.2 vs. 4.0±1.8, p<0.0001) and worked more often with symptoms (17.1±1.9 vs. 4.7±1.3, p<0.0001). CM also had lower MSQ scores (worse QOL) across multiple domains. *Conclusions:* CM was associated with greater disability and lower QOL than EM, supporting the substantial impact of chronic migraine on sufferers in Canada.Study Supported by: Allergan, Inc.

P-017

Asperger's K.I.S.S.

*ME Berry (Nelson)**

Two cases will be presented to represent Asperger's syndrome and high functioning autism. Simple strategies to make a diagnosis and treat individuals with these conditions will be reviewed. Keep it simple strategies or K.I.S.S. has been designed after a careful review of available treatment options. The strategies will be useful for clinicians, parents and caregivers.

P-018

Isolated phrenic nerve palsy caused by air bag deployment in motor vehicle collision

JG Boyd (Kingston), D Jichici (Hamilton), C Bolton (Kingston)*

Background: Unilateral phrenic nerve palsy is a well described complication of thoracic surgery and ablative procedures for cardiac arrhythmias. It has very rarely been described in blunt thoracic trauma. *Methods:* Single case report. *Results:* We saw a 57 year old man who experienced acute chest pain and shortness of breath following a motor vehicle collision that resulted in airbag deployment. The chest pain persisted for an hour, but he had ongoing nonprogressive symptoms of resting and exertional dyspnea. He had no orthopnea. His neurological exam was normal. There was no paradoxical breathing in the supine position. MRI of the cervical spinal demonstrated degenerative changes that contributed to foraminal stenosis bilaterally at C3-C4, and on the left at C5-C6. Chest radiographs during inspiration and expiration demonstrated paralysis of the left hemidiaphragm. Phrenic nerve conduction studies and diaphragmatic EMG were performed. The right phrenic nerve was normal. The left phrenic nerve demonstrated a tiny amplitude response (<100 microvolts) and a prolonged latency (9.8 seconds). Needle EMG of the left hemidiaphragm did not demonstrate any spontaneous activity, but had only 3 large polyphasic units which were recruited during inspiration. Other muscles innervated by the left C4 and C5 nerve roots (i.e. C4 paraspinal, trapezius (upper border), deltoid) were normal. These findings localize the phrenic nerve pathology to most likely be along its intrathoracic course. *Conclusions:* This is the first report of intrathoracic phrenic nerve injury secondary to airbag deployment. Physicians should consider this diagnosis when investigating shortness of breath following blunt thoracic trauma.

P-019

Neuro cognitive and behavioral changes in a healthy 41 year-old male

V Brunette (Montreal), J Boileau (Montreal)*

We present the case of a 41 year-old man without relevent past medical history. In 2008, he was found unresponsive at home. Lumbar puncture was normal. MRI showed hyperintense white matter signal, predominantly in the temporal lobes. Despite negative PCR, he was diagnosed with herpes encephalitis. He was treated accordingly and was released after two weeks. Then he experienced tonico-clonic generalized seizures for which he was treated. During this period he also noted having episodic behavioral changes, memory loss and confusion. In fall 2009, he was admitted again for depressive mood and alcohol abuse. While in the hospital, he became unable to eat, speak and transfer by himself. He went blind and was comatose at times. Again, MRI showed impressive diffuse white matter lesions and the CSF was positive for oligoclonal bands. Empirically, he was treated with solumedrol pulses to which he responded well. In december 2010, a white matter brain biopsy showed granulomatous formations compatible with SNC neurosacroïdosis. The work-up did not show any extra-SNC manifestation of the disease. Our patient is under prednisone and slowly improving. Sarcoïdosis presenting as an isolated SNC involvment is very rare and we find this case interesting to share with collegues.

P-020

Clinical and genetic characterization of a polymerase gamma (POLG) mitochondrial myopathy syndrome

JL Bouchard (Quebec City), N Chrestian (Quebec City), N Dupré (Quebec City), D Brunet (Quebec City), LC Wong (Houston)*

Background: Mitochondrial myopathy syndromes include a large variety of phenotypes, the commonest being made of progressive external ophthalmoplegia (PEO), with ptosis and variable muscle weakness. Mutations in either mtDNA or nuclear genes can cause PEO in association with many clinical manifestations. *Methods:* We report two brothers with childhood-onset of severe PEO and ptosis,

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progressive weakness of the face, neck, and selective groups of limb muscles, sensory neuropathy, but no cerebellar ataxia. There was no cardiac, renal, digestive, or endocrine dysfunction. No other relatives were affected, including the parents and two sisters. *Results:* Muscle biopsies showed a mitochondrial myopathy with only a few ragged-red fibers and some COX negative/SDH positive fibers. No large mtDNA deletion was originally found in the proband who died of pneumonia at the age of 23. A whole mitochondrial genome mtDNA sequencing revealed no significant abnormalities. The youngest brother was tested for mutations in the POLG-1 gene and was found to be a compound heterozygote for a known mutation (p.L304R), and a unclassified missense mutation variant predicted to be deleterious. Both parents and the two unaffected sisters were hererozygotes for either one mutation. *Conclusions:* The POLG gene is the most frequently mutated nuclear gene causing a broad clinical spectrum of diseases that overlap with the clinically heterogeneous mitochondrial disorders due to primary defects in mtDNA, including PEO and myopathy. Thus, analysis of POLG gene should be considered in the molecular work-up of a suspected mitochondrial disorder.

P-021

Botulinum type A (Botox) in the management of cervical dystonia: a seven-year retrospective review

*JY Chu (Toronto)**

Introduction: Botulinum neurotoxin has been used successfully as first-line treatment for cervical dystonia over the past 15 years. * *Method:* This study is a retrospective analysis of the clinical experience of 4 patients with cervical dystonia treated with botulinum type A (Botox) at a community neurology clinic in Toronto between 2002-2009. Details of these cases will be presented along with a summary of their response. *Results:* The mean age for this series is 56.25 years (49-66), male to female ratio is 1:1, mean duration of symptoms is 3.17 years (2 months to 6 years), mean # of injections is 9.25 (2 to 13), mean response duration is 5.5 months (4 - 7 months), mean follow-up duration is 3.85 years (0.66 to 6 years), usual dose per injection visit is 200 U. Response was rated good to excellent both by the patient and by the author. All muscles were injected with EMG guidance. There was no major complications or side-effects reported by these 4 patients. *Conclusion:* Botulinum type A (Botox) has been found to be an effective and safe treatment in the long term management of cervical dystonia in a community neurological practice.

Reference:
Costa J et al. Botulinum toxin type A therapy for cervical dystonia Cochrane Database Syst Rev. 2005;(1) CD003633.

P-022

In vivo imaging of TLR2 response: effects of gender and estrogen on microglial activation following brain ischemia

PJ Cordeau (Quebec), Y Weng (Quebec), J Kriz (Quebec)*

Background: Microglia possess steroid-converting enzymes and should be affected by the concentration of estrogen present in the mouse. Despite abundant research, there is still controversy on whether or not microglia cause damage following brain ischemia. On that basis, the in vivo study of the activation of the microglia and the effect of estrogen on microglia activation patterns could bring some light on the mechanism affecting stroke evolution in female mice. *Methods:* TLR2-Luc mice were subjected to 60 minute middle cerebral artery occlusion (MCAO) after a deprivation of estrogens for 14 and 40 days and compared to adequate controls. The pattern and the intensity of the TLR2 signals were longitudinally monitored using biophotonic/bioluminescence imaging and high resolution CCD camera. *Results:* In all groups we detected a marked upregulation of the TLR2 signal post MCAO. The signal peaked at 48 hours. Furthermore, our results revealed a significant difference in the signal measured before and after the MCAO in the group chronically deprived of estrogens as compared to controls. *Conclusion:* The TLR2-luc reporter mouse represents a valid model to study microglia activation in ischemic brain of live animals after chronic or acute estrogens deprivation.

P-023

Brachial plexopathy complicating Epstein-Barr virus infection in an adult

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EBV infection has been described, likely as a dysimmune neuropathy triggered by the EBV. We present a case of brachial plexopathy complicating prior EBV infection in a healthy adult. A previously healthy, 26-year-old female presented with a six-month-history of slowly progressive weakness and wasting of her left hand muscles. Electrodiagnostic studies indicated the presence of a left brachial plexopathy. MRI of the left brachial plexus showed no abnormality in the plexus but extensive bilateral lymphadenopathy. Lymph node biopsy demonstrated abundant Epstein - Barr virus positive cells. The patient was treated with intravenous immunoglobulin, 2G/kg, without effect and with physiotherapy. This case is unique in that the brachial plexopathy occurred in an adult and her course is not as benign as previously described. It differs in the prolonged temporal course between infection and weakness, complete lack of pain, and lack of improvement at one year after onset. It is unique as being the first case of a biopsy documented EBV lymphadenopathy associated with painless focal amyotrophy. Therefore, EBV infection with lymphadenopathy should be included in the differential diagnosis of lesions involving the lower trunk of the brachial plexus and presenting with painless amyotrophy of the hand.

P-024

Use of acyclovir in suspected herpes simplex encephalitis

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Background: Herpes simplex encephalitis (HSE) is a severe sporadic encephalitis with 70% untreated mortality and morbidity. The diagnosis is based on the clinical picture, magnetic resonance (MR) imaging findings, and detection of herpes simplex virus DNA in cerebrospinal fluid (CSF) using polymerase chain reaction (PCR) amplification. Therapy is intravenous acyclovir for 14 – 21 days and clinical outcome is improved by early initiation of therapy. *Methods:* The records were reviewed of all adult patients who received intravenous acyclovir for suspected herpes simplex encephalitis and were admitted over a one year period at Winnipeg Health Sciences Centre (n=25). Their clinical course, laboratory and imaging investigations, and timing of initiation and discontinuation of

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therapy with intravenous acyclovir were assessed. *Results:* One patient had HSE. Five of 25 patients did not undergo CSF examination, 5/20 of CSF samples were not sent for PCR testing, and 8/25 of patients did not have MR imaging performed. Acyclovir therapy was initiated a median of 19 hours (range 1-57) after initial presentation, and more than 48 hours for two patients. *Conclusions:* Therapy was initiated much earlier than in a very recent comparable study performed in the UK, but several areas were identified in which current management of HSE might be improved.

P-025

Recovery of awareness after hyperacute hepatic encephalopathy with "flat" EEG – 3 cases and review of the literature

G Hunter (London), GB Young (London)*

Background: Hyperacute hepatic failure (HHF) is defined by the onset of encephalopathy within 7 days of the onset of liver dysfunction, and the most common cause remains acetaminophen overdose. The typical EEG findings have been described, including generalized suppression, which generally indicates a poor prognosis. The pathophysiology of hepatic encephalopathy is likely related to the effects of hyperammonemia on astrocytes, including astrocytic edema, neurotransmitter excesses and deficits, and secondary effects on neuronal function. *Case Reports:* The index case is a 35 year-old male with a remote history of alcohol abuse who presented with jaundice and drowsiness. History revealed he had taken up to 4.2 grams of acetaminophen for back pain over the previous 48 hours. He quickly became comatose with extensor porturing with evidence of moderate edema on CT. MRI showed diffusion restriction in both thalami. The EEG was 'flat', with no cerebral activity detected. After 48 hours of hypothermia he recovered slowly and was discharged home within a week with no apparent deficits. Two other similar cases are also reviewed. *Conclusions:* Based on these reports and review of the literature, we suggest that: 1) Astrocytic edema results from hyperammonemia in HHF, and is capable of producing EEG suppression due to secondary neuronal dysfunction. 2) Astrocytic edema may produce DWI changes in the thalami in HHF. 3) Even severe cases of HHF with a flat EEG and poor clinical status may recover, since neurons seem to be relatively spared, and these patients should therefore be supported aggressively.

P-026

Seizures after cardiac surgery – a toxic syndrome

G Hunter (London), GB Young (London)*

Background: Seizures are reported to occur post-operatively in approximately 0.5% of cardiac surgery patients and have usually been attributed to vascular events. However, we have observed seizures due to a toxic syndrome with characteristic features. *Methods:* Retrospective 14 month review of seizures in the cardiac surgery recovery unit. *Results:* A 3 month peak seizure incidence of 3.8% coincided with an increased dose of tranexamic acid, an antifibrinolytic agent with GABA-A blocking properties. The baseline then remained at 0.9%. Eighty-five percent were generalized convulsive seizures. The most common EEG finding was generalized spike and wave (GSW), although some also showed focal epileptiform discharges. Neuro-imaging was negative in 83%. The patients with generalized seizures and generalized ictal recordings had negative neurological examinations after the seizures, did well and did not require anti-epileptic drugs after the first few days in hospital. *Conclusions:* We describe a toxic syndrome manifesting as generalized convulsive seizures early after cardiac surgery, with GSW on EEG, negative examinations and imaging and a benign course. The cause is likely to be a medication, perhaps cefalozin, which is still being used in high doses (5 grams in the 1st 24 hours). Future work will attempt to correlate serum levels of these drugs with the incidence of seizures after cardiac surgery.

P-027

Medical therapies for botulism

MR Keezer (Montreal), T Benstead (Halifax), C Chalk (Montreal)*

Background: Botulism has a mortality rate of 50% if untreated. Supportive care is key, but the role of other medical therapies is unclear. We conducted a systematic review evaluating medical therapies for botulism. *Method:* We searched the Cochrane Neuromuscular Disease Group Trials Register, MEDLINE and EMBASE for randomized controlled trials (RCT) of botulism therapies. Our primary outcome was death occurring within 4 weeks, and secondary outcomes were death occurring within 12 weeks, duration of hospitalization, mechanical ventilation, or tube feeding. *Results:* Our search returned 308 citations, but only 1 RCT, which evaluated intravenous human botulinum immunoglobulin (BIG) for the treatment of infant intestinal botulism. In 59 BIG and 63 control patients, there were no deaths. There was a significant difference in duration of hospitalization (weighted mean difference (WMD) 3.1 weeks, 95% CI 1.6 to 4.5), mechanical ventilation (WMD 2.6 weeks, 95% CI 0.9 to 4.3) and tube or parental feeding (WMD 6.4 weeks, 95% CI 2.7 to 10.0) but not in rate of adverse events or complications. *Conclusions:* There is reasonable evidence supporting the use of BIG in infant intestinal botulism, but for other medical treatments in botulism, good quality evidence is lacking.

P-028

Aphasia camp: a inclusive recreational case study

LA Klaponski (Toronto), J Roadhouse (Brantford)*

Aphasia is an acquired communication disorder caused by an injury to the brain, affecting survivor's speech and language. In 2008, the first-ever known Canadian Aphasia Camp took place in Brantford, Ontario, created through the partnership of Adult Recreation Therapy Centre (ARTC), Stroke Recovery Canada of March of Dimes Canada (MODC) and the University of Western Ontario's School of Communication Sciences and Disorders. The goal was to offer a recreational weekend camp for people with aphasia and their family members. The mission of the initiative was to be physically accessible (adapted sports and activities, accessible facilities, etc.), and communicatively-accessible for stroke survivors with aphasia. Through training in supported conversation techniques, staff, students and volunteers learned tools to communicate and interact with people with aphasia. Outcomes included reduced isolation, increased socialization, peer support and networking as well as a sense of belonging. The success of the camp focused on planning with speech language pathologists, adaptive recreation specialists, as well as stroke survivors with aphasia. ARTC and MODC will be hosting Aphasia Camp for the third year in a row to meet the

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recreational needs of a severely underserved population of people that have acquired communicative disabilities. This poster presentation aims to outline the qualitative themes highlighted by participants and volunteers alike.

P-029

Relationship between amyotrophic lateral sclerosis and occupation

L Limenis (London), A Rowe (London), CL Shoesmith (London)*

Background: Amyotrophic lateral sclerosis (ALS) is a debilitating disease without known causes. Occupational data encompasses some proposed risk factors. The purpose of this study was to determine if certain occupations are associated with development of ALS, age and region of symptom onset, and disease duration. *Methods:* The charts of 212 ALS patients were reviewed. Data on occupation, age and region of symptom onset, and duration of disease was extracted. Occupations were classified based on the U.S. Department of Labor's Standard Occupational Classification (SOC). *Results:* Average age of onset was 56.9 years old. Trends indicate that disease onset may occur at a later age in homemakers and healthcare workers. There were no remarkable correlations between region of onset and occupation, although a few trends were observed. Average disease duration was 42 months. Disease duration was significantly shorter in military veterans (17 months), homemakers (21.5 months) and those employed in computer, mathematics and engineering professions (25 months). *Conclusions:* While certain occupations appear to be predictive of disease duration, the association between occupational exposure with age and region of ALS symptom onset remains unclear. Larger studies are needed.

P-030

Mitochondrial myopathy with inflammation due to novel missense mutation in the cytochrome c oxidase I gene

R Massie (Rochester), J Wang (Houston), LC Wong (Houston), M Milone (Rochester)*

Background: Cytochrome c oxidase (COX), complex IV of the mitochondrial respiratory chain, is composed of 13 subunits, three of which are encoded by mitochondrial DNA (mtDNA). Mutations in these 3 genes result in variable phenotypes. We report a patient with isolated mitochondrial myopathy and inflammatory exudate harboring a novel mutation in COX subunit 1 (COI). *Methods:* Clinical evaluation and entire proband's muscle mitochondrial genome sequencing. *Results:* A 64-year-old woman presented with progressive painless proximal lower extremity weakness. She had major depression and previous bariatric surgery. Neurological examination revealed bilateral ptosis, facial and proximal muscle weakness. Brain and spine MRI's, EKG, resting serum CK and lactate were normal. EMG showed myopathic changes without fibrillation potentials. Muscle biopsy revealed numerous COX-negative fibers and multiple small collections of inflammatory cells. Complex IV activity was at 57% of controls on muscle biochemical analysis. Sequencing of muscle mtDNA identified a novel heteroplasmic missense variant m.7222A>G in COI (p.Y440C), which was absent in the patient's, her daughter's and her sister's blood. Oral prednisone resulted in equivocal benefit. *Conclusions:* The COX-negative fibers, the mutation of the highly conserved tyrosine in muscle and its segregation with clinical phenotype suggest that the novel mutation is pathogenic. Inflammatory changes can occur in hereditary myopathies, including mitochondrial myopathies.

P-031

Repeated intracutaneous injections of botulinum toxin-type A for the treatment of Frey's syndrome after parotidectomy: a case report

*SM Mirsattari (London)**

Introduction: Frey's syndrome is characterized by gustatory hyperhydrosis, flushing, and warmth in the preauricular and temporal areas. Treatment of Frey's syndrome can be challenging. *Methods:* A typical case of Frey's syndrome following parotidectomy and its response to repeated injections of botulinum toxin type A (BTX-A) is presented here. *Results:* A 74 year old woman underwent left parotidectomy for Warthin's tumour ten years ago. Postoperatively, she developed gustatory sweating on the left side of her face associated with flushing within three months of her surgery which has became disabling to her. As a consequence, she stopped eating in public places such as restaurants in order to avoid social embarrassments. She was treated with intracutaneous injections of BTX-A 50-100 mouse units (MU) every 3-5 months for two years with good results. *Conclusions:* BTX-A is an effective and minimally invasive treatment of Frey's syndrome which should be offered early to the affected patients to improve their quality of life. Repeated injections of BTX-A is safe in Frey's syndrome.

P-032

Acute encephalopathy following a large amount of milk consumption

F Moien-Afshari (Saskatoon), C Voll (Saskatoon)*

Background: Urea dysmetabolism generally manifests in newborns with lethargy, vomiting, and seizures. Initial presentation in an adult is unique. *Methods:* Case report. *Results:* A 34-year-old Métis male with history of cocaine abuse presented with acute chronic cognitive dysfunction and aggressivity. He scored 15/30 on a Montreal Cognitive Assessment (MOCA). Examination was additionally remarkable for visuospatial impairment, brisk DTRs, extensor plantar reflexes, dysmetria and gait ataxia. Urine toxicology was negative. EEG background was slowed. CSF was normal. Cranial CT showed hypodensities in right frontal lobe. Brain MRI revealed infarcts in frontal and insular cortices. Cerebral and carotid/vertebral MR-angiogram and stroke work up were negative. He subsequently became unconscious with clonic movements. EEG was encephalopathic but not epileptiform. Hyperammonemia (291 μmol/L), hyperornithinemia and hyperhomocitrullineuria (Triple H syndrome) and a mutation (F188del) in ornithine transporter 1 (SLC25A15) were found. Protein restriction improved MOCA (24/30) and visuospatial abilities. He recalled consuming milk prior to becoming unconscious. *Conclusion:* SLC25A15 gene mutation in this Métis male is the same mutation described in the Quebec French population with triple H syndrome and clinicians should be aware of this rare entity. Protein restriction is essential for therapy.

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P-033

Two modern cases of encephalitis lethargica, with an historical review

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Background: A global pandemic of Encephalitis Lethargica (EL) between 1915 and 1930 affected over 5 million people worldwide. About a third of these patients died in the acute phase and a large percentage of the survivors developed post-encephalitic syndromes including post-encephalitic Parkinsonism, oculogyric crises, respiratory tics and behavioural abnormalities. Contemporary observers clearly differentiated the disease from pandemic "Spanish" influenza and modern testing of archival pathology specimens from victims have confirmed that pandemic EL was not caused by the influenza virus. *Methods:* Two recent case of probable EL are presented and the EL literature reviewed. *Results:* Our 2 cases meet proposed diagnostic criteria for EL. One of the cases had confirmed H1N1 infection. No infectious cause was identified in the second case, in spite of extensive testing. Both survived the acute phase of the disease but required mechanical ventilation for part of their course. *Conclusions:* EL, although rare, still exists and should be considered in patients presenting with the characteristic clinical picture.

P-034

Abdominal pain in Parkinson's disease – off or on phenomenon of levodopa

A Rana (Toronto), O Syed (Toronto)*

Objective: To report abdominal pain as a symptom of levodopa wearing off in Parkinson's disease. *Background:* Abdominal pain has been know to be induced by levodopa but at the same time it has also been reported as a wearing off symptom. History taking and establishing a clear relationship of abdominal pain with the dosage of levodopa becomes critical in these patients. *Methods:* A 61-year-old male with PD who was on levodopa/carbidopa for about four years when he began to experience end of dose wearing off when he would suffer severe abdominal pain in the wearing off period. His abdominal pain would improve on taking next dose of levodopa. Mr. K.W. was a 71year-old male with PD, who was on levodopa 200/50 four times daily and entacapone. He began to experience abdominal pain at 3 AM, six hours after taking his last scheduled dose of levodopa/carbidopa, as his evening dose of levodopa /carbidopa wore off. The abdominal pain would continue till 5 AM when he would take his next dose of levodopa resulting in complete relief of abdominal pain. *Results:* The first patient was seen in the emergency department.CT scan of abdomen, MRI spine, and chest X-ray were normal. Analgesics and spasmolytics were ineffective in addressing his abdominal discomfort. The adjustment of dosing schedule of levodopa in both patients ameliorated abdominal pain. *Conclusion:* Abdominal pain may be a levodopa induced ON as well as Wearing OFF symptom in PD patients and careful history taking may help avoiding the other invasive investigation.

P-035

Initial presentation of diabetic optic neuropathy and retinopathy to Neurology

A Rana (Toronto), A Al-Shahrani (Toronto), S Zia (Toronto)*

Objective: To discuss the neurological presentation of bilateral sever optic neuropathy and severe non proliferative diabetic retinopathy in a 17 year old. *Background:* Diabetic retinopathy is one of the leading cause of blindness. Diabetic retinopathy is a microvascular condition that affects the retinal blood vessels at capillaries. Almost all patients with type 1 diabetes in their first two decades and a significant number of type 2 diabetics can develop diabetic retinopathy. It can be classified into background, preproliferative, and proliferative diabetic retinopathy. Initially some of these patients may present to neurology with a clinical picture of optic neuritis and unilateral visual loss. We present a case of a patient who developed an optic neuritis-like picture and was sent to neurology by an ophthalmologist and who was later found to have diabetic retinopathy. *Methods:* An 18-year old university student started experiencing painless visual loss in the left eye initially. She had decreased VA left eye with mild color vision problems without any improvement with pinhole. Several months later she developed diabetes mellitus type I and was diagnosed with bilateral sever optic neuropathy and sever proliferative diabetic retinopathy *Results:* MRI Brain showed no demyelination. *Conclusion:* Optic neuritis like clinical picture presenting to neurologists may be the first manifestations of young onset type 1diabetes who may later develop severe retinopathy.

P-036

Cervical fusion as a treatment for Parkinson's induced head drop syndrome

N Rasool (Halifax), SD Christie (Halifax), KL Schoffer (Halifax)*

Background: Head drop syndrome (HDS) results from an imbalance of the neck muscles, typically as a consequence of either a focal myopathy posteriorly or a dystonia anteriorly. It has been associated with multiple neurological diseases such as amyotrophic lateral sclerosis, Guillain Barre syndrome, a variety of myopathies, and rarely, parkinsonism. Despite causing significant disability in terms of pain, dysphagia, and social isolation, it remains highly refractory to treatment. The utility of neurosurgical interventions is uncertain and limited to a few case reports in the literature. *Methods:* We present a 63 year old man with an 18 year history of idiopathic Parkinson's disease (PD) and significant antecollis, resulting in HDS. Medications, botulinum toxin injections and bilateral deep brain stimulation surgery were unsuccessful in managing his pain and functional limitations. As a palliative measure, a cervical-thoracic fusion from the occiput to T4 was performed. *Results:* Following the surgery, the patient's pain, ambulation, dysphagia, and quality of life improved significantly. *Conclusions:* Our case illustrates that neurosurgical interventions, particularly cervical-thoracic fusion surgeries, may have a role in select cases of refractory HDS in parkinsonian syndromes.

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P-037

Regaining mobility: VON Canada's SMART (Seniors Maintaining Active Roles Together) ® program

*SV Schuehlein (Kitchener)**

For stroke victims, fear of falling can be an insurmountable hurdle to recovery and regaining mobility. 'Targeted' physical activity is part of the solution: improving balance/coordination, flexibility, strength and endurance. Since 2002, VON Canada's SMART (Seniors Maintaining Active Roles Together)® Program has proven to be a promising intervention. The VON SMART Program provides volunteer-led functional fitness (In-Home and Group), reaching older adults who would not normally have access to exercise at an appropriate level. VON SMART Program's recent demographic profile showed that just under 30% of participants reported 'stroke' as a health condition they are managing. Three external evaluation studies completed by the Canadian Centre for Activity and Aging (2004), The University of Western Ontario's School of Physical Therapy (2008) and the University of Waterloo's Health Sciences/Gerontology Department (2009) highlight the positive impact of the program. Findings have demonstrated statistically significant improvements functional fitness. The majority of VON SMART In-Home Program participants (>91%) reported on follow-up that they were able to maintain or improve function during the course of the program. All of the Group participants maintained or improved their function. The new Leading Practice Guide, which is now available, provides valuable information regarding the program's successful delivery model.

P-038

Prolonged restricted diffusion white matter changes in carbon monoxide delayed encephalopathy: a case report

ME Sharp (Vancouver), JA Pettersen (Vancouver)*

Background: A sizable minority of carbon monoxide poisoning cases develop delayed encephalopathy following a lucid interval of 2-40 days. Diffuse white matter (WM) lesions are typically seen on MRI and may be confused with small vessel ischemic change. We describe a case in which DWI revealed a pattern distinct from ischemia. *Methods:* Case Report. *Results:* A 51 year old man was admitted with acute CO poisoning (level: 37). CT revealed globus pallidi and diffuse WM hypodensities. At day 15, he developed akinetic mutism and incontinence. MRI (5 weeks) revealed extensive diffusion-restricted confluent WM changes. Gradual improvement occurred in all symptoms. Neuropsychological assessment at 6 months revealed attention/executive, visuo-spatial and short-term memory deficits, while neurological exam revealed parkinsonian gait, rigidity and tremor. He was discharged home. At 10 months, parkinsonian features and incontinence had largely resolved, while all neuropsychological domains had improved mildly. A follow-up MRI is pending. *Conclusion:* Confluent WM T2-hyperintensities underlying CO delayed encephalopathy may appear as small vessel ischemic disease on MRI. However, DWI reveals prolonged restricted diffusion which helps differentiate this entity from ischemia. We recommend DWI imaging in cases where the clinical history is uncertain and the etiology of white matter change is unclear.

P-039

Hematopoietic stem cell transplantation (HSCT) for adult-onset Krabbe disease: first report in the literature

ME Sharp (Vancouver), C Laule (Vancouver), S Sirrs (Vancouver)*

Background: Krabbe disease is caused by a deficiency of galactocerebrosidase which results in the accumulation of the substrate psychosine causing glial cell death and demyelination. The adult-onset variant is very rare. Therapeutic developments have focused on stem-cell based strategies which allow for enzyme replacement. HSCT is reported to be successful in treating asymptomatic infants but there are no reported cases of its use for adult-onset Krabbe disease. *Methods:* We report the first follow-up data for a patient with adult-onset Krabbe disease who underwent HSCT 16 years after the onset of her neurological symptoms. The use of advanced MR imaging techniques, including diffusion tensor imaging (DTI), myelin water imaging and spectroscopy is also discussed. *Results:* Six months after successful HSCT our patient showed improvement of her spasticity and ataxia. Prior to HSCT, DTI and myelin water imaging revealed extensive areas of abnormality not detected on conventional MRI. Given her clinical improvement, we hope to see a similar trend in her post-HSCT MR imaging. *Conclusions:* HSCT may reveal itself to be a successful enzyme replacement strategy for adult-onset Krabbe disease to both prevent progression and reverse symptoms. Advanced MRI methods might prove useful for early detection, prognostication and assessing response to HSCT.

P-040

Short term adaptation of visual search strategies in simulated hemianopia

SM Simpson (Vancouver), M Abegg (Vancouver), JJ Barton (Vancouver)*

Patients with visual field defects are well known to have impaired visual search and exploration performance both clinically and experimentally. It has been questioned whether this difficulty is a result of the brain pathology leading to the defect or caused by the defect itself. A computerized gaze-contingent display was used to create a simulated homonymous hemianopic condition (sHH) to investigate how healthy individuals perform with an imposed visual field defect. Normal individuals with an imposed sHH have shown spontaneous adaptation; however, it was not known if this was task specific learning. Our study results are suggestive that adaptation does occur to an imposed sHH that is not related to task learning.

The individual trials consisted of finding 0-4 of the target letter "A" among 25 randomly placed distracting letters on a computer screen. EyeLink system recorded eye movements and created the sHH. Subjects were significantly more accurate in the number of targets detected in the normal condition compared to sHH condition. There was a trend toward more efficient search time comparing trial position in each block. In addition, there was a similar trend to improved accuracy comparing trial position.

The search pattern of healthy individuals parallels those observed in patients with HH thus providing further support that the visual search impairment observed in patients with HH is more likely secondary to the visual field defect itself and less likely cerebral damage. Our findings support that there is short term adaptation in healthy individuals to a sHH condition.

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P-041

Innovative web-based software to assist students in localizing neurologic lesions

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Objective: To evaluate a web-based application that helps medical students learn the process of localizing neurologic lesions. *Methods:* After the development of a prototype web-based localization application to help localize neurologic lesions, a randomized study was designed to evaluate its effectiveness as an educational tool. Second year medical students at the University of Ottawa will be invited to participate in this study in January 2010. Students will receive a didactic teaching session on cranial nerve VII neuroanatomy, then will be randomized into two groups and presented with patient cases and a multiple choice test on localization of cranial nerve VII lesions. As a resource, Group 1 participants will have access to the online localization prototype, whereas Group 2 participants will have access to selected neuroanatomy textbook images. Accuracy of test answers will be compared between groups. Participants will complete a survey on perceived effectiveness of the two resources as neurologic educational tools. Data on computer use and self-assessed computer proficiency will also be collected. *Results:* Results will be collected in January 2010. *Conclusion:* We anticipate positive subjective feedback from participants on the usefulness of the localization application, and strong user preference for the application over the standard textbook when faced with localization-based neurologic problems.

P-042

Degeneration of the mid cingulate cortex in amyotrophic lateral sclerosis (ALS) detected in vivo with MR spectroscopy

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Background: Various lines of evidence implicate involvement beyond the motor system in ALS, including the cingulate gyrus and thalamus. The purpose of this study was to assess neurodegeneration in these regions in vivo using proton magnetic resonance spectroscopic imaging (MRSI). *Methods:* Patients with ALS and healthy controls underwent MRSI using a coronal acquisition scheme. The N-acetylaspartate to choline ratio (NAA/Cho) was quantified in the mid-cingulate cortex (MCC) and thalamus. *Results:* Fourteen patients with ALS and 14 controls were studied. NAA/Cho was reduced in the MCC in patients with ALS compared to the controls ($p=0.0004$). There was no difference in the ratio of NAA/Cho in the thalamus ($p=0.59$). We also found a strong correlation of NAA/Cho between the precentral gyrus, MCC and the thalamus in controls, which was disrupted in patients with ALS. *Conclusions:* Neurodegeneration beyond the motor cortex is present in the MCC in ALS. The significant correlation of NAA/Cho between the motor cortex, MCC, and the thalamus in healthy subjects supports the notion of neuronal connectivity between these regions. The loss of these relationships in ALS patients suggests that such connectivity does not drive the pattern of degeneration in these regions.

P-043

Supranuclear ophthalmoplegia in Powassan encephalitis

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Background: Powassan encephalitis (PE) is a rare tick-borne encephalitis. Fatality is around 15% and 66% of patients have significant neurologic sequels. Supranuclear ophthalmoplegia is unusual in an acute setting but has been reported once in PE. *Methods:* We describe herein what is, to our knowledge, the second case of PE with acute supranuclear ophthalmoplegia. *Results:* A 61 year-old man from Quebec City, Canada, presented with a 41°C fever and an acute confusional state. Physical examination revealed a rapidly progressive, almost complete ophthalmoplegia for voluntary ocular movement during the first few days of hospitalisation, with preserved oculocephalic reflex. MRI showed a mild FLAIR/T2 hypersignal at the junction between the internal capsule and the caudate nucleus on the left side. Multiple investigations including cultures and polymerase chain reactions on cerebral spinal fluid and serologies were negative. Antibodies to Powassan virus were detected in inhibition hemagglutination assay with specific antigen. Infection was confirmed at National Microbiology Laboratory by plaque reduction neutralization testing with a titer of 40 on early serum and ≥ 640 on late serum. *Conclusions:* The combination of ophthalmoplegia and preserved oculocephalic reflex is consistent with supranuclear ophthalmoplegia, which is very unusual in an acute setting and only reported to occur with Whipple disease among other infections. When confronted with a case of supranuclear ophthalmoplegia and encephalitis, it may be relevant to include PE in the differential diagnosis, particularly when the epidemiology is suggestive.

P-044

Whipple disease presenting with hypersomnia

C Xia (Montreal), M Keezer (Montreal), A Duquette (Montreal), A Lafontaine (Montreal)*

Background: Whipple disease, caused by the bacillus *Tropheryma whippelii*, is a multisystem disorder with protean manifestations such as gastrointestinal symptoms, seronegative polyarthropathy and intermittent fevers. Ophthalmoplegia, myoclonus and ataxia are commonly encountered neurological signs. *Methods:* We report a case of CNS Whipple disease with negative duodenal biopsy who presented with progressive hypersomnia. *Results:* A 45 year-old Caucasian man presented with a three-month history of daytime hypersomnia attacks, preceded by three years of segmental myoclonus of unclear etiology progressing from the upper limbs to the trunk. Further questioning and examination revealed weight loss, polyarthritis, intermittent fevers, impaired vertical gaze, dysarthria and ataxia. Oculomyorhythmia and rhythmic 2-3 Hz jerky movements of the arms and superficial abdominal muscles recorded on EMG were noted during hypersomnia episodes, with concomitant continuous EEG monitoring showing no epileptic activity. MR of the brain and C-spine were unremarkable. Duodenal biopsies failed to show evidence of Whipple disease. CSF PCR assay for *Tropheryma whippelii* was subsequently positive. Polysomnography showed a paucity of REM sleep and no evidence suggesting narcolepsy. Genetic testing for HLA antigens associated with

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narcolepsy was also negative. Clinical improvement was achieved after eight weeks of intravenous ceftriaxone followed by oral trimethoprim-sulfamethoxazole. *Conclusions:* Less than 10% of patients with Whipple disease present with neurological complaints. Even rarer is hypersomnia as the main symptom despite the well recognized potential hypothalamic involvement. Our case report highlights the importance of considering Whipple disease in the differential diagnosis of narcolepsy-like episodes.

Multiple Sclerosis

P-045

What influences patient's choice of disease-modifying medication for multiple sclerosis?

*F Moore (Montréal), H Bahig (Montréal)**

Currently approved disease-modifying medications for the treatment of multiple sclerosis (MS) are given via subcutaneous injection, intramuscular injection, or intravenous infusion. The development of new oral drugs is an active area of research, with at least four drugs currently in phase III clinical trials This is a qualitative study whose first objective is to understand how patients' choice of disease-modifying medications is influenced by factors such as efficacy, side effects, mode and frequency of administration, physician recommendations, media, and friends or family. The second objective is to ask patient's opinions on future oral medications for MS, and how their treatment choices would change if oral medications were less efficacious and/or had more side effects than existing parenteral medications. We are using qualitative descriptive methodology and are in the process of interviewing approximately 30 randomly-selected participants aged 18 to 50 with definite MS. Interviews are conducted in-person by one of the two investigators using a structured questionnaire, recorded, and transcribed. Transcripts will be analyzed using open coding to break down the data into groups of common ideas, followed by axial coding to organize emerging ideas into overarching themes. The transcripts will be separately analyzed by the two investigators and then compared to reach a consensus. The final results will be available for the CNSF meeting in June. If one or more of the oral MS medications currently in phase III trials are soon approved for use it will be extremely important to understand patients' perspectives regarding MS medications.

P-046

The adherence and disability outcomes of disease-modifying therapies in relapsing-remitting multiple sclerosis: a ten year prospective open-label study

*WJ Hader (Saskatoon)**

Background: The beneficial effects of disease-modifying therapies (DMT) in decreasing attacks in relapsing-remitting Multiple Sclerosis have been previously reported. However the results related to disability outcomes and the effects on progression of the disease in the shorter term pivotal trials are variable and inconclusive. *Objectives:* To describe adherence to an initial DMT prescription and to compare the Kurtzke expanded disability status (EDSS) at baseline and after ten years. *Methods:* A prospective open-label cohort of 262 clinical definite patients, 78 men and 184 women, with two attacks in the past two years and disability level EDSS≤ 5.5) were enrolled between 1997 and1999 and followed to 2009. A baseline questionnaire was completed, and the annual neurological assessments (EDSS) were recorded. The drug chosen was at the discretion of the patient and physician. The reasons for drug switching and discontinuation were tabulated. A descriptive analysis of the cohort and individual drugs adherence and switches were performed. *Results:* After 10 years 80/262 (30.5%) remain on the initial prescription, 137/262 (52.2%) continued a drug (including 57 switches) At baseline 232 (88.2%)) were EDSS≤ 3.5, decreasing to 75/262 (28.6%) at 10 years. 125/262 (47.7%).discontinued treatment at a median duration of 55.5 months. 53/118 (45%) who started and stopped therapy were EDSS≥4 including 38/118(32%) who progressed to EDSS≥6. The outcomes of the individual DMT'S were recorded. *Conclusions:* This data does not support a beneficial impact of the drugs on the progression of disability in Multiple Sclerosis in the longer term.

P-047

Multiple sclerosis disease-modifying therapy physician prescribing practices in Ontario in 2008

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Background: MS is a condition treated by both community neurologists and academic MS-specialists. Differences in disease-modifying therapy (DMT) prescribing patterns between different groups of neurologists have not been previously explored. *Methods:* Through a retrospective analysis of linked, anonymized Ontario databases, the demographic and geographical characteristics of Ontario neurologists will be linked to DMT prescription data obtained from the Ontario Drug Benefit (ODB) Plan for the year 2008. Lorenz curves and Gini coefficients will be constructed to examine prescribing patterns. The specific hypotheses are that: (1) the majority of DMT prescriptions are made by a minority of Ontario neurologists (MS-specialists); (2) DMTs are not equally prescribed across the province with a specific preferential trend towards Avonex prescriptions amongst all neurologists; (3) rural and non-MS specialist neurologists preferentially prescribe Avonex in contrast to a broader distribution of DMT prescriptions by specialists; (3) both older and male neurologists preferentially prescribe Avonex in contrast to a broader distribution of DMT prescriptions amongst younger and female neurologists. *Results:* Data compilation is ongoing and final results will be presented. *Conclusions:* This study will demonstrate how concentrated MS DMT prescribing is in Ontario and what specific associations exist between neurologist characteristics and patterns of DMT prescribing.

P-048

Post influenza vaccinations encephalomyelitis

A Rana (Toronto), S Naz (Toronto)*

Objective: To discuss a case of postinfluenza vaccination encephalomyelitis. *Background:* Viral influenza or flu is very common contagious respiratory illness caused by influenza A or B viruses. It is a seasonal infection associated with significant morbidity and mortality. Yearly flu vaccine decreases risk of

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respiratory infections, pneumonia, hospitalization and death especially in individuals more that 65 years old, children less than one year, pregnant females, healthcare professionals, and individuals with co-morbid conditions. The flu vaccine may cause mild systemic syndrome in some cases. In rare cases acute disseminated encephalomyelitis (ADEM) which is an inflammatory demyelinating disease of the central nervous system may be seen after the vaccination. It can develop after 3 weeks to 3 months of immunization. Herein, we present a patient diagnosed with who developed brainstem encephalomyelitis within few weeks after receiving flu vaccine. *Methods:* A 38 year old right handed female had flu vaccination and within few day she started having vomiting, dizziness, double vision, fever and myalgias. She was diagnosed as brainstem encephalomyelitis and required IV coriticosteroids. Since then she has severe weakness of all four extremities, double vision and multiple hospitalizations. She is wheelchair bound and wears diapers because of bowl and bladder incontinence. *Results:* MRI showed numerous areas of T2 hyperintensity in the periventricular white matter and middle cerebral peduncles. *Conclusion:* Acute disseminated encephalomyelitis (ADEM) is rare but an important and serious complication of flu vaccination.

P-049

Multiple sclerosis (MS) and pregnancy: a comparison study

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Background: As MS is usually diagnosed in young adults between the ages of twenty and forty, it is of no surprise that reproductive issues concern both males and females after diagnosis. MS and not-MS related factors in the decision making process are compared in two populations, with and without health insurance. *Methods:* Males aged 18 to 60 years and females aged 18 to 45 years were ascertained from the MS Clinic at Hopital Notre Dame in Montreal, Canada (297 females, 166 males) and 459 US residents (295 females; 164 males). Data were collected through standardized questionnaires. *Results:* Canadian females were diagnosed on average at age 29.0 years (SD 6.7), significantly younger than Canadian males - $z = -7.7392$, $p<0.00001$. A similar pattern was observed for the NARCOMS group ($z = -7.74837$, $p<0.00001$). *Conclusions:* MS and non-MS related reasons in the decision making process differed by gender in both study groups. However, financial concerns about medical costs were clearly more prominent for all American patients. These data strongly suggest that more prospective studies are needed and these must be controlled not only for age and gender but also for the medical system of the geographic area.

P-050

Canadian Asians with multiple sclerosis (CAMS) study: epidemiological and clinical correlates of phenotype

D Sadovnick (Vancouver), T Traboulsee (Vancouver), J Lee (Vancouver)*

Background: Two clinically distinct MS phenotypes are common in Asians: opticospinal MS (OSMS) and conventional MS (CMS). The OSMS phenotype is restricted to the optic nerves and spinal cord; CMS by dissemination of lesions at multiple central nervous system (CNS) sites. Here we characterize the epidemiology and clinical features of MS in Chinese-Canadians. *Methods:* Patients were identified from the UBC MS Clinic Database. A retrospective chart review was conducted. *Results:* 59 charts were reviewed (20 OSMS; 27 CMS). The gender ratio was 5.7:1 for OSMS cohort and 2.9:1 for CMS. The most common onset symptom among OSMS cases was visual dysfunction (50%), followed by sensory disturbance (35%), motor dysfunction (10%), and other complaints (5%). In contrast, sensory disturbance was the most common onset symptom (59%) in CMS, followed by motor problems (22%), visual disturbance (22%), and other complaints (4%). CSF oligoclonal bands were detected in 43% (3/7) and 44% (4/9) of OSMS and CMS cases, respectively. NMO-IgG seropositivity was observed in half of OSMS cases but no case of CMS. *Conclusions:* In this population, OSMS is characterized by a greater female preponderance, greater propensity to visual onset symptoms ($p = 0.01$), and greater frequency of NMO-IgG seropositivity compared to CMS.

General Neurosurgery

P-051

Unusual hyperdense posterior fossa epidermoid cyst: 2 case reports and review of the literature

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Background: Epidermoid cysts are unfrequent congenital tumors that are characteristically hypodense on head Computed Tomography (CT) scans. However, mixed density epidermoid cysts have been reported. Rarely, epidermoid cysts may appear spontaneously dense on CT images. The etiology of the hyperdense signal remains unknown. *Methods:* We report two cases of hyperdense posterior fossa epidermoid cysts. Clinical and radiological presentation, intra-operative findings as well as histopathological examinations are detailed for both cases. *Result:* For both patients, initial symptoms were related to mass effect on adjacent posterior fossa structures. Both patients underwent microsurgical resection of the epidermoid cysts with good surgical outcome. *Conclusion:* Posterior fossa hyperdense epidermoid cysts are rare. Since these lesions must be distinguished from life-threatening spontaneously hyperdense entities such as posterior fossa haemorrhages, the patient's clinical presentation is of outmost importance.

P-052

Evan's ratio evaluated

*Sa Almenawer (Hamilton)**

Measuring the ventricular size is an important tool especially in evaluating patients with signs and symptoms of hydrocephalus. While volumetric techniques are more accurate estimate of true ventricular volume, they are often impracticable for quick assessment. Evan's ratio is one of the common ways to assess the ventricular size as a linear measurment (the ratio of the transverse diameter of anterior horns of the lateral ventricles to the internal diameter of the skull). In this study we have examined 500 normal

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head CT scans to evaluate Evan's ratio. We found that the ratio above 0.3 can't be used as an indicative of ventricular dilatation (as it was used by Evan's) since the ventricular size change normally with age.

P-053

Misplaced extraventricular drains (EVD): reasons and consequences

AO Alobaid (Hamilton), D Jichici (Hamilton), A Yarascavitch (Hamilton), B Lo (Hamilton), P Klurfan (Hamilton), K Reddy (Hamilton)*

Objective: To study the safety and accuracy of EVDs. *Methods:* chart review from November 2006 to June 2008, at Hamilton General Hospital. Variables: demographics, etiology requiring EDV, level of training, accuracy of placement by CT scan, infection, hemorrhagic rates post EVD. Outcome variables: ICU and hospital LOS, days on ventilator, Glasgow outcome scale (GOS), Rankin Score (RS), disposition. Accuracy of EVD placement was graded in 3 groups: perfectly placed (Grade1), incorrect placement but in non-eloquent area (Grade2), incorrect placement in eloquent brain tissue (Grade3). We used Fisher Exact and Chi-Square tests. *Results:* We collected 162 patients. 42 patients were excluded. 52 males, 63 females, mean age 51.6 (14-79), mean GCS 7.84 (3-15). Etiology: trauma 34, intracerebral hemorrhage 19, intraventricular hemorrhage 25 subarachnoid hemorrhage 52 and 15 other diagnosis. EDV Placement post CT: 60 Grade 1, 33 Grade 2, and 23 Grade 3. Rates of suboptimal placements were highest in patients with midline shift (P=0.05) and trauma (P=0.01). Resident's training experience did not affect the accuracy of EVD placement. Accuracy of EVD insertion did not reach statistical significance regarding ICU/hospital LOS, patient outcomes (GOS, RS), and final disposition. *Conclusion:* Misplaced EDV was not associated with worse outcome in this study.

P-054

Minimally invasive tubular access for the resection of spinal and intracranial neoplasms

*WA Alsunbul (Hamilton)**

The trend of using smaller operative corridors is seen in various surgical specialties. With the new era of surgical microscope, Neurosurgery has also embraced minimal access technique to approach spine and intracranial pathology, and it has rapidly evolved over the past couple of years. Recently, new muscle-sparing technology, METRx, has come into use with tubular access. A retrospective chart review of 250 patients who had undergone METRx approach for multiple spine and intra-cranial pathologies was performed. Data on Patient demographic characteristics and operative results, including length of stay and surgical complications were collected. Of our 250 patients, we are presenting our primary report of 28 and 11 Patients, who underwent resection of spinal and intracranial neoplasms respectively.

P-055

Craniotomy and direct catheterization for Onyx embolization of an inoperable arteriovenous malformation

MR Boulton (London), DA Steven (London), D Pelz (London), S Lownie (London)*

Background: Treatment of large eloquent arteriovenous malformations (AVMs) is limited. We report an effective and infrequent treatment method that should be considered for these challenging situations. *Method:* A young man experienced medically refractory seizures and progressive left hemiparesis. Investigations revealed a large AVM that appeared centred about the right Rolandic sulcus. Initial attempts at endovascular embolization were not successful due to inability to distally cannulate the intended feeding artery. Awake craniotomy with cortical mapping was subsequently performed, which confirmed the Rolandic location. The main feeding artery was identified at the margin of the craniotomy and directly catheterized with a microcatheter. Intraoperative angiographic views revealed exclusive supply to the AVM. Embolization with Onyx provided excellent nidus penetration without venous compromise. Usual concerns of reflux resulting in inadvertent cortical embolization, or inability to remove the catheter were not pertinent in this case because of direct catheterization at the surgical site. *Results and Conclusion:* Intraoperative angiography afforded direct catheterization of an otherwise inaccessible feeding artery. Usual concerns with embolization were minimized with this technique. The incomplete obliteration did not result in a new neurological deficit, and future embolizations are planned

P-056

A Canadian case of a newly-characterized coronal synostosis syndrome (Muenke syndrome): the value of genetic testing versus clinical determination of diagnosis

A Ranger (London), N Chaudhary (London), J Rau (London), D Matic (London), S Goober (London), I Makar (London), V Siu (London)*

Background: Muenke's syndrome is a form of fibroblast growth factor receptor 3 (FGFR3)-associated coronal craniosynostosis, with or without impaired cognitive function. *Case:* We report the case of a girl who was born to a 29-year old primapara at 38 weeks of gestation. At 3½ days old, her facial features included a high forehead, beaked nose, shallow mid-face structures, and heavily-ridged coronal sutures bilaterally. All other sutures appeared normal, and the baby seemed neurologically normal. Skull radiographs and computed tomography (CT) confirmed the presence of bilateral coronal synostosis. Genetic testing revealed a mutation in the fibroblast growth factor receptor gene 3 (FGFR3), with a change from cysteine to guanine at position 749, resulting in an amino acid change from proline to arginine at codon 250. Her father was later identified to have this same genetic mutation and a slightly flatter than normal face, and the father's mother and first maternal cousin were reported to have facial abnormalities as well. At 9 months old, the patient underwent anterior cranial expansion, craniotomies for facial repair, correction of orbital hypertelorism, intracranial orbital osteotomies, and advancement of the frontal bandeau. *Conclusions:* We report a patient with features consistent with the recently described Muenke syndrome, with a positive family history in at least her father, and possibly two additional paternal relatives.

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Despite her phenotypic appearance, genetic testing was necessary to make the correct diagnosis in our patient. The pertinent literature, in which only two prior Canadian cases were identified, is reviewed.

P-057

The rare complication of bowel perforation within 29 hours of a ventriculoperitoneal shunt insertion

N Chaudhary (London), A Ranger (London)*

Introduction: We present a rare case of bowel perforation within 29 hours of a ventriculoperitoneal (VP) shunt insertion. *Case Presentation:* Our patient is a 2 month old infant who was born with holoprosencephaly, initially detected on prenatal ultrasound. The decision to insert a VP shunt was made after his head circumference increased from 39 to 46 cm in the matter of 7 weeks, and this was corroborated with increased ventricle size on ultrasound. Twenty nine hours following VP shunt insertion, catheter tubing was noted in the infant's diaper. During urgent mini-laparotomy, the sigmoid colon was found to be adherent to the undersurface of the right upper quadrant incision. The sigmoid colon was repaired, the shunt was removed, and an external ventricular drain was placed. Initial CSF cultures revealed *Enterobacter cloacae* and *Enterococcus faecalis*, and the infant was started on Meropenem and Vancomycin. The next 3 cerebrospinal fluid (CSF) samples were negative, and a VP shunt was re-inserted. *Discussion:* Over 60 cases of bowel perforation following a VP shunt have been documented in the literature, most of which have occurred months to years following shunt insertion. To the best of our knowledge, this is the first case to present within 48 hours of shunt insertion. It is likely that the peritoneal end of the shunt was inserted directly into the sigmoid colon at the time of initial placement, given the sigmoid adhesion.

P-058

Atypical presentations of spontaneous intracranial hypotension: case series

N Chaudhary (London), N Duggal (London), P Cooper (London), SP Lownie (London)*

Introduction: Spontaneous intracranial hypotension (SIH) is an increasingly described entity, classically presenting with the triad of orthostatic headache, diffuse pachymeningeal enhancement on magnetic resonance imaging (MRI) with gadolinium, and low cerebrospinal fluid (CSF) in the lateral decubitus position. We present a case series of four rare clinical presentations of SIH. *Case Presentations:* Our first patient is a 60 year old gentleman who presented with a complex partial seizure. Additional findings prior to the seizure included bilateral ptosis, diplopia, and profound dyspnea. Lumbar puncture revealed an opening pressure (OP) of 40 mm Hg. Our second patient is a 42 year old gentleman who presented with a headache, which was exacerbated with the Valsalva maneuver and in the supine position. The only potential antecendent event included chiropractic manipulation. Our third patient is a 54 year old gentleman who presented with an orthostatic headache and bilateral subdural hemorrhage (SDH), three weeks following an episode of violent sneezing. Our fourth patient, a 37 year old gentleman presented with a unilateral SDH requiring multiple subdural evacuation surgeries for reaccumulation. CT myelography suggested a potential spinal dura leak in three of our patients. *Discussion:* We report patients with SIH that manifested as seizures, paradoxical pattern of headache, and a recurrent unilateral SDH, not previously described in the literature, to the best of our knowledge. A fourth patient presented with bilateral SDH, a rarely described manifestation. In keeping with a diagnosis of SIH, all patients met MRI imaging criteria for SIH and responded to blood patches or saline injections.

P-059

Streptococcus anginosus subdural empyema secondary to otitis media: case report

N Chaudhary (London), S deRibaupierre (London), A Ranger (London)*

Introduction: Subdural empyemas (SDE) represent 13-23% of all intracranial infections. Predisposing factors most commonly include sinusitis, otitis media and mastoiditis. We present a case of a subdural and parafalcine empyema secondary to mastoiditis with cultures positive for *Streptococcus anginosus*. We also reviewed all the *Streptococcus anginosus* related central nervous system infections at our institution, over a 10 year period; and we performed a literature review. *Case report:* Our patient is a 10 year old boy who presented with a headache, nuchal rigidity and vomiting in the context of a recently treated otitis externa. He was drowsy, febrile, had decreased bilateral lateral gaze, a right superior quadranopsia and positive Brudzinsky and Kernig's signs. Magnetic resonance imaging (MRI) revealed an extensive supratentorial subdural and parafalcine empyema, with associated mastoiditis. A temporo-parietal craniotomy with a mastoidectomy was performed to evacuate the empyema. Cerebrospinal fluid (CSF) cultures returned positive for *S anginosus*, and our patient was treated with Meropenem. *Discussion:* Although CNS infection with *Streptococcus anginosis* is not uncommon, it is rare to have a SDE secondary to an otitis externa with mastoiditis due to the same bacterium. Early recognition and prompt surgical drainage coupled with antibiotics is essential to circumventing the morbidity and mortality associated with SDE.

P-060

Rapid reversal of a severe acute subdural hemorrhage in a patient with myelodysplastic syndrome – spontaneous resorption or secondary to hemostasis correction?

N Chaudhary (London), A Leung (London), E Small (London), C Hsia (London)*

Introduction: Acute subdural hematoma (SDH) is associated with a 60-80% mortality rate and is considered a neurosurgical emergency. We present an unexpected case of significant SDH reversal within 48 hours of human prothrombin complex (HPC) and platelet administration in a patient with myelodysplastic syndrome (MDS). *Case Presentation:* Our patient is a 73 year old gentleman who had an acute onset of left-sided weakness, but he was alert and oriented. His platelets were 17 and INR was 1.6. Computed tomography (CT) demonstrated a large acute right sided SDH. Five hours later, his level of consciousness deteriorated, necessitating intubation. A follow-up CT demonstrated dramatic enlargement of the SDH with significant mass effect, including midline shift and uncal herniation. Given his acute deterioration, HPC and platelets were ordered in

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anticipation of emergent surgical evacuation. However, the patient's family opted for comfort measures because of his extensive comorbidities. A follow-up CT demonstrated an unexpected significant resolution of the SDH. Although our patient continued to improve neurologically to the point of obeying simple commands over the next 2 weeks, he unfortunately succumbed to an aspiration pneumonia 23 days following admission. *Conclusion:* To the best of our knowledge, our case is the first in the literature to document significant reversal of a large acute SDH following the administration of HPC and platelets, in a patient with an underlying hematalogic disorder. Furthermore, this is the only documented case of clinical improvement following progressive SDH causing tentorial herniation resulting in an infarct.

P-061

Case report: spontaneous cervical spine cerebrospinal fluid leak

S Gul (Vancouver), K Chapman (Vancouver), M Heran (Vancouver), R Sahjpaul (Vancouver)*

Clinical presentation: We report a 34 year-old male, who developed spontaneous and gradual onset neck pain and stiffness, headache, nausea and vomitting. His headache eventually became postural in nature that was worse in the upright position. On examination, the patient was alert and fully oriented. He demonstrated mild meningismus without neurologic deficit in the upper or lower extremities. *Investigations:* The cerebrospinal fluid lumbar puncture revealed a slightly elevated protein and glucose, and was unremarkable for subarachnoid hemorrhage or infection. The CT head/neck angiogram demonstrated no relevant abnormality. The MR head scan demonstrated smooth dural enhancement of the intracranial dura. The CT and MR cervical spine studies demonstrated a non-enhancing collection ventral to the spinal cord with mild associated mass effect. This collection extended from C2-C3 to T2, and appeared to be extradural. On the basis of the CT and MR imaging modalities, the differential diagnosis for the fluid collection included cerebrospinal fluid amongst other considerations. The CT cervical spine scan demonstrated a focus of calcification along the posterior midline aspect of the C7-T1 disc. *Intervention:* The patient received a fluoroscopic guided cervical epidural blood patch at C7-T1, and this provided him with immediate symptomatic improvement that has persisted. Subsequent images have also demonstrated a reduction in the size of the extradural collection. *Conclusion:* A spontaneous cervical spine cerebrospinal fluid leak may resolve without surgical intervention. An epidural blood patch, ideally targetted in the vicinity of the leak, may provide a non-surgical method for management in selected cases with associated resolution of symptoms and imaging findings.

P-062

Fibro-osseous pseudotumor – case report and review of literature

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Background: Fibro-osseous lesions are an exceedingly rare clinical entity. We present the case of a 65 year old female with infrequent partial seizures. Electroencephalography revealed Grade I dysrythmia of the right hemisphere and an MRI revealed a calcified lesion in the right precentral frontal lobe. The patient underwent surgical resection and histopathology revealed a fibro-osseous pseudotumour. No further therapy was required and the patient is symptom free one year post-operatively. *Methods:* A review of all existing cases of fibro-osseous lesions was undertaken. The clinical and radiographic characteristics, histopathology, management and outcome of each case were evaluated. The suspected pathophysiology of these lesions is also discussed. *Results:* Only 44 cases (28 intracranial, 16 spinal) have been reported to date. The majority occur in adults over 40, with a slight male predominance. Neurological symptoms result from local mass effect, however seizures are also frequently observed. Imaging demonstrates central calcification with variable contrast enhancement. Histopathologically, a variably calcified chondromyxoid matrix with surrounding gliosis and without mitoses or cellular atypia is characteristic, suggesting a reactive origin to the lesion. In all reported cases, surgical excision is curative with only one reported case of recurrance. No further treatment is required, although routine surveillance may be of benefit. *Conclusion:* Although uncommon, awareness of this entity and its inclusion in the differential diagnosis of long-standing calcified lesions along the craniospinal axis has practical importance in preventing unnecessarily aggressive investigation and treatment.

P-063

Chondroblastoma of the temporal bone: case report and review of the literature

LP Hnenny (Saskatoon), DR Fourney (Saskatoon)*

Chondroblastoma is a rare, benign, bony tumor that most commonly arises from the epiphyses of long bones in young males. Chondroblastoma arising from the temporal bone is exceptionally rare, with approximately 50 cases reported in the literature. We present the case of a 51 year-old female who was referred to our institution by an otolaryngologist following a one and a half year history of unilateral hearing loss. Imaging revealed a left temporal bone lesion. She underwent stereotactic biopsy, and the pathology revealed chondroblastoma. She subsequently underwent gross total resection of the lesion, and has been free from recurrence for two and a half years. Also presented is a review of the literature with regards to the diagnosis, treatment, and prognosis of this rare condition.

P-064

Rosette-forming glioneuronal tumor of the fourth ventricle presenting in the lateral ventricle: case report

RR Janicki (Vancouver), A Singhal (Vancouver), G Hendson (Vancouver)*

Background: Rosette-forming glioneuronal tumor of the fourth ventricle (RGNTFV) is a rare tumor, added to the WHO nomenclature in 2007. By definition the tumors are confined to the vicinity of the fourth ventricle. Approximately 30 cases have been reported. We report a case of RGNTFV presenting in lateral ventricle discovered incidentally in a healthy 16-year-old male. To our knowledge this is the first described RGNTFV occurring in the lateral ventricle. *Methods:* This patient underwent an MRI to investigate unilateral sensory neural hearing loss. A non-enhancing lesion arising from the subependymal area of the frontal horn was identified. Neurological and fundoscopic exam were normal apart

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from mild unilateral hearing loss. *Results:* The patient underwent an endoscopic biopsy. Pathological findings were consistent with RFGNTFV. Given the asymptomatic nature, deep location, and WHO grade I status observation with serial imaging was offered. *Conclusion:* As suggested by the name of the tumor, these are described as solely occurring in the fourth ventricular region. However, this case demonstrates an identical pathology occurring in the lateral ventricle. Given this case, and other recent reports suggesting similar pathology elsewhere, the nomenclature might need revision to encompass other possible origins in the CNS.

P-065

An endoscopic endonasal classification of the internal carotid artery segments: anatomical borders and surgical landmarks

M Labib (London), D Prevedello (Pittsburgh)*

Background: The internal carotid artery (ICA) is at risk of injury during all endoscopic endonasal approaches (EEA)s. An endoscopic classification of the ICA is necessary for understanding its anatomy from a ventral perspective. *Methods:* Five cadaveric specimens were prepared for endoscopic dissections. *Results:* Six segments are proposed: parapharyngeal; from the bifurcation to the orifice of the ICA canal, petrous; from the entrance to the petrous bone to sphenoid lingual process, paraclival; from foramen lacerum to the sellar floor level, parasellar; from the floor of the sella to the proximal dural ring, paraclinoid; from the proximal to the distal ring, and intradural; distal to the distal ring. The landmarks are: the Eustachian tube and Rosenmuller's fossa for the parapharyngeal segment, the vidian nerve for the petrous segment, the basopharyngeal fascia for the paraclival segment, the sellar floor for the parasellar segment, and the lateral and medial opticocarotid recess (L- and M-OCR), for the paraclinoid segment. While endoscopic approaches to Meckle's cave are safely directed lateral to the paraclival ICA, approaches lateral to the parasellar ICA can injure the cavernous sinus nerves. *Conclusion:* This is the first complete endoscopic classification of the ICA segments from a ventral perspective based on surgical criteria.

P-066

A case of ventriculoperitoneal shunt silicone allergy

BW Lo (Hamilton), F Saunders (Kingston), P Ellis (Kingston), R Pokrupa (Kingston), J Rossiter (Kingston)*

Background: Silicone shunt tubing allergy is a rare complication. Its diagnosis is one of exclusion, after ruling out infection and obstruction. A delayed hypersensitivity response may occur after re-exposure to shunt antigen. *Case Report:* We report a case of a 19-year-old right handed male who presented to the Kingston General Hospital with traumatic cerebellar hematoma requiring decompressive posterior fossa craniectomy and evacuation. Subsequently, he developed communicating hydrocephalus for which he needed CSF diversion. After placement of silicone-based shunt, he developed multiple shunt obstructions within a period of 2 months, with revisions of both lateral and fourth ventricular shunts. He developed CSF eosinophilia, meanwhile his MRI revealed marked ventricular and surgical site debris. Debridement tissue revealed exuberant foreign body-type giant cell response in association with densely collagenized scar-like tissue. CSF remained clear of infections. After placement of silicone-extracted shunt, the patient's clinical status gradually improved, with no further clinical or radiological evidence of blockages at 3 month follow-up. *Discussion:* The appearance of eosinophils in the patient's CSF signifies increased likelihood of malfunction secondary to infections, obstructions, and shunt allergy. In this case, it is a marker for the patient's hypersensitivity response to his shunt material. Silicone-extracted shunts avoid hydrophobic interactions between catheters and surrounding tissues.

P-067

Apoplectiform onset of peri-meningioma intracerebral hemorrhage: a discussion on possible mechanisms

BW Lo (Hamilton), R Pokrupa (Kingston), P Ellis (Kingston), F Saunders (Kingston), S Ludwin (Kingston)*

Background: Spontaneous intracranial hemorrhage is an uncommon phenomenon in meningiomas, with an incidence of approximately 1.3% of all meningiomas. An apoplectiform onset of peritumoral hemorrhage may clinically mimic a cerebrovascular accident. We present a case and discuss possible mechanisms of hemorrhage. *Case Report:* A 59-year-old right handed female presented to the Kingston General Hospital with rapid onset of left hemiparesis, associated with cortical sensory changes. Her MRI revealed a 2 cm dural based mass overlying the right precentral gyrus, with associated subjacent hematoma. Complete resection of parasagittal tumour was achieved, with evacuation of hematoma via a right frontal craniotomy. Pathology revealed an atypical meningioma with both fibrous and syncytial features, Ki67 index of 25%, but no areas of brain invasion. At 3 month follow-up, the patient demonstrated gradual improvement of left hemiparesis with persistence of left foot dystonia. *Discussion:* Overall mortality rate with hemorrhagic meningiomas approaches 20%. The clinician should rule out concurrent cerebrovascular insufficiency, vascular malformations, venous thrombosis, hypertensive apoplexy, hematogenous malignancy, blood dyscrasias, anticoagulation use and trauma. Pathological mechanisms for such hemorrhage include: (1) weakening of peritumoural vasculature with tumour involvement, (2) enlargement of feeding arteries and stretching of subdural bridging veins, (3) intratumoural necrosis from rapid growth, endothelial proliferation and vascular occlusion, and (4) intratumoural infarction with resultant coagulopathy.

P-068

Acute paraplegia due to intramedullary arachnoid cyst

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Background: Spinal arachnoid cysts are uncommon lesions and the intramedullary location is extremely rare. We present an adult patient with a rapid onset of paraplegia due to intramedullary cyst. *Method:* A 45 year old male presented about five months ago with complaints of a tingling sensation in both feet progressing over a two month period to the legs, abdomen and mid chest region. There was no evidence of any neurological deficit. He was booked for an elective MRI to rule out demyelating disease. Two weeks prior he had complained of severe pain of the posterior upper thoracic region followed over a period of 15 hours of complete paraplegia with sensory level and urinary retention. MRI revealed an intramedullary

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cystic lesion, compatible with arachnoid cyst. Drainage of the cyst resulted in a quick recovery of his paraplegia. *Conclusion:* Intramedullary arachnoid cysts are extremely rare. There are a handful of cases reported. The concept of acute paraplegia is discussed together with review of the literature regarding spinal arachnoid cysts in general and intramedullary variety in particular.

P-069

Intracerebral dermoid cyst removal through a transtuberculum/ transplanum endoscopic approach

N McLaughlin (Santa Monica), M Laroche (Montreal), F Lavigne (Montreal), MW Bojanowski (Montreal)*

Background: Dermoid cysts are uncommon benign lesions that rarely occur within the brain parenchyma. Their removal through a craniotomy most often requires some normal brain tissue retraction and manipulation. Recently, the use of endoscopic endonasal surgery for deeply seated lesions has gained popularity. The expanded endonasal approaches, such as the transtuberculum\ transplanum, have rendered possible the safe removal of frontobasal lesions. *Methods:* We describe such a case and present intraoperative findings. *Results:* A 42 yr-old male presented with recent headaches. Imaging was suggestive of an intracerebral frontobasal dermoid cyst. This lesion was completely removed through a transtuberculum/transplanum approach using the double suction technique and gentle grasping forceps. Progressively, the endoscope could be entered within the tumor cavity to pursue resection under direct visualization, taking care to preserve the underlying neurovascular structures. The skull base defect was reconstructed using a multilayer closure. The patient had a favorable post-operative course besides a short episode of chemical meningitis. Complete tumor resection was confirmed on imaging. *Conclusion:* The expanded endonasal approach for intracerebral frontobasal lesions enables maximal preservation of brain parenchyma integrity. This technique offers an excellent panoramic and dynamic visualization during exposure, tumor removal and attentive intraoperative assessment of the resection cavity.

P-070

Endoscopic endonasal transsphenoidal approach to cholesterol granuloma of the petrous apex: case report and review of the literature

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Background: Cholesterol granulomas (CG) of the petrous apex (PA) are uncommon lesions. In symptomatic cases, cyst drainage and creation of an aerated cavity has been performed via numerous transcranial approaches. Overall, recurrences have been reported in up to 60% of cases. The endoscopic transsphenoidal approach (TSA) is a direct route that enables safe treatment of lesions that specifically abut, protrude or invade the sphenoid sinus (SS). *Method:* Case report and review of the literature *Results:* A 19 yr-old woman presented with a subacute headache and VIth nerve palsy. Imaging showed a right PA mass suggestive of a CG, abutting the posterior wall of the SS. Through an extended endoscopic TSA, the cyst was drained and symptoms completely resolved post-operatively. However, recurrence 4 months after initial surgery mandated a redo-transsphenoidal and transpetrous approach with resolution of symptoms and uncomplicated post-operative course. Twelve other cases of PA CG that abut, protrude or invade the SS have been treated through an endoscopic TSA, with 2 recurrences (16%) and no complications following redo-surgeries. *Conclusion:* Petrous apex CG that abut, protrude or invade the SS can be safely treated by the TSA. Recurrence rates are lower than that generally reported and redo-surgeries may be less morbid than redo-transcranial approaches.

P-071

Intrathecal baclofen pump treatment for cerebral palsy: a case of post-operative respiratory depression

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Intrathecal baclofen pumps are increasingly being used to manage spasticity in children with cerebral palsy (CP), avoiding the debilitating side effects of high dose oral baclofen. Complications are rare but well characterized, and include urinary retention, infection, CSF leaks, catheter fracture or migration, and pump malfunction. The latter may lead to baclofen overdose or withdrawal. Respiratory depression has been reported in cases of oral baclofen overdose, but is usually associated with stupor. Here, we report the case of a 16 year old female with CP who experienced significant respiratory depression about 12 hours following pump insertion, at a dose of one half (1/2) the usual minimal dose. Despite a respiratory rate of 2-3 breaths/min, she was rousable and hemodynamically stable. Her pump setting was lowered to ¼ the minimum dose and her respiratory rate improved slowly over the following 48 hours. The dose was gradually increased without further respiratory depression. As ITB therapy becomes more widely used, previously unrecognized complications may arise, some relating to baclofen dosing. As indicated by our experience, patients may require post-op observation to ensure management of sub-acute complications and to discover an optimal pump rate.

P-072

Augmentation of routine craniotomy with titanium and methylmethacrylate for improved cosmesis in individuals with alopecia

C Pinkoski (London), MR Boulton (London)*

Background: Routine craniotomy techniques suffice for individuals with normal hair density, or for individuals not overly concerned about cosmesis. We report a technique that uses readily available materials to greatly improve the long-term cosmetic result in cosmetically sensitive individuals with alopecia. *Methods:* A middle aged gentleman underwent a frontal parasagittal craniotomy for third ventricular tumour removal. Titanium mesh and burrhole covers were used at initial operation. The patient returned with a spicule of mesh protruding through his atrophic scalp necessitating revision of his craniotomy. The patient was also dissatisfied with the profile of the screws used to attach the burrhole covers, and the scalp retraction present along the margins of the craniotomy. At revision, the mesh and burrhole covers were removed and scar tissue dissected from the regions of concern. The screws were reinserted as radially oriented posts within the burrholes, and methylmethacrylate used to fill the defect. Small troughs were drilled in perpendicular orientation across the craniotomy margin at regular intervals. Small

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single titanium plates were countersunk and screwed into place within these troughs. Methylmethacrylate was then poured into the marginal defect to fully encompass the countersunk plates. The methylmethacrylate was then drilled flush with the contour of the outer skull table. No titanium or screws protruded from this profile. Results and Conclusion: A fully normal profile was restored to the craniotomy defect in a mechanically sound manner. No methylmethacrylate could be pried from the margin of the craniotomy. Long term cosmetic results are pending.

P-073

Spontaneous resolution of Chiari malformation

JA Pugh (Edmonton), I Ho (Edmonton), V Mehta (Edmonton)*

Type 1 Chiari Malformation is the descent of the cerebellar tonsils below the foramen magnum. 120 years after the first description of idiopathic tonsillar herniation, debate continues as to the significance of cerebellar ectopia and its impact on cerebrospinal fluid (CSF) dynamics. The clinical presentation is extremely variable, and the majority of patients remain asymptomatic. The natural history of this finding remains uncertain.

We present the case of a 4 year old girl with benign occipital lobe epilepsy, poor coordination, hiccups, and snoring. She did not complain of headaches. She had a normal neurologic examination, and no scoliosis. An MRI completed for evaluation of epilepsy demonstrated cerebellar ectopia of 12-13 mm. A Cine-MRI demonstrated dynamic CSF flow across the foramen magnum.

Due to a fluctuating clinical history, the decision was made to closely follow the patient without surgical intervention for the past three years. The patient has developed well and continues to have a normal neurologic examination. Follow-up imaging demonstrates cerebellar ectopia of only 3 mm, a near complete spontaneous resolution of her type 1 Chiari Malformation. The medical and surgical management of patients with type 1 Chiari Malformation remains variable due to our poor understanding of the natural history. This is the first report of spontaneous resolution of a significant Chiari Malformation.

P-074

Distraction osteogenesis for expansion cranioplasty in symptomatic craniostenosis

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Background: Distraction osteogenesis is used commonly in the axial skeleton, midface and mandible to overcome growth deficiencies. The lengthening exceeds that which could be achieved in a single or series of operations. In symptomatic craniostenosis, cranial vault expansion is traditionally performed as a single or staged operation. We present two children diagnosed with symptomatic craniostenosis, who were treated successfully with distraction osteogenesis. *Methods:* The first child was originally subjected to multiple operations in an attempt to achieve a satisfactory intracranial volume. Unfortunately, each procedure achieved limited volume expansion and was followed by rapid re-ossification and cessation of growth in head circumference. Initial volume expansion using resorbable poly-L-lactic-polyglycolic distractors was unsuccessful because of device failure. A second attempt using custom devices was successful in achieving the goal head circumference. Following this experience, a second infant was treated successfully using standard titanium distractor components. There were no infectious complications. *Results:* In these patients, distraction osteogenesis resulted in intracranial expansion exceeding that which could be achieved using standard techniques. *Conclusions:* Distraction osteogenesis is an effective management option for cranial vault expansion in children with symptomatic craniostenosis.

P-075

A rare presentation in an unusual location: supratentorial hemorrhagic hemangioblastoma

RW Ryan (Edmonton), L Resch (Edmonton), JM Findlay (Edmonton)*

Background: Hemangioblastomas are benign, vascular tumors of the central nervous system that rarely present with hemorrhage and are uncommonly found above the tentorium. *Case description:* We describe a 31 year old man who presented with headaches and recurrent spontaneous right frontal intracerebral bleeding from what was eventually diagnosed as a hemangioblastoma. Initial investigation following the primary hemorrhage, and including catheter angiography, failed to detect the source of the frontal hematoma, and the patient was discharged home without intervention after improving clinically. He represented 5 weeks later after suffering a recurrent hemorrhage in the same location, and angiography on this occasion revealed what was felt to be a small dural arteriovenous fistula supplied by ethmoidal artery branches. At the time of surgery the patient's clot was evacuated as well as some surrounding parenchyma and sent for pathological evaluation. Histology and immunohistochemistry were consistent with an underlying transitional hemangioblastoma. The patient made a good recovery, and follow-up magnetic resonance imaging was unremarkable. *Conclusion:* While rare, hemangioblastoma should still be considered in the differential diagnosis of spontaneous intracerebral hemorrhage. The angiographic appearance can be subtle and resemble a vascular malformation, and the diagnosis might only be made pathologically.

P-076

Edward Archibald: a Canadian surgeon's role in the professionalization of neurosurgery

RW Ryan (Edmonton), W Feindel (Montreal), R Patterson (New York), MC Preul (Phoenix)*

Background: Edward Archibald (1872-1945) was a landmark figure and pioneer in many fields of surgery, including general surgery, thoracic surgery and neurosurgery. This historical paper explores his entry into the latter field, his numerous contributions to its early development, including his role as a founding member of the Society of Neurosurgeons, and culminates with his recruitment of Penfield to Montreal and the establishment of the Montreal Neurological Institute. *Historical Information:* As a junior surgeon at the Royal Victoria Hospital, Archibald was assigned a majority of the neurological cases. Accepting this challenge, he pursued further training in the area with Horsley, applied the scientific approach he had learned from von Miculicz in Breslau and compiled careful

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records of all his cases. This lead to his publication of a landmark monograph on the subject in 1908, the same year as major works from Cushing and Krause, and established him as a leader in the field. As neurosurgery became a specialty distinct from general surgery, Cushing moved to form a society to establish the field, and Archibald was invited as a founding member. In the face of mounting demands on his time, Archibald looked for a way to establish a legacy of academic neuroscience in Montreal under a new leader with outside resources, and worked to bring Penfield and the MNI to Montreal. *Conclusions:* While a generalist, Edward Archibald played a fundamental role in distinguishing the specialty of neurosurgery and was Canada's first neurosurgical expert.

P-077

Endoscopic endonasal resection of the odontoid process for basilar invagination in Chiari type I malformation

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Introduction: The expanded endonasal approach of the cranio-cervical junction provides comfortable working space while avoiding some of the disadvantages of the trans-oral route. We report the purely endonasal endoscopic resection of the odontoid process for basilar invagination in a patient with a Chiari type I malformation. *Case Report:* A 54 year old female presented with cranial nerve and brainstem deficits. CT and MRI showed a Chiari type I malformation and compression of the medulla by basilar invagination of the odontoid process. The tip of the latter was displaced up to the bulbo-pontine sulcus. The odontoid process was resected via the expanded endoscopic endonasal approach, without additional posterior decompression or fusion. The post-operative course was uneventful, including the absence of velo-pharyngeal insufficiency. At 5 month follow up, neurological examination showed regression of the deficits and the patient was functional at home. The pre-operative cervical pain virtually disappeared. Post-operative dynamic radiography and CT showed painless minimal mobility at the cranio-cervical junction. *Conclusion:* Decompression of the bulbomedullary junction by purely endoscopic trans-nasal resection of the odontoid process is well tolerated and efficient. Immediate stabilization is not mandatory in certain cases of congenital causes of basilar invagination.

P-078

Clinical impact of myelodysplasia (MD) and myeloproliferative disorders (MPD) in patients undergoing neurosurgical procedures

AH Wong (Liverpool), K Saeed (Liverpool), MK Lee (Liverpool), T Pigott (Liverpool), M Javadpour (Liverpool)*

Objective: This study examined the clinical impacts of myelodysplasia and MPD in patients who had undergone neurosurgical operations. *Methods:* Retrospective study of 11 patients (8 with MD and 3 with MPD) who underwent neurosurgical procedures over the last 8 years. Medical records were examined with particular attention to indications for surgery, preoperative haematological parameters and postoperative complications. *Results:* From Dec 2001 to Nov 2009, eleven patients (8 MD, 3 MPD; 7 male, 4 female) with median age 71 (range 62-90) years underwent neurosurgical procedures. Indications for surgery included 6 chronic subdural haematomas, 1 acute subdural haematoma, 1 drainage of brain abscess, 1 expanding cystic vestibular schwannoma, 1 lumbar laminectomy and 1 excision of thoracic spine meningioma. Median (range) of preoperative haemoglobin, platelets and white cell count were 9.8 (6.3-18.2)g/dL, 92.5 (30-314)109/L, 6.9 (2.1-59.0)109/L, respectively. 3 patients returned to the operating theatre for complications relating to haemorrhage. Mean of packed red cells and platelet transfusion was 4.2 (0-13) and 7.7 (0-57) units, respectively. In-hospital mortality rate was 27.3 % (2 related to haemorrhage and 1 related to sepsis). Median hospital stay was 6 (4-71) days. *Conclusions:* MD and MPD have significant impact on postoperative complications and mortality following neurosurgical procedures. Non-surgical management options should be considered in these patients. If surgery is performed, adequate preoperative counselling of patients and relatives is important. Close monitoring of haematological parameters as well as clinical condition can not be overemphasised.

P-079

Intraventricular cystic mature teratoma in adults: case series

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Introduction: Teratomas are rare lesions, accounting for 0.5% of intracranial tumors. They usually occur during infancy and childhood and are typically midline tumors located in the pineal and suprasellar regions. Their occurrence in adults and their location in the ventricles are quite exceptional. *Methods:* We report a series of 3 adult patients, 1 male and 2 females aged 31 to 57 years, with symptomatic intraventricular mature teratomas. Tumor location was in the lateral ventricles in 2 patients and in the fourth ventricle in 1 patient. The lesion was predominantly cystic in all 3 cases with a smaller solid component. *Results:* All 3 lesions were surgically treated: gross total resection was achieved in 1 patient, while partial resection with cyst drainage and marsupialization were performed in 2 cases. None of the patients received adjuvant therapy. After a 1 to 8-year follow-up, none of the patients exhibited progression or recurrence of the tumor or regrowth of the cyst. *Conclusion:* The surgical management of intracranial teratomas may be challenging if the tumor is adherent to surrounding structures. When possible, gross total resection is the ultimate goal. However, partial resection with cyst drainage may offer an alternative in difficult cases. Long-term follow-up is mandatory in these cases to rule out tumor progression and/or cyst regrowth.

P-080

Growing "gauzoma" (gauze induced granuloma) following wrapping of an aneurysm

HA Engelbrecht (St. John's), FB Maroun (St. John's), GP Murray (St. John's), N Hache (St. John's)

Background: The consequences of rupture of an insecurely obliterated aneurysm have encouraged surgeons to use every means at their disposal to secure the fundus. One popular strategy consists of cutting a piece of gauze sponge into small fragments and then applying a thin layer to cover either the neck alone or both the neck and fundus of the aneurysm after clipping. Incompletely and even

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adequately clipped berry aneurysms have often been reinforced this way. *Methods:* A 57 yr. old female presented with a SAH as a result of a ruptured Right MCA aneurysm. The aneurysm was clipped on day 3. Although the clipping was satisfactory, we packed shredded gauze around the neck of the aneurysm. She made a complete recovery and had returned to work. A number of CT scans over the past years has demonstrated an enhancing mass in the right sylvian fissure. She presents now, 3 years later, with a partial seizure and a recent CT shows enlargement of the enhancing mass as well as edema in the adjacent frontal lobe. *Discussion:* Gauze wrapping has been around since the 1950's but "gauzomas" was only reported from the 1980's possibly because CT scanning became more readily available. In 1990 Israel Chambi, MD., Ronald R. Tasker, MD et al reported on 7 females from their department in Toronto and 3 additional cases, all female were identified in the literature. We report our case and review the literature.

SPINE

P-081

A systematic review of pain following traumatic spinal cord injury – an instance of abhorrent plasticity?

DW Cadotte (Toronto), MG Fehlings (Toronto)*

Introduction: Neuropathic pain in the spinal cord injury (SCI) patient represents a unique subset of pain sufferers. To add to the mystery behind neuropathic pain, not all persons who suffer SCI develop neuropathic pain. Various mechanistic theories have been proposed and various treatments have been outlined. *Object:* We provide a systematic review of both animal and human literature regarding neuropathic pain in the spinal cord injured patient. We focus on mechanistic theory derived from animal models and a review of reported cases in human subjects. *Methods:* The National Library of Medicine was queried (1950 – present) using the MeSH heading "spinal cord injuries" and the keyword "neuropathic pain". Abstracts were reviewed and appropriate studies were selected. Inclusion and exclusion criteria were applied. Animal models were reviewed and evidentiary tables were constructed to summarize the clinical studies. *Results:* Our search revealed 247 studies. Of these, 144 were animal studies and 77 were adult human studies. 56 Animal studies attempt to elucidate pathophysiological mechanisms. 36 clinical studies, representing 1082 patients, were chosen and fall into one of three categories: measurement strategy (2), treatment strategy (22) and pathophysiological observations (12). *Conclusions:* Our understanding of neuropathic pain in the SCI patient has evolved considerably over the years. Animal models have improved our understanding of specific mediators of pain and delineated cell types that may alleviate pain. Human studies have resulted in modest results with regard to pain measurement and insight into potential mechanisms. Human clinical trials have resulted in drug protocols that allow for relief, in subsets of SCI patients.

P-082

Cervical spondylotic myelopathy following cervical decompression: a prospective cohort

SA El-Zuway (Hamilton), E Kachur (Hamilton)*

Introduction: Cervical spondylotic myelopathy is the most common cause of spinal cord dysfunction in adults. There is a lack of firm evidence regarding surgical options and prognostic factors associated with management. The Japanese Orthopedic Association Scale (JOA) is an outcome measure of the neurological function of cervical myelopathy. The main goals of the study are to assess prospectively the clinical outcome of myelopathic patients following cervical decompression and to look for potential factors that may influence the degree of functional recovery following cervical decompression *Methodology:* A prospective cohort of myelopathic patients underwent cervical decompressive surgery at Hamilton General Hospital between June 2008 to October 2009. Interval analysis at preop, postop 6 weeks, 6 months, 1 year & 2 years. Demographic data were obtained. Clinical diagnosis and surgical intervention were based on clinical and radiological evidence of severity. Treatment options included ACDF, ACCF, Laminectomy/ fusion and Laminoplasty. *Results:* Follow-up analysis at 6 weeks postop is presented in this paper. 34 patients met the inclusion criteria. 26 men & 8 women. Mean age was 61 years. 24 patients underwent surgical decompression. Preop JOA range 5 – 16. Postop and JOA range 9 – 16. Laminoplasty was the most commonly used procedure in our study. Age, sex, BMI did not seem to be factors that influence the clinical outcome of CSM. More than half of patients presented with duration of myelopathy of 3 yrs. Hoffman sign was slightly more sensitive but significantly more specific than Babinski sign. There was an overall significant improvement in patient outcome following decompression

P-083

Does intra-operative EMG affect pedicle screw position?

EM Frangou (Saskatoon), JR Tynan (Saskatoon), L Ogieglo (Saskatoon), L Hnenny (Saskatoon), D Fourney (Saskatoon)*

Intra-operative electromyography (EMG) is coming into favor as a tool to detect and avoid neurologic complications of pedicle screw placement. No study to date has compared CT scans in patients with and without EMG assistance in the placement of pedicle screws. Our center has recently started using surgeon-directed EMG regularly for pedicle screw placement. We routinely perform CT scans postoperatively, providing an opportunity to compare pedicle screw placement in consecutive cases before and after the implementation of EMG in our institution.

Surgeons' records were scrutinized for cases of lumbar pedicle instrumentation between January 2006 and present. Images were assessed by a senior radiology resident and senior neurosurgery resident. Pedicle breaches were graded as in or out. Screws were further graded by degree of breach: A (in), B (<2.1mm), C (2.1mm-4.0mm), D (>4mm). Surgical time and outcome were taken from the patient's chart. Outcome was graded as resolved, improved or unchanged/worse. Comparisons between the EMG and non-EMG groups were made with respect to pedicle breach, surgery time and neurological outcome.

We evaluated 247 pedicle screws (144 in the EMG group and 103 in the non-EMG group). There was no statistically significant effect of

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EMG on pedicle screw position. A preliminary analysis demonstrated a trend toward better neurological outcomes (p=0.054) and longer surgical time (difference of 10 minutes, p=0.108).
The present study suggests that surgeon-directed intra-operative EMG does not affect pedicle screw position. Monitoring of neural integrity may reduce poor outcomes at the expense of longer surgical times. Further study is required.

P-084

Bilateral C5 palsy following multilevel cervical laminectomy and fusion: case report and review of the literature

PA Gooderham (Vancouver), R Sahjpaul (Vancouver), J Stewart (Vancouver)*

Background: C5 palsy is a rare but well recognized complication following decompressive cervical spine surgery. *Methods:* We present a case of delayed onset, complete, bilateral motor palsy of the C5 nerve root after multilevel laminectomy and fusion for cervical spondylotic myelopathy (CSM). Serial MRI and electrophysiological studies were obtained. *Results:* BM underwent an uncomplicated multilevel cervical laminectomy and lateral mass fusion for advanced CSM. In the immediate postoperative period, he had mild residual C5 weakness (unchanged from preoperatively). Within 24 hours, he developed complete bilateral paresis of biceps and deltoid muscles. Serial MRIs revealed evolution of signal change over several months. His long tract myelopathic deficits improved significantly. After 1 year of follow-up he has slight recovery of C5 function, both clinically and electrophysiologically. Delayed C5 motor palsy has been reported to occur in 4.5% of patients undergoing decompressive procedures on the cervical spine. Risk factors are posterior procedures and ossification of the posterior longitudinal ligament. The underlying mechanism remains unclear. Mechanical root compression or stretch, and vascular etiologies have been proposed. The majority of patients demonstrate some recovery, over up to 1 year. *Conclusions:* C5 palsy following decompressive cervical spinal procedures is a rare but serious complication that remains poorly understood. If severe, it is a devastating deficit for patients from a functional perspective. Patients should be specifically advised of this risk prior to posterior cervical decompressive procedures.

P-085

A case of mistaken identity: spinal epidural angiolipoma case report and review of literature

FA Haji (London), YK Patel (London), L Ang (London), J Megyesi (London)*

Background: Spinal angiolipoma (SAL) is a rare lesion infrequently implicated in spinal cord compression. We report the case of a 65 year old female who presented with a nine month history of progressive myelopathy and a T7 sensory level. MRI revealed a homogeneously enhancing dorsal thoracic spinal epidural mass causing extrinsic spinal cord compression at T6. Preoperatively the lesion was favoured to represent lymphoma or metastasis, however histopathology revealed an angiolipoma. After gross total resection, the patient's weakness and gait disturbance improved. *Methods:* We reviewed the existing literature on SAL, including the epidemiology, histopathology, clinical and radiographic presentation, treatment options and outcome of these lesions. *Results:* SAL is a rare clinical entity, with a recent review noting 123 cases in the literature. Occurring primarily in the mid thoracic region, these lesions contain mature adipocytes admixed with abnormal, poliferative vasculature and may represent an intermediate entity between lipomas and hemangiomas. Clinical symptoms are consistent with neural compression from a slow growing mass. The lesions appear heterogeneous on MRI, with or without infiltration into adjacent tissue. Enhancement correlates with the vascularity of the lesion. The preferred management is complete surgical excision, however preoperative embolization may be of benefit. No adjuvant therapy is required. *Conclusion:* This report further demonstrates the importance of understanding the clinical, radiographic and pathologic characteristics of spinal angiolipoma and its inclusion in the differential diagnosis of patients presenting with spinal cord compression.

P-086

Operative versus nonoperative management of acute odontoid type II fractures in elderly patients: a meta-analysis

*IU Haq (Thunder Bay)**

Odontoid fractures Type II are the most common cervical spine fractures in patients over the age of 70 years and are considered relatively unstable. The incidence of fracture nonunion in this population has been reported to be 20-fold greater than that in patients under the age of 50 years if conservative management was applied. Surgical treatment in elderly patients with type II odontoid fracture is still controversial. Conservative management includes immobilization in a cervical collar or in a halo vest. External immobilization with a cervical collar has had unpredictable results. Halo vest immobilization is related with a significant nonunion rate and several complications. Operative management is recommended in older patients with posterior displacement of the fracture, anterior displacement of > 4-6 mm, neurological deficit, associated unstable subaxial spine injury that requires surgical fixation, and symptomatic nonunion. Surgical management includes either anterior odontoid screw fixation or posterior C1-C2 instrumentation with fusion. Direct fixation of Type II odontoid fractures showed stability rates > 80% in this elderly population, but surgeons should understand the limitations of the various techniques before considering them in clinical practice and to look for any associated clinical co morbidities that might affect management. Review of literature and author's personal case series will be discussed.

P-087

A comparison of four quantitative methods to assess spine stenosis on magnetic resonance imaging in patients with cervical spondylotic myelopathy(CSM)

AV Karpova (Toronto), MG Fehlings (Toronto), S Chua (Toronto), D Rabin (Toronto), S Craciunas (Toronto), SR Smith (Toronto)*

Design: Retrospective analysis. *Objective:* To measure the intraobserver and interobserver reliability of transverse area (TA), compression ratio (CR), maximum canal compromise (MCC), and maximum spinal cord compression (MSCC) using digitized and magnified images to assess the degree of spine stenosis in population with CSM. *Methods:* Four spine surgeons examined mid-sagittal and axial T1/T2 MR weighted images from 17 patients with

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spine stenosis who were clinically diagnosed with CSM. Spine surgeons examined the images on four occasions to assess stenotic changes, while blinded to the clinical status of the patients. The degree of spine stenosis were evaluated by measuring TA and CR on axial T2WI (weighted imaging), MCC on mid-sagittal T1WI and MSCC on mid-sagittal T2WI using digitized/magnified images and written instructions. Analyses included interclass correlation coefficients (ICCs) and the assessment of intraobserver and interobserver reliability. *Results:* Two-way ANOVA analysis indicated intraobserver reliability for TA, CR, MCC and MSCC with ICCs of 0.97, 0.95, 0.94, and 0.93, respectively. The interobserver reliability for all four radiologic parameters with ICCs of 0.76, 0.80, 0.64, and 0.84, respectively. *Conclusion:* The degree of agreement among raters was moderately high in all four measurement tools. The T2-weighted images, especially in the mid-sagittal plane, elicited the highest rates of agreement. This supports the common use of mid-sagittal T2WI images, complemented with axial images, in the clinical and research settings.

P-088

Spinal cord compression due to neuroendocrine carcinoma, a rare case

M Maleki (Montreal), CE Chatillon (Montreal), M Guiot (Montreal)*

Background: Various primary, or secondary tumors of spine may cause cord compression, however neuroendocrine tumors very rarely behave in such a manner. We report such a case. *Method:* Female, age 74, presented with progressive paraparesis due to a spinal epidural tumor. T5-T6 laminectomy and gross total resection of tumor was done . Pathological report; neuroendocrine carcinoma. Complete workout failed to discover any other pathological site. She underwent radiotherapy, with significant clinical, as well as radiological improvement. *Result:* 5 years later she presented with recurrent, symptomatic tumor at the previously operated site . She underwent second surgery in 2010, and pathological report was similar to the previous one. Further reinvestigation were undertaken. Literature is reviewed about involvement of spinal neuraxis with neuroendocrine tumors. *Conclusion:* Neuroendocrine tumors are heterogeneous group of tumors occurring in gastrointestinal and respiratory tract, and endocrine glandular tissues, etc. Even though pathologically some may appear cancerous, their behavior is less aggressive than other cancers, hence called “Carcinoids”. Majority of them are non-functional. Some may produce vasoactive amine inducing carcinoid syndrome, or other endocrinological dysfunctions. Occurrence of neuroendocrine tumors in spine is very uncommon, and in 10-15% of these tumors, the primary site of tumor could not be identified.

P-089

Spinal cord injury without initial MRI abnormality: case report

M Schellenberg (Kingston), R Pokrupa (Kingston)**

Background: In 1982, Pang and Wilberger defined SCIWORA (spinal cord injury without radiographic abnormality) as an acute spinal cord injury that results in sensory and/or motor deficits with normal plain radiographs and computed tomography scans. It is rare. 90% of the cases are pediatric, mostly children under 8 years, but it also occurs in adults over the age of 60. SCIWORA is very rare among young adults (16-35 years old) but may be underreported. Symptoms are varied. Typically it has a grave prognosis. Treatment is usually nonoperative. Controversy exists whether SCIWORA exists in the era of MR imaging. *Results:* We present the case of an 18 year old male who presented with acute paraplegia and sensory loss from a motor vehicle accident. Initial CT of the spine and MRI imaging did not disclose a spinal cord injury. However a repeat MRI five days post-injury demonstrated the presence of a spinal cord injury corresponding to his neurological presentation. Eight months post-collision, the patient has recovery of sensation and ambulates independently. *Conclusions:* A patient may have neurological deficits in the context of an initially normal MRI scan. This supports that the diagnosis of SCIWORA can be broadened to include MR findings.

P-090

Lumbar microdiscectomy for symptomatic disc herniation: analysis of clinical, functional, and radiological outcomes in a cohort of 41 patients, with a special emphasis on instability and disability

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Introduction: The long-term outcome after lumbar microdiscectomy (LMD) is often marked by low back pain (LBP) and segmental instability (SI). We reviewed our experience to determine the rate of post-operative LBP and SI and their impact on the functional outcome. *Methods:* All patients who underwent LMD in 2004-2005 were invited to participate. Clinical and functional outcomes were assessed and radiological results were determined using MRI. Medical records and preoperative MRIs were retrospectively reviewed. *Results:* Forty-one patients were enrolled. Median follow-up was 41 months (range 32-59). Twelve patients (29.3%) reported moderate-severe sciatica, 12 (29.3%) had moderate LBP, and 13 (31.7%) exhibited clinical evidence of SI. Most patients had minimal disability, only 3 (7.3%) had moderate disability. All patients were satisfied, although 18 (43.9%) expected better outcome. Thirty-three patients (80.5%) returned to full-time work. Median disc space collapse (DSC) was 20%. Prevalence of Modic changes increased from 46.3% to 78% with type 2 predominance. Multivariate analysis identified the following independent predictors: female sex for job change, young age for SI, regular exercise for no sciatica and full satisfaction, LBP > 6 months for moderate disability, L4-L5 level for severe DSC. There was no correlation between the course of Modic changes, DSC, and patient outcome. *Conclusion:* Although LBP and SI develop frequently after LMD, significant disability and dissatisfaction are uncommon. Female sex, young age, lack of exercise, and chronic preoperative LBP predict a worse outcome. DSC is a universal finding, particularly at L4-L5. Neither DSC nor Modic changes seem to affect patient outcome.

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P-091

What happens to Modic changes following lumbar discectomy? Analysis of a cohort of 41 patients with a 3 to 5-year follow-up

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Introduction: The natural history of Modic changes in the lumbar spine is often marked by conversion from one type to another, but their course following lumbar discectomy remains unknown. We sought to study the impact of surgery on the natural history of these lesions. *Methods:* Forty-one patients treated with lumbar microdiscectomy between 2004 and 2005 were enrolled in this study and underwent clinical evaluation and repeat MRI after a median follow-up of 41 months (range 32-59). Preoperative and follow-up MRIs were reviewed and the type, location, and extent of Modic changes at the operated level were recorded and compared. *Results:* The study population consisted of 27 males and 14 females with a mean age of 54 years (range 24-78). During the follow-up period, the prevalence of Modic changes increased from 46.3% to 78% and 26 patients (63.4%) had type 2 lesions at the operated level. Of the 22 patients without Modic changes, 4 (18.2%) converted to M1 and 9 (40.9%) to M2. Of the 5 M1 lesions, 3 (60%) converted to M2 and 2 (40%) remained M1 but increased in size. In contrast, none of the 14 M2 changes converted to another type, although 10 (71.4%) increased in extent. There were no reverse conversions to M0. *Conclusion:* Following LD, most patients develop M2 changes at the operated level, possibly as a result of accelerated degeneration in the operated disc. Neither the preoperative presence of Modic changes nor their post-operative course seems to affect the clinical outcome.

P-092

Siemens Arcadis Orbic C-arm and BrainLab for thoracolumbar instrumentation

RL Sahjpaul (North Vancouver), S Gul (North Vancouver), J Padilla (North Vancouver)*

Background: Advances in image guidance for spinal surgery have promised to make spinal instrumentation safer and more accurate. Such technologies lend themselves to use in minimal access spine surgery, including percutaneous pedicle screw placement. *Methods:* Our initial experience with the Siemens Arcadis Orbic C arm and BrainLab image guidance system for the placement of spinal instrumentation in 19 patients (both minimal access percutaneous and open cases) is presented. Nuances of surgical technique are described. Postoperative CT scans were obtained for assessment of screw placement accuracy. *Results:* Images acquisition and screw placement was successful in all cases, with no cases of screw malposition of clinical consequence. No cases required revision. System accuracy was excellent. The technology proved especially useful in deformity cases and in large patients where exposure proved challenging. There is a definite learning curve in setting up the sytem, draping challenges, intraoperative camera position and instrument detection, and in the use of the system for percutaneous pedicle screw placement, but these were successfully overcome. *Conclusions:* Pedicle screw placement using the Siemens Arcadis Orbic and BrainLab system is accurate and safe. It reduces dependence on intraoperative fluoroscopy. There is a definite learning curve with regards to surgical technical nuances.

P-093

Traumatic spinal injuries in children

C Kim (Ottawa), M Vassilyadi (Ottawa), PJ Moroz (Ottawa)*

Background: Spinal injuries in children are less common than adults with a reported incidence of up to 10% when compared to all spinal trauma. These children can have spine fractures with or without myelopathy, or spinal cord injury without radiological abnormalities. *Methods:* Between 1990 and 2004, 187 children with spinal injuries were retrospectively reviewed using ICD-10 codes, the Children's Hospital of Eastern Ontario trauma registry and an independently maintained fracture database. *Results:* The mean age on admission was 11.8±4.4 years with a male to female ratio of 1.1:1. The age distribution of spinal injuries was highest in the 12 to 16 year-olds, with most injuries at 15 years of age. The top three mechanisms of spinal injury were motor vehicle related (49%), sports (29%), and falls (14%). Myelopathy occurred in 19% and SCIWORA in 9%. The most common spine levels injured were between L2 and sacrum, followed by noncontiguous levels. Associated injuries, including fracture/dislocations (28%) and head injuries (16%), occurred in 56% of children. Overall mortality rate was 4%. *Conclusions:* This study has combined patients seen in a level 1 pediatric trauma centre by Orthopedics and Neurosurgery. The results at CHEO are consistent with the few studies in the literature indicating that the highest risk of injury is in the more active adolescent males. Efforts should continue to educate children, especially teenagers, about injury prevention.

P-094

Giant cystic intradural lumbosacral schwannoma: is stabilization necessary?

JS Wilkinson (Saskatoon), SA Mann (Saskatoon), CA Robinson (Saskatoon), DR Fourney (Saskatoon)*

Background: Giant invasive cystic schwannoma of the lumbosacral spine is an exceedingly rare tumor. To our knowledge, only two other cases have ever been reported. Slow-growing intradural tumors may erode the pedicles, making spinal stabilization difficult. *Methods:* A 38-year old woman with 1-month history of radiculopathy was diagnosed with a large intradural tumor/cyst with erosion of the L3-S1 vertebral bodies and pedicles. Almost two-thirds of the vertebral body at L4 was eroded away. She underwent L3-5 laminectomy and gross total microsurgical resection of the mass. Given the patient's young age, svelte body habitus, preservation of lumbar lordosis, and normal alignment, we decided not to perform a fusion and instead followed her for evidence of instability. *Results:* At 21 months post-operatively, she has no lower back pain and has full range of motion with no evidence of clinical or radiologic instability. There is no evidence of tumor recurrence. *Conclusions:* Giant invasive cystic schwannoma of the spine is exceedingly rare. The extent of bony erosion and would be expected to cause instability, especially after laminectomy. We hypothesize that the slow-growing nature of the tumor resulted in remodeling of the bone, with maintenance of alignment and weight-bearing capacity of the anterior column.

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P-095

Traumatic expulsion of the L4 vertebral body from the spinal column

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Background: Traumatic lateral spondyloptosis has previously only been described at single levels in the lumbar spine. We present a case of double lateral spondyloptosis, rostral and caudal to the L4 vertebral body, resulting in right lateral L4 expulsion of the vertebral body. *Methods:* A 16-year-old girl was referred to our center for management of an extremely unusual L2-5 fracture/dislocation. Remarkably, the motor deficits were incomplete and sacral sensation was spared. *Results:* Surgical management involved decompression, reduction, reconstruction of L4 with a cage, and L1-ilium stabilization/fusion. The trauma had disrupted all of the soft tissue attachments to L4, allowing the vertebral body to be rolled out posterolaterally, similar to the method of complete en bloc spondylectomy. The neurologic recovery at 18 weeks has included resumption of normal bladder and bowel function, and ambulation with a right leg brace. *Conclusion:* This pattern of fracture-dislocation fracture has not been previously reported, likely because patients would be expected to succumb to vascular or visceral injury. We believe this is the first case report of double lateral spondyloptosis at adjacent levels, resulting in expulsion of the vertebral body from the spinal column.

P-096

Effects of a novel Chinese herbal formula on traumatic spinal cord injury in rats

DH Zhang (Hamilton), C Su (Hamilton), S Jiang (Hamilton), K Reddy (Hamilton), M Rathbone (Hamilton)*

Background: Traumatic spinal cord injury (TSCI) is a common and devastating problem. Based on the results of our pilot project presented at the 2009 Meeting, XGS-1, a novel chinese herbal formula, was shown to improve functional recovery and reduce lesion volume in the rat model. We therefore undertook a full scale study to establish the effect of XGS-1 on TSCI in rats. *Method:* We used the rat spinal cord coverslip forcep compression model (n=24). Locomotor behavior was assessed using the Open-Field-Walking Test (OFWT) scored on the Basso-Beattie-Bresnahan Scale (BBB). At the end of the observational period, spinal cord tissue was submitted for gross histology and for immunohistochemical analysis. *Results:* Animals in the treatment group demonstrated smaller lesion volumes and reduced caspase 3-positive apoptotic cell death. Behavior testing showed greater OFWT scores in the treatment group (17.5) versus vehicle treated controls (14.1). Alterations in the expression of key mediators of neuronal injury and repair were also demonstrated by immunohistochemistry. *Dicussion:* Our results strongly suggest that XGS-1 improves functional recovery in rats following TSCI. This is effected by reduced lesion volume, attenuated apoptotic cell death, and likely through the modulation of multiple pathways in the pro-inflammatory, excitotoxic and neuroregenerative cascades. Based on these finding, XGS-1 holds promise as treatment for patients with TSCI.

Pediatric Neurology

P-097

The use of ketamine for refractory status epilepticus

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Background: Ketamine is an NMDA receptor antagonist that has been used recently in the treatment of refractory status epilepticus (RSE). Its potential advantages include maintenance of hemodynamic status and protection from glutamate-induced neurotoxicity. There is no consensus on dosing, and little information on efficacy. *Methods:* Retrospective single centre review of children treated with ketamine infusion for RSE between 2004 and 2009. We examined the duration of treatment, dosage, safety and efficacy in each case. *Results:* We identified 5 patients, aged 5-17 years, who received ketamine for treatment of their RSE. All had ongoing continuous EEG monitoring. They had received between 4-6 other anti-epileptic drugs prior to ketamine use. Dose was titrated to maximum infusion rate of between 0.04 mg/kg/hour to 7 mg/kg/hour. Duration of ketamine treatment ranged from 1 to 9 days. There were no serious side effects noted during treatment. Efficacy varied: one patient had complete seizure cessation for 26 hours, and the remainder had incomplete or no response. *Conclusion:* Efficacy of ketamine was variable, possibly reflecting the wide variability in dosing. No significant adverse events were observed during ketamine therapy.

P-098

Functional implication of the cAMP pathway learning genes in downstream long-term memory and cognition

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Introduction: Fragile X Mental Retardation syndrome accounts for the majority of cases of single gene related intellectual disability. We have validated a Drosophila model for Fragile X. The Fragile X gene in flies and humans share similar function and molecular pathways, allowing us to investigate possible interactions between the cyclic AMP pathway and Fragile X. *Methods:* This is accomplished by testing various forms of olfactory memory in Drosophila using a classical conditioning paradigm. Our assay allows us to induce long-term memory (after spaced training) and transient memory (after massed training). *Results:* First, we tested the hypothesis that Drosophila mutants producing too little (rutabaga) or too much (dunce) cyclic AMP would have defects in long-term memory. We observed a significant defect in long-term memory in mutants for adenylate cyclase (rutabaga) and phosphodiesterase (dunce) as compared to genetic controls. Second, we tested the performance at 1 day after massed training and observed significant defect in rutabaga but not in dunce mutants. Discussion: Our results suggest that mutants affecting cAMP levels have impaired long-term memory performance and that the effect of excess cAMP may be generally deleterious. Next, it will be important to study the interaction between Fragile X and the cAMP mutants.

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P-099

Intermediate-dose idebenone and quality of life in Friedreich ataxia

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Background: Idebenone has been used as therapy for Friedreich Ataxia for over a decade. While several studies have assessed the impact of therapy on neurological or cardiac function, there is a paucity of data surrounding Patient Reported Outcome measures. *Materials and Methods:* We undertook an observational study of the effect of intermediate-dose idebenone (20 mg/kg/day) on quality of life and neurologic function measures. Seven patients with Friedreich ataxia were assessed using the Pediatric Quality of Life Inventory, the International Cooperative Ataxia Rating Scale, and an Activity of Daily Living Scale prior to initiation of idebenone therapy and in follow-up after one year of therapy. *Results:* Physical scores on the quality of life inventory were universally worse after one year, and correlated with decreased activities of daily living scores. Despite worsening physical scores, there was a trend toward improved total, emotional, social and school components of quality of life scores after 1 year of idebenone therapy. *Conclusions:* Our study showed no statistically significant change in Pediatric Quality of Life Inventory scores from baseline evaluation to those after 1 year while on idebenone. Functional ability, as measured by activities of daily living scores, appeared to have the most influence on the perception of physical quality of life, which may be important in planning future therapeutic trials.

P-100

Failure to recognize inferior vermian hypoplasia in congenital ocular motor apraxia

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Congenital ocular motor apraxia (COMA) is characterized by impairment of horizontal saccades and distinctive compensatory head thrusting. In many cases, MRI is normal and no cause is found. *Case Report:* A 2-month-old girl presented with visual inattention since birth. Neurological and ophthalmological examination showed no abnormalities other than a lack of visual fixation and tracking. Visual evoked responses were normal. By age 6 months, she was using head thrusts to track visual targets horizontally. Brain MRI was interpreted to be normal and she was diagnosed with idiopathic COMA. Over the next year, she also had delayed walking and language development. Other than these findings and impaired horizontal saccades with head thrusts, neurological examination was unremarkable. At age 18 months, the MR scan done a year earlier was re-examined. Only when attention was directed specifically at the inferior vermis was it apparent that it was clearly hypoplastic. There was also subtle elongation of the superior cerebellar peduncles. In 1997, Sargent et al reported that 8 of 13 patients (62%) with COMA who had MR scans had vermian hypoplasia. The hypoplasia was localized to the inferior vermis in at least 5 patients (38%). This MR finding is easily overlooked and likely underdiagnosed.

P-101

Hemimegalencephaly in 2 newborns: role of fetal MRI, gestational age, and surgery

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Introduction: Hemimegalencephaly (HME), unique cerebral malformation characterized by overgrowth and dysplasia of one hemisphere, has multiple anatomical forms, but asymmetry is universal. HME can be isolated or associated with neurocutaneous syndromes; mild, moderate or severe. Epilepsy is the most frequent postnatal manifestation. Mortality is high in severe forms in the first year. *Material and Methods:* Two male newborns with severe HME, 37 (case 1) and 32 weeks (case 2) GA and epilepsy. Case 1: Mother 29 years, G5 P3, SA/IUD 1; obese. Several US from week 9 for high- risk pregnancy. US 34 weeks reported microcephaly, ventriculomegaly. Fetal MRI 35 weeks: severe left HME. C-section 37 weeks: Apgar 6,9; HC > 90%. No external anomalies. EEG 2nd day: abnormal paroxysmal, left; no clinical seizures. Levetiracetam started. *Case 2:* Mother 33 years, G 2 P1; PROM. Labour 2 hrs; vertex vaginal delivery, Apgar 3,5,8. HC 34 cm. No external anomalies. Intractable seizures since 1st day. Severe left HME on day 2 by MRI. Seizures unresponsive to phenobarbital, topiramate, levetiracetam. Status epilepticus responded to lidocaine infusion, relapse after stopping. Callosotomy at 3 wks; improvement brief. *Results:* Patient 1, at 4 mos, few, brief clonic seizures. Last EEG: asymmetry, no seizures. Developmental delay. *Patient 2:* EEG, seizures improved transiently after callosotomy, followed by relapse. Subtotal frontotemporal resection at 2.5 mos. Died next day. Neuropathological confirmation. *Conclusion:* Preterm gestational age and postnatal diagnosis after onset of epilepsy predicts poor prognosis with complications. Prenatal diagnosis by MRI permits planning and early intervention that improve outcome.

P-102

Parkinsonian rigidity in Rett syndrome

P Humphreys (Ottawa), N Barrowman (Ottawa)*

Background: Patients with Rett syndrome (RTT) frequently have a progressive parkinsonian state. We describe a scoring system for the severity of parkinsonian rigidity in RTT, and its correlations with functional ability. *Methods:* MECP2 mutation-positive RTT patients (n=35) were assessed for the presence and distribution of parkinsonian features. Muscle tone rigidity in the extremities, neck and facial muscles was documented and summarized as an RTT Rigidity Distribution Score (RTTRDS) with a range from 0-15. RTTRDS were correlated with age, ability to walk and speak and, in a small subgroup (n=9), CSF HVA and 5HIAA levels. *Results:* Subject ages ranged from 2 ½ to 46: 2-5 years, n=9; 6-10, n=12; 11-19, n=7; 20+, n=7. Rigidity was found in 29/35 (82.9%); it appeared as early as age 3, increased in extent with age, and was present in all subjects aged 13+. Leg rigidity appeared first, with subsequent involvement of arms, neck and face. In the 4 age groups, average RTTRDS were, respectively, 0.89, 3.17, 6.29, 7.86. Ambulatory subjects (n=15) had lower RTTRDS (1.80 ± 2.34) than non-ambulatory (n=20; 5.90 ± 3.68; $p<0.001$ [Student's t-test]). Likewise, scores were lower in those with retained speech (n=9) than those without words (n=26; 1.78 ± 2.54 vs 4.96 ± 3.79; p=0.03).

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There was a negative correlation between RTTRDS and CSF HVA levels (R=-0.83, p=0.005) but not with 5HIAA levels (R= -0.45, p=0.22). *Conclusion:* The severity of parkinsonian rigidity in RTT correlates with impaired ambulation and communication, and with HVA levels.

P-103

Acute transverse myelitis in infancy: is there a relationship to immunization?

F Jacob (Edmonton), J Neilson (Edmonton), JY Yager (Edmonton)*

Background: Acute transverse myelitis (ATM) is a rare neuroinflammatory condition of the spinal cord. Between 8-38% of pediatric cases occur in children below the age of 3 years. Occurrence at 6 months of age or less is rare. Temporal associations at a mean of 14 +/- 7 days post immunizations have been described. *Methods:* Case report. *Results:* A previously healthy and developmentally normal 6-month-old male presented with acute onset bilateral lower extremity weakness, urinary retention and constipation 3 days post DTaP-IPV-Hib and Pneumococcal conjugate vaccination. He had his 2 and 4-month immunizations. There was no history of preceding or inter-current illness. Examination revealed lower extremity weakness, hyper-reflexia with sustained ankle clonus, and decreased rectal tone. MRI of the spinal cord revealed a T2-hyperintense lesion between the C3-T5 spinal levels as well as spinal cord edema in the same distribution. CSF examination revealed a white cell count of 42 consisting mostly of macrophages and lymphocytes, with increased protein 0.53 g/L. Viral studies were negative. He was treated with a 3-day course of intravenous methylprednisolone (30mg/Kg) with limited recovery. Follow up at 6 months post event has shown near complete recovery, with residual bladder dysfunction – diagnosed clinically due to urinary frequency. *Conclusions:* Our case describes the occurrence of transverse myelitis at an unusually young age. In this regard, a temporal association between its onset and immunization may exist. Further immunological studies are required for clarification of the association between immunizations and transverse myelitis.

P-104

Hemiplegic migraine in the pediatric population: different phenotypes and associated neurological diseases

LH Rodan (Toronto), T Soman (Toronto)*

Purpose: Hemiplegic migraine (HM) is a well defined headache syndrome affecting children. HM is considered a benign condition, though it can mimic more serious neurological diseases and can also be associated with them. We describe a variety of phenotypes of this condition. *Methods:* In this retrospective case series we report 3 cases from our Pediatric Neurology clinic. *Results:* Case 1 is a 13 year-old girl with familial HM episodes since age 3. Episodes consist of hemiparesis, abdominal pain, and bradycardia. Past history is significant for stroke. Episodes subsided on acetazolamide. Case 2 is a 6 year-old girl (sister of # 1) who presented with familial HM at age 4. Episodes consist of hemiparesis, abdominal pain, and urinary retention that can last up to 72 hours. Genetic testing demonstrated a novel mutation in the CACNA1A gene. She responded well to acetazolamide. Case 3 presented with her first episode of HM at 2 years, with symptoms resolving after several hours. She has a strong family history of HM. In all cases, neuroimaging, EEG, and stroke work-up were unremarkable. *Conclusion:* HM may occur concomitantly with other neurological diseases. HM should be a diagnosis of exclusion. It is important for clinicians to be aware of early age of presentation and various phenotypes of this condition.

P-105

CAPOS syndrome: further delineation of phenotype and etiology

CD van Karnebeek (Vancouver), G Horvath (Vancouver), MK Demos (Vancouver)*

Background: Cerebellar Ataxia, areflexia, pes cavus, optic atrophy and sensorineural hearing loss (CAPOS) syndrome was reported in 1996 as a new, early onset 'ataxia plus' syndrome of unknown cause in a family with autosomal dominant or mitochondrial inheritance. We report the second affected family, and expand on phenotype, mode of inheritance and etiology. *Methods & Results:* The proband is a 10 year old girl, who developed the CAPOS phenotype after a viral illness with encephalopathy. The optic atrophy and sensorineural hearing loss are progressive. Her 2 siblings and father show similar features albeit milder. The early onset cardiomyopathy in the proband and siblings expand the phenotype. Mode of inheritance is autosomal dominant. Normal investigations include: head MRI, nerve conduction studies, extensive metabolic testing (including respiratory chain enzymes), karyotype, array-CGH, and mutation analysis of OPA-1, FXA, SCA1-3, SCA 6-7, POLG1, TWINKLE, ANT1, TK2 genes. We aim to identify the responsible gene with exome sequencing. *Conclusion:* Insight into the etiology of CAPOS will benefit this family with respect to improved genetic counseling and management of this progressive condition. It will also increase our understanding of the pathophysiology of cerebellar ataxias, especially those presenting with a 'mitochondrial phenotype'.

P-106

Creating a community based paediatric neurology teaching clinic

*S Wendy (Rothesay)**

Introduction: The majority of patients and families have access to information on the internet and other media. The creation of a clinic that is dedicated to teaching patients, families and housestaff, utilizing current technology is the goal of this venture. *Methods:* Following financial approval, the author moved into the community as a salaried subspecialist. An Electronic medical record (EMR) was implemented. A website was created to provide information on the clinic and to provide access to a pre-consult questionnaire and handouts for families. It also includes a health portal that allows secure online interaction. Shadow and fee for service billing are currently being initiated from the EMR. Additional technologies are being used to enhance the educational experience on-line and in the office. *Results:* A child friendly environment has been created that is welcoming for families and easily accessed. The benefits, issues and costs when using an EMR will be discussed. Experience with a clinic website and on-line interactions will be reviewed. *Conclusions:* Current technology can be used to enhance teaching,

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healthcare access and ongoing patient management. Internet tools are utilized regularly by the younger generation and and it is crucial we become familiar with these technologies, including EMR.

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

P-107

Thalamic deep brain stimulation for the treatment of Dravet syndrome: short and long-term seizure control

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Dravet syndrome is a genetically determined severe epilepsy associated with cognitive decline and ataxia. Diagnosis in childhood has become easier after the isolation of the SCN1A gene, which is responsible for the majority of cases. The many types of seizures seen in these patients are typically pharmacoresistant. Mortality during childhood is high, mainly due to status epilepticus or sudden unexpected death in epilepsy. Here we describe two adults with Dravet syndrome who were treated with thalamic deep brain stimulation (DBS) targeted to the anterior nucleus of the thalamus and followed for 10 years. No changes in medications were done in the first year after DBS implantation. Subsequent changes were made in order to obtain better seizure control. One patient with partial onset seizures receied DBS at age 19 and showed a marked improvement in seizure control immediately after DBS insertion and stimulation. The improvement was maintained over the years. The other patient with generalized onset seizures received DBS at age 34 and did not show any immediate benefit. No side effects or changes in cognition were observed in either of the patients.
This is the first report of (short and) long term results in Dravet patients treated with thalamic DBS. We speculate that the results of DBS for epilepsy in patients with Dravet syndrome may be related to age at initiation of DBS treatment and seizure type.

P-108

The relationship between the epileptic focus and fMRI language patterns in children with epilepsy

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Background: Children with epilepsy have a higher incidence of atypical language patterns, identified using functional MRI (fMRI). The influence of the epileptogenic focus in the development of atypical language patterns is unclear. Our aim is to study the correlation of the localization of epileptogenic foci recognized by Magnetoencephalography (MEG) to atypical language pattern. *Methods:* A retrospective cohort study of 63 children with epilepsy that underwent fMRI for language lateralization and (MEG) for epileptogenic focus delineation was performed. Atypical language pattern was defined as right hemisphere or bilateral fMRI activations on a standardized battery of pediatric fMRI language paradigms. Epileptogenic foci were defined by a cluster of >6 MEG spike sources, with ≤1 cm between adjacent sources. *Results:* Thirty-six children had a single MEG epileptogenic focus and 27 children had multiple MEG foci. Multiple MEG foci and a single MEG cluster within a classic anatomical language area were associated with atypical language patterns. *Conclusions:* As expected, active epileptogenic foci within anatomical language areas are associated with atypical language patterns in children with epilepsy. However, the presence of multiple epileptogenic foci, regardless of location, is also associated with atypical language patterns, perhaps indicating the effect of a diffuse epileptogenic network on language development.

P-109

MEG source localization for epileptogenic zone in children with porencephalic cyst

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Background: Porencephalic cyst is a brain lesion caused by early ischemic insult or hemorrhage. We evaluated interictal spike sources on magnetoencephalography (MEG) to localize the epileptogenic zone in children with intractable epilepsy secondary to porencephalic cyst. *Methods:* We retrospectively studied 14 children with intractable epilepsy secondary to porencephalic cyst (5 girls; 9 boys; age range 2-19 years at MEG), who underwent prolonged scalp video-EEG, MRI and MEG. Interictal MEG spike source locations were compared to ictal and interictal zone from scalp video-EEG. *Results:* MEG spike sources were clustered in margins of the porencephalic cyst in all 14 patients. One cluster of MEG spike sources was seen in 7 patients, two clusters in 4, and three in 3 patients. Lateralized ictal EEG discharges were concordant to the hemisphere of predominant MEG clusters and porencephalic cyst in 9 (64%) patients (one lobe in 3, two lobes in 4, and diffuse hemisphereric discharges in 2). Interictal EEG was lateralized in 9 patients (64%, one lobe in 1, two lobes in 3, and diffuse hemispheric in 5). Five patients had resective surgery including porencephalic cyst and MEG clusters. All of them achieved seizure freedom.. *Conclusions:* MEG accurately delineated single or multiple marginal epileptogenicity surrounding porencephalic cyst in children with intractable epilepsy secondary to the porencephalic cyst. Complete resection of MEG clusters produced favorable outcomes.

P-110

EEG findings in a cohort of patients with new-onset seizures

JG Burneo (London), E Sandison (London)*

Introduction: The purpose of this study was to describe the frequency of EEG abnormalities and explore relationships between MRI and EEG findings, as well as prognosis of seizure recurrence to determine their relevance in the assessment of patients with new-onset seizures. *Methods:* All patients with newly-diagnosed seizures or epilepsy seen at the new-onset seizure clinic (inception until April 30th, 2009) at the University of Western Ontario Epilepsy Programme were included. As part of the assessment patients had a history and physical examination, outpatient EEGs, and 1.5 T MRI of the Brain. *Results:* Of 172 patients with newly diagnosed epilepsy, 51 presented after a single unprovoked seizure. 29 were male, mean age was 38 (range: 10-81), and 44 were right-handed. In

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terms of risk factors for seizures: 13 had head trauma, 10 had family history of seizures, and 3 febrile seizures. An abnormal MRI was found in 20 patients. On EEG, 17 had epileptiform discharges (11 focal and 6 generalized), 12 showed slowing (9 focal and 3 generalized) and 22 had normal EEG. In terms of outcome, 47% of those with epileptiform abnormalities continue to have seizures (46% focal abnormalities and 50% generalized abnormalities), while 40% of those with slowing in the EEG have continued to have seizures (45% focal, 33% generalized), and of the ones with normal EEG, 46% continued to have seizures. *Conclusions:* In this cohort of patients, we found that approximately 50% of new-onset seizure patients have abnormal EEGs, and the results did not influence prognosis.

P-111

Generalized nonconvulsive status epilepticus with reactive alpha rhythm

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Background: Bihemispheric ictal activity has been reported to involve unequally certain thalamocortical pathways. For example, this phenomenon is seen in absence epilepsy, in which certain brain areas do not seem to be as involved as others, as proven by the lack of motor manifestation. However, to our knowledge, no one has ever reported persistent physiological EEG findings supporting this concept. *Case Report:* A 48-year-old epileptic man was hospitalized following a generalized tonic-clonic seizure. He remained confused many hours after the seizure. EEG recordings displayed generalized spikes and polyspikes-and-waves, more prominent in the anterior regions, consistent with electrical status epilepticus. This continous ictal activity was combined with posterior alpha rhythm, reactive to eye opening. A few minutes later, he presented a second generalized tonic-clonic seizure treated with IV lorazepam. Afterward, his level of consciousness gradually improved. A second EEG showed diffuse delta and theta activity, without epileptiform or rhythmic activity. *Discussion:* This is, to our knowledge, the first report of nonconvulsive bihemispheric status epilepticus combined with a posterior reactive alpha activity. These observations suggest that bihemispheric nonconvulsive status epilepticus might be compatible with simultaneous physiologic alpha reactive activity. *Conclusion:* We conclude that certain thalamocortical pathways can be unequally involved in generalized nonconvulsive status epilepticus, allowing normal physiological activity to persist.

P-112

Appraising content of specific health measures in childhood epilepsy: an important step in questionnaire selection

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Background: Health-status and quality of life questionnaires are increasingly becoming part of standards for therapy evaluation worldwide. In childhood epilepsy, questionnaires are often based on minimally defined concepts of health, quality of life and their measurement. Overlap between what one wishes to evaluate and the content of a measurement tool is often disconnected. These deficiencies threaten the content validity of research findings, which could lead to erroneous clinical decision-making. *Purpose:* To provide precise information about the content of measures used in childhood epilepsy by using the International Classification of Functioning, Disability and Health (ICF) to appraise and classify questionnaire content. *Methods:* A systematic review of Medline, PsychInfo and CINAHL between 2001 and 2008 was used to identify health-status and quality of life questionnaires. Two reviewers screened all abstracts and extracted data independently. Once identified, questionnaire content was appraised by trained raters using a method revised in partnership with the ICF Research Branch of the World Health Organization. *Results:* ICF categories such as body functions, activities and participation and the environment, representing various daily aspects of health are shown for each questionnaire. These questionnaire findings were contrasted with intended areas of evaluation for each study identified from the review. *Conclusion:* Precise information about the content of questionnaires is required for appropriate evaluation and management in childhood epilepsy. The results of this study provide information to assist questionnaires selection to improve clinical and research evaluations, based on the target one wishes to measure using the ICF.

P-113

N complexes: an under-recognized normal EEG variant that needs to be distinguished from generalized spike-waves

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Background: N complexes were described in 1991 by Reiher and Carmant. They are considered normal EEG variants. In our opinion, they may be easily mistaken for generalized spike-waves. A comparative study was undertaken. *Method:* Two groups of EEGs from our EEG database were compared: N complexes and generalized spike-waves. N complexes were identified from EEGs done between February 2004 and January 2009. Age matched EEGs containing generalized spike-waves were randomly selected for comparison. All EEGs from both groups were blindly categorized by Dr Jean Reiher as containing N complexes or generalized spike-waves. Several electrographic features were then assessed in the two groups. *Results:* We identified 21 EEGs containing 63 N complexes, and selected 18 EEGs containing 52 generalized spike-waves. Features favouring N complexes over generalized spike-wave were: 14-6 Hz positive spikes preceding the complex (86% vs. 0), multiple successive phase reversals of the slow wave on bipolar montage (66% vs. 10%), and oscillating amplitude of the slow wave in successive electrodes on referential montage (48% vs. 10%) while a frontal maximum amplitude of the negative spike favoured generalized spike-waves (52% vs 5%). *Conclusion:* In this study, electroencephalographic features were identified to recognize N complexes and avoid misdiagnosis of generalized spike-waves.

P-114

Functional activity of generalized spike-and-wave discharges in the GBL rat model: an EEG-fMRI study

R Hutchison (London), L Leung (London), JS Gati (London), SM Mirsattari (London)*

Background: Generalized spike-and-wave discharges(GSWDs) are the result of irregular coupling between thalamic oscillations and cortical rhythms. However, the varying contributions of each cortical region to its clinical manifestations have not been well

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studied. This study aimed to characterize hemodynamic changes during GSWDs over time in order to better understand the dynamic processes that lead to the development of clinical manifestations of absence seizures. *Methods:* A pharmacological animal model was used. Animals were anesthetized using 1% isoflurane. Following 10min simultaneous baseline scalp-EEG and 9.4T fMRI recordings, GSWDs were generated in 8 Long-Evans rats using an intraperitoneal injection of γ-butyrolactone(GBL; 200mg/kg). fMRI recordings were made for 60min post-injection. EEG recordings were used to demonstrate the temporal occurrence of spiking and seizure activity, while general linear modeling, independent component analysis and dynamic-causal-modeling were implemented to characterize the hemodynamic changes and functional network abnormalities. *Results:* GBL produced bilaterally synchronous GSWDs within 2-5min of its administration. We observed hemodynamic changes following GSWD onset in which there were unique patterns of activity specific to each brain area. The cerebral cortex showed a gradual and sustained increase in blood oxygenation in response to GBL injection preceding GSWD onset. A lesser effect was observed in the thalamic nuclei. Cortical hemodynamic "spiking" was also observed in some rats during GSWDs. *Conclusions:* We demonstrated robust hemodynamic changes in brain areas that have been electrophysiologically implicated in the generation of GSWDs. Hemodynamic "spiking" superimposed on the rise in the blood flow to the cerebral cortex was a novel finding that requires further study.

P-115

The effective and ethical use of voluntary induction of psychogenic drop attacks in a patient with idiopathic generalized epilepsy

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Background: Psychogenic nonepileptic seizures (NES) represent an estimated 10-22% of referrals to epilepsy centers. While common, NES also raises important issues about the ethics of certain seizure provoking techniques. *Method:* This case study illustrates an interesting example of psychogenic drop attacks and addresses the controversial use of provocative techniques in the diagnosis of NES. *Results:* A woman known to have never fully controlled idiopathic generalized epilepsy presented at 47 years of age with new onset of drop attacks. After searching investigations, including prolonged video EEG telemetry, tilt-table testing and polysomnography, the etiology of her drop attacks remained elusive. During further psychiatric assessment she agreed to actively recall her memories of past sexual abuse in the protected environment of the video EEG unit to test whether there was any relationship with her drop attacks. Remarkably, within 20 seconds she had a typical drop attack. One day later, the procedure was repeated producing an identical result. *Conclusions:* This case study highlights the need to consider psychological factors when evaluating otherwise unexplained drop attacks. In addition, we propose a seizure provoking technique which may be used both effectively and ethically in the diagnosis of psychogenic drop attacks as well as of NES.

P-116

Effectiveness and safety of vagus nerve stimulation for intractable epilepsy

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Background: The vagus nerve stimulator (VNS) is a battery powered device used in the management of intractable epilepsy. Placed in the upper chest, it delivers a current to the left vagus nerve via electrical leads. A computerized hand held magnet waved over the VNS noninvasively programs the therapeutic parameters. *Methods:* Over the last 22 months patients with severe intractable generalized epilepsy and who were determined candidates were implanted with the VNS. A gradual increase in the output current was adjusted as tolerated by the patient. The patient was periodically assessed for adjustment of the device, monitoring of seizures, tolerability and side effects. *Results:* Of the 6 patients who were implanted with the VNS, 40% experienced transient discomfort. The first 4 patients to receive the VNS noticed significant improvement in frequency of seizures. The fifth patient implanted noticed a more gradual onset of benefit, progressively improving as time increased from implantation. The most recent patient had yet to be assessed. 40% of the patients were able to abort some seizures by swiping the magnet on the stimulator. Seizure severity was reduced in 60% of the patients. *Conclusion:* Vagus nerve stimulation is an effective and safe adjunct for management of intractable seizures.

P-117

Familial hemiplegic migraine and epilepsy: a case report

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Background: Familial hemiplegic migraine is a rare, autosomal dominant disorder, characterized by episodes of hemiparesis and encephalopathy during migraine attacks. Sporadic cases have associated epileptic and/or cerebellar features. *Case Report:* An 80 year old right-handed male presented to the Hamilton Health Sciences ICU with both partial and complex partial seizures (right sided postical paralysis), on a background of excruciating migraines, with episodes of fluctuating mentation. He has a history of familial hemiplegic migraines, right subdural hematoma evacuation; family history of mitochondrial cytopathy (complex 1/3 deficiency) and porphyria. CSF - negative for infection, lactate levels – normal, CT - subcortical microangiopathic changes, EEG - global disorganization with cortical irritability, maximal in frontocentral and temporal regions, consistent with decreased seizure threshold. His level of mentation gradually improved after placement on verapamil and levetiracetam, with return to his baseline depressed cognitive state at six months' follow-up. He remained seizure free. *Discussion:* To date, three variants of familial hemiplegic migraines have been described, with approximately 50% having mutations in the CACNA1A gene located on chromosome 19p13 (neuronal P/Q type voltage-gated calcium channels), 20% having mutations in the ATP1A2 gene (transmembrane Na/K-ATPase), and lower frequency linking the SCNA1 gene mutation (sodium channels). Mechanisms of epileptogenesis remain unclear, possibly due to cerebral edema induced by prolonged cortical spreading depression.

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P-118

Late onset epilepsy: a case of historic proportions

*RS McLachlan (London)**

Although the prevalence in the general population of epilepsy at any one point in time is 0.7%, the risk of developing the condition throughout a lifetime is 3%. The incidence is higher in childhood and the elderly and lowest during middle age. The cause and thus the differential diagnosis of new onset seizures depends in part on the age at presentation. Julius Caesar developed infrequent seizures at age 54 years but remained otherwise healthy until he died 2 years later from unrelated causes. Several possible explanations for his illness have been suggested including hypoglycemia, Meniere's disease, malaria, neurosyphilis, tumor, trauma, stroke and late onset primary generalized epilepsy. Evidence that seizures were focal in onset, the mild nature of the epilepsy and the absence of other symptoms over the course of 2 years are more consistent with a diagnosis of neurocysticercosis, the most common worldwide cause of focal epilepsy. There is evidence that cysticercosis did occur in ancient Egypt around the time Caesar made an extended stay there. That his epilepsy onset within the year after his return to Rome from North Africa supports this diagnosis.

P-119

A benign variant of TLE with long follow-up

*MA Smith (London)**

Background: To describe a patient with a benign variant of temporal lobe epilepsy (TLE) who had medically responsive course during a long follow-up. *Methods:* A patient referred to our Comprehensive Epilepsy Program at London Health Science Centre in London, Ontario was diagnosed with TLE. *Results:* This patient had a mild course with one anti-epileptic drug (AED) monotherapy for about 50 years. She had evidence of mesial temporal sclerosis in MRI and EEG findings supportive of TLE. Her long-term follow-up revealed a medically responsive form of TLE with respect to seizure outcome. *Discussion:* This case extends the spectrum of TLE to include mild, medically responsive variants.

P-120

Evaluation of an extended French Canadian pedigree with idiopathic generalised epilepsy

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Background: Both inherited and acquired factors contribute to the multi factorial etiology of Epilepsy. The identification of the mutations causing Idiopathic generalised epilepsy is of great interest. We studied a French Canadian family with several members affected by generalised epilepsy. The purpose of this study was to characterize the clinical phenotype in a large French Canadian family with an inherited epilepsy syndrome. *Methods:* We undertook telephonic and personal interviews with family members to collect information about the subjects affected and to identify the type of epileptic syndrome. *Results:* 6 males and 2 females were identified to have idiopathic generalised epilepsy. 1 male had died secondary to drowning during a seizure. 2 males and 1 female developed absence seizures at age 12-14 followed a year later by generalised tonic clonic seizures. They continued to manifest both seizure types as adults. Of the other 3 affected males, two had absence seizures and the other had GTCS. The other affected female had one GTCS. Male to male inheritance confirms autosomal dominant inheritance. *Conclusions:* The epileptic syndrome in this French Canadian family appears to have combined GTCS and absence phenotypes. The inheritance appears to be autosomal dominant as both males and females have been affected in successive generations.

P-121

Early somatosensory symptoms suggest insular seizures and predict poor outcome in temporal lobe epilepsy surgery

AG Weil (Montreal), W Surbeck (Montreal), R Rahme (Montreal), P Cossette (Montreal), N Giard (Montreal), J Saint-Hilaire (Montreal), A Bouthillier (Montreal), D Nguyen (Montreal)*

Background: Recent evidence has shown that failure to recognize insular cortex seizures may be responsible for TLE surgery failures. Insular epilepsy has been shown to have a high prevalence of somatosensory symptoms (SSS). We sought to determine if SSS are a negative prognostic factor for TLE surgery. *Methods:* Retrospective chart analysis of patients undergoing TLE surgery for refractory epilepsy from 2000 to 2007. Each patient underwent a comprehensive epilepsy surgical workup. Over 60 prognostic variables were analyzed and particular attention was placed on the presence of early SSS. *Results:* Seventy-five patients underwent temporal lobe surgery for drug-resistant TLE (37 males). Mean duration of epilepsy was 22 years and mean age at surgery was 38 years. There were 45 anterior temporal lobectomies, 22 selective amygdalo-hippocampectomies and 8 lesionectomies. Hippocampal sclerosis was diagnosed at pathology either alone (n=44) or with other diagnosis (n=9). Other pathologies included cavernoma (n=3), astrocytoma (n=1), FCD (n=4), DNET (n=2), ganglioglioma (n=1), gliosis (n=3) or were inconclusive (n=5). Eight (11%) patients reported experiencing early SSS during seizures. The outcome was significantly worse in patients with early SSS (62.5% Engel I or II, n=5) than those without (91% Engel I or II, n=61). *Conclusion:* The presence of early ictal SSS in apparent refractory TLE predicts a poorer surgical outcome. Potential explanations include unrecognized insular seizures. We recommend that patients with drug-resistant apparent temporal lobe epilepsy exhibiting SSS be further investigated by invasive EEG recordings with insular sampling as this could modify the surgical plan and potentially improve outcome.

P-122

Epilepsy surgery for pharmacoresistant temporal lobe epilepsy at Notre Dame Hospital

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Rationale: Resective surgery is an accepted option for patients with refractory temporal lobe epilepsy. Self-evaluation of complication and long-term outcome rates in individual centers is important to improve patient care. *Methods:* Retrospective study of patients undergoing temporal lobe epilepsy surgery from 1996 to 2007. All patients underwent a comprehensive presurgical evaluation.

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Multiple variables were analyzed and seizure outcome was evaluated using the Engel classification scale. *Results:* During the study period, 75 patients underwent temporal lobe surgery for refractory TLE. The study population consisted of 37 males with a median age of 38 years (range 14-58). Mean age duration of epilepsy prior to surgery was 22 years. In this series, 54.7% (n=41) were operated on the left side. Preoperative intracranial recording was performed in thirteen patients (17%). Hippocampal sclerosis was diagnosed at pathology either alone (59%) or with other diagnosis (12%). There were 21 anterior temporal lobectomies (ATL), 23 selective amygdalo-hippocampectomies (SAH), and 5 lesionectomies. After a mean follow-up of 4.3 years, 88% (n=66) of patients had a satisfactory outcome (Engel I and II). A worse outcome occured in the setting of higher number of antiepileptic drugs, older onset epilepsy, non-normal pathology, left-sided resection and early onset somatosensory symptoms. There was a 3% infection rate in patients undergoing TLE surgery alone as compared to 23% for those with invasive monitoring. Quadranopsia Hemorrage *Conclusion:* Long-term seizure outcome and complication at our center is comparable to previous reports.

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

P-123

Metastatic choriocarcinoma: a treatable cause of intracranial hemorrhage and status epilepticus

Z Abu-Sharar (Vancouver), P Teal (), M Heran (), MB Connolly (Vancouver)*

Background: Cerebral metastatic choriocarcinoma is very rare. Clinical features include seizures, focal weakness or cognitive changes. *Methods:* Review of medical records and clinical course. *Report:* A 16 year old woman presented with episodic tingling and weakness of the left hand, 9 days post-delivery of a healthy infant girl. The pregnancy was uncomplicated. Her mother had breast cancer and a grandparent had an early stroke. She had several focal episodes of simple partial status involving the left hand and arm for 1 hour. Mental status and cranial nerve examination was normal. She had left arm and hand weakness. General examination was normal. CT and MRI demonstrated a large hemorrhage in the right parietal region and multiple smaller hemorrhages. Cerebral angiography was normal. Extensive testing for hypercoagulable disorders, rheumatologic disorders were negative. Echocardiogram demonstrated a PFO and no vegetations. Beta-hCG was 170,000. Chest x-ray demonstrated multiple pulmonary metastases. She received Phenytoin, chemotherapy comprising dactinomycin, methotrexate, cisplatin, etoposide, and folinic acid. She also received cranial radiation. At most recent follow-up, beta-hCG is normal, and no evidence of cranial or lung metastases. *Conclusion:* Metastatic choriocarcinoma should be considered in the differential diagnosis of stroke and seizures post-partum. The key to diagnosis is an elevated beta-hCG.

P-124

Evaluation of concomitant temozolomide and radiotherapy treatment in patients with glioblastoma multiforme in two Canadian tertiary care centers: retrospective population based cohort study

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Background: Glioblastoma multiforme (GBM) is the most aggressive and frequent primary malignant brain tumor in adults. In 2004, Stupp et.al demonstrated a statistical significant survival benefit for patients treated with concomitant/adjuvant temozolomide (TMZ) and radiation therapy (RT). *Objective:* To evaluate the efficacy of concomitant temozolomide and RT after proved efficiency in a randomized controlled trial. The research question was "among treated GBM patients in Edmonton and Halifax; does the survival rate differ with introduction of concomitant temozolomide and RT versus non concomitant treatment?" *Method:* The data of 346 patients (216 from Edmonton and 130 from Halifax over the period 2000-2006) was both retrospectively and prospectively collected. Patients who were at least 18 years or older with a pathological diagnosis of GBM were included. Patients are classified according to the modality of the treatment they received (surgery alone, surgery and RT, Surgery with concomitant and adjuvant TMZ and RT). *Results:* The hazard ratio HR of TMZ group was 0.53(95%CI 0.38-0.75). The HR of resection vs. biopsy was 0.50(95%CI 0.37-0.67), HR for time to radiation was 0.95(95%CI 0.91-0.99) for every week of delay in radiation where the HR of age was 1.02(95%CI 1.01-1.03) for every extra year. *Conclusion:* TMZ is associated with longer survival in our population based study (18 months). Age; surgical resection and shorter time to radiation therapy are important factors for longer survival.

P-125

Brain tumor stereotactic biopsy: fame-based or frameless?

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Introduction: The choice of performing brain tumor stereotactic biopsy with or without a stereotactic frame depends mostly on the personal experience, preference or familiarity of the surgeon with the instruments. Until now, many studies have looked at each technique individually, but few have compared them. This study evaluated both approaches and compared diagnostic yield, surgical complications and socio-economic aspects. *Methods:* We have reviewed 335 cases of brain tumor stereotactic biopsy performed in the same hospital over a 7-year period. Both types of stereotactic biopsy approaches were used. Histopathologic results, complications and impact on the healthcare system were studied. *Results:* Both techniques showed a high degree of diagnostic yield, and similar low morbidity rates. However, significant differences in favor of the frame-based technique were highlighted, including anesthesia type (local versus general) and the number of days spent in the hospital. *Conclusion:* Frame-based and frameless stereotactic biopsy approaches were equally effective at providing a tissue diagnosis with similar low rates of morbidity. On the other hand, the

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frame-based approach has less impact on the healthcare costs by utilizing less anesthesia resources and requiring shorter hospital stays.

P-126

Cavernous hemangiomas associated with primary brain tumours: case reports and etiological hypotheses

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The co-existence of primary brain tumours and cavernous hemangiomas is a rare occurrence, and the causative association, if any, has not been elucidated. On the contrary, radiation-induced cavernous hemangiomas have been described in large case series, and evidence, including mouse models, is most consistent with a two-hit hypothesis involving the cerebral cavernous malformation (CCM) family of loci and the tumor suppressor gene, p53, in the pathogenesis of these lesions. We present a novel case of cavernous hemangioma associated with a primary intraaxial brain tumour, and discuss the possible causative pathogenic mechanisms of this association, including the two-hit gene alteration hypothesis, as well as the role of tumor-derived angiogenic factors.

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P-127

Clinicopathological implications of congenital brain tumours: 10-year experience at Hamilton Health Sciences

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Background: Congenital brain tumours are rare accounting for 1.1–3.4 per million live births with a proportion of 0.5–4% of all paediatric brain tumours. These neoplasms comprise 5–20% of all cancer-related deaths during the perinatal period. *Methods:* A retrospective study based on review of autopsy and neurosurgical specimens with the diagnosis of brain tumour from November 1999–2009 was conducted in the Division of Neuropathology at Hamilton Health Sciences, McMaster University. *Results:* The series included 6 cases (4 female; 2 male). Four cases were diagnosed antenatally by ultrasonography and magnetic resonance imaging. Histology of tumours consisted of 2 teratomas, 2 choroid plexus papillomas (CPP), 1 gemistocytic astrocytoma, and 1 glioblastoma multiforme. Two patients were stillbirths, two died as neonates, and one died at 7 months of age. Only one case (CPP) underwent surgery and the patient is alive. *Conclusions:* Our six cases illustrate the diversity of congenital brain tumours. Relative to the literature, our series presents a rare case of congenital gemistocytic astrocytoma with an increased occurrence in CPP (33%). This case series also illustrates the difficulties associated with the reduced sensitivity of ultrasonography for early fetal diagnosis and the limitations of current diagnostic and therapeutic interventions.

P-128

Hemostasis management during completely endoscopic removal of a highly vascular intraparenchymal cerebellar tumor: technique assessment

N McLaughlin (Santa Monica), D Kelly (Santa Monica), DM Prevedello (Pittsburgh), K Shahlaie (Santa Monica), A Kassam (Santa Monica)*

Background: Recently, stereotactic-guided removal of intra-parenchymal lesions through a brainport using endoscopic visualization has been successfully reported. Although endoneurosurgical tumor resection uses the same principles as those used in microneurosurgery, the ability to control bleeding through the port requires an adapted technique particularly in the posterior fossa. *Method:* We present a patient that underwent a completely endoscopic resection of a highly vascular brain tumor through a brainport and describe the hemostatic technique. *Result:* A 68 yr-old female presented with progressive gait difficulties. She had been previously treated for a breast cancer. MRI showed a right subcortical solitary cerebellar lesion that homogeneously enhanced. The patient underwent an endoscopic brainport for removal of a supposed brain metastasis. After port cannulation, the tumor partly delivered itself along with active bleeding. After irrigation and application of surgifoam, numerous tumor vessels were visualized. The suction served as countertraction, elongating the vessels, while an adapted bipolar coagulated over a long segment the vessels. Hemostasis was performed circumferentially along the cavity's walls from deep to superficial. Pathology confirmed intra-operative suspicion of hemangioblastoma. *Conclusion:* Removal of highly vascular lesions is feasible through the brainport, including posterior fossa leisons. However, specific hemostasis techniques must be mastered in order to assure rapid control of bleeding.

P-129

The endoscopic endonasal transmaxillar approach to pterygopalatine fossa schwannomas

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Background: Pterygopalatine fossa (PPF) schwannomas are very rare lesions arising most often from branches of the trigeminal nerve. Symptomatic lesions have been traditionally approached by conventional external approaches. However, the development of expanded endonasal approaches (EEA) has enabled to reach such deep lesions through less invasive routes. *Method:* Case report and review of the literature *Results:* A 41 yr-old female was referred to our clinic with a 6-year history of right sided facial pain and numbness. Symptomatology had increased over the last year. More recently, she developed right side otalgia. MRI revealed a right pterygopalatine fossa mass, hypointense on T1 and T2 sequences with homogeneous enhancement following gadolinium. A biopsy was attempted in another institution but was non-diagnostic. Complete removal of this lesion was possible through an endoscopic endonasal transmaxillar approach with image guidance assistance. Final pathology confirmed the diagnosis of schwannoma. Post-operatively, the patient's symptoms significantly improved. *Conclusion:* The endonasal transmaxillar approach should be

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recommended for removal of PPF lesions that are located medial and inferior to critical neurovascular structures. This approach enables safe tumor removal with less morbidity than conventional routes.

P-130

Medulloblastoma and gorlin syndrome: an extraordinary case of survival without adjuvant therapy

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Background: Patched gene (PTCH) is implicated in desmoplastic medulloblastoma. Germline mutations in PTCH are associated with Gorlin syndrome (GS). GS is characterized by multiple developmental anomalies, a predisposition to neoplasms and desmoplastic medulloblastoma. The best survival in medulloblastoma is following gross total resection with adjunctive radiotherapy and chemotherapy. Some patients have been cured with surgery and intensive chemotherapy. Avoiding radiation is of particular importance in children with GS given their predisposition to developmental delay and radiation induced tumors. *Methods:* This is a case report of a child with medulloblastoma and GS treated with resection alone. *Results:* A 4-month-old male had a gross total resection of a posterior fossa desmoplastic medulloblastoma with extensive nodularity (MBEN). Aggressive chemotherapy was not given in view of his extensive medical issues and severe developmental delay. Given his age, he was not a candidate for radiation. The diagnosis of GS was confirmed by phenotypic diagnosis. Two years post-operatively he remains in remission with remarkable developmental gains. *Conclusion:* This is the first report of MBEN progression-free survival following resection alone. It is widely accepted that MBEN has a better prognosis and we postulate that surgery alone may be curative in the context of GS.

P-131

Intravascular large B-cell lymphoma masquerading as primary CNS angiitis

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Background: Intravascular large B cell lymphoma (IVLBCL) is a rare subtype of Non-Hodgkins lymphoma that remains exclusively within the lumen of small vessels thereby affecting any organ. When the CNS is the primary system of involvement, the diagnosis can be difficult to establish and may not be determined until post-mortem. *Methods:* We present a 65 year old man with IVLBCL who initially presented with sub-acute cognitive decline. He was first diagnosed with acute demyelinating encephalomyelitis. As he developed progressive neurological deficits and new MRI lesions were identified with prominent restricted diffusion, the white matter lesions were thought to likely be ischemic. Diagnostic considerations included vasculitis and IVLBCL. *Results:* Cerebral angiography showed vascular tapering in small vessels of the CNS compatible with a small vessel vasculitis. He improved on prednisone and cyclophosphamide. As prednisone was tapered, he deteriorated and more white matter lesions were noted on MRI. A brain biopsy revealed IVLBCL. *Conclusions:* Our case illustrates one example by which IVLBCL mimics other diagnoses - particularly primary CNS vasculitis - and may be indistinguishable except by pathological evaluation. Therefore, clinicians must maintain a high index of suspicion for IVLBCL as early diagnosis and treatment provide a greater chance of survival.

P-132

Herpes encephalitis and glioblastoma multiform: a rare but serious occurrence

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Background: Herpes simplex virus (HSV) encephalitis with gliomas including glioblastoma multiform (GBM) is a rare occurrence with only four adult and three paediatric patients found in an English literature review. *Method:* Literature cases were reviewed and we present a 51 year old male with a right temporal lobe GBM with HSV encephalitis 3 weeks after radiation therapy. *Results:* After four days of worsening partial seizures he developed status epilepticus. He was initially afebrile. Dilantin and propofol, then keppra and a pentobarbital coma were used. EEG changes: independent bi-hemispheric PLEDs suppressed by propofol with left epileptiform discharges, and MRI brain with bitemporal punctate haemorrhages were consistent with HSV encephalitis. Cerebral spinal fluid (CSF) was positive for HSV PCR, despite a white cell count of nine. Acyclovir was started, but he died. Literature cases were in status epilepticus with fever, and pleocytosis or normal CSF resembling status epilepticus without infection. Seizures started within a month of radiation, chemotherapy or surgery. *Conclusion:* Although rare, HSV encephalitis should be considered when patients with a GBM develop status epilepticus, despite being afebrile. Early EEG, CSF analysis and empiric antiviral treatment should be considered. Rule out infection even if CSF pleocytosis is consistent with postictal values.

P-133

Subtotal resection of vestibular schwannomas: a restrospective review of one centre's experience

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

Background: Vestibular Schwannomas are the most common lesion affecting the cerebello pontine angle and account for 10% of all intracranial lesions. Although histologically benign, they often cause deficits through a compression of surrounding neurovascular structures. Treatment is challenging given the eloquence of surrounding anatomy and while considered curative, gross total resection may be precluded by the potential for further injury. Numerous studies suggest that subtotal resection can offer symptomatic relief as well as bridge patients to adjuvant therapy; however few studies have reported the longitudinal outcomes of patients with subtotal resection. Here we review the experience of a single surgeon in a quartenary surgical care centre. *Method:* Retrospective chart review of all patients undergoing subtotal resection of vestibular schwannoma. *Results:* A total of 20 patients were identified. No patients died in the peri operative or follow up period. Demographic, morbidity, and outcome data was tabulated and reviewed. Quality of life surveys completed by patients pre and post operatively were also reviewed. *Conclusions:* Although subtotal resection for vestibular schwannomas represents a suboptimal result, long term patient outcomes are positive. A minority of patients require further treatment beyond interval

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observation. Further clinical deficits are in keeping with known complication rates. In addition, subjective patient outcomes suggest an overall improvement in quality of life that is stable with ongoing follow up. These findings suggest that subtotal resection, although not ideal, does represent a viable and feasible option in cases where gross total resection is not possible.

P-134

Gliomatosis cerebri presenting as bilateral thalamic glioma: case report and review of the literature

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

We report a case of a 75-year-old woman with gliomatosis cerebri who has a rare diffuse bilateral thalamic glioma. She presented with a constellation of symptoms including fatigue, excessive daytime somnolence, memory impairment and gait disturbance. T2-weighted magnetic resonance imaging revealed enlarged thalami with homogenous hyperintensity and absence of contrast enhancement. Histological examination of the biopsy specimen identified a diffusely infiltrative astrocytoma (WHO grade II) with Ki-67 positive cells. Gliomatosis cerebri involving both thalami is an extremely rare variant of thalamic neoplasms, that can be distinguished clinically and radiologically from other gliomas. In the handful of reported cases, the presenting symptoms were cognitive impairment varying from personality changes to frank dementia. MRI showed symmetrically enlarged thalami in all cases. Death usually occurs within one to two years following diagnosis, independent of adjuvant chemotherapy or radiotherapy.

Key Words: Gliomatosis Cerebri, Bilateral Thalamic Glioma, Cognitive Impairment

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

P-135

Endogenous neural stem/progenitor cell proliferation and differentiation with a novel biomaterial

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Background: We have developed a biodegradable poly-lactide co-glycolide (PLGA) biomaterial for sustained, targeted release of trophic factors to promote proliferation and differentiation of adult neural stem/progenitor cells (NSPC) following neural injury. Iron oxide nanoparticles were also used to label the biomaterial and enable non-invasive evaluation of biodegradation by magnetic resonance imaging (MRI). To assess the effect of PLGA and nanoparticles on NSPC proliferation, differentiation and toxicity, we utilized an in vitro model of rat NSPC. *Methods:* NSPC were cultured for 14 days with and without PLGA. Cell counts and propidium iodide were used to assess proliferation and toxicity of adult rat NSPCs. Nanoparticle toxicity was assessed with concentrations of 0.01-50mM. The effect of PLGA on differentiation at 7 days into astrocytes, oligodendrocytes and neurons was assessed with immunocytochemistry. *Results:* No significant differences in proliferation and differentiation between NSPCs cultured with or without the biomaterial were observed (ANOVA, $p<0.05$). NSPC toxicity was not found with nanoparticle concentrations <10mM. *Conclusion:* PLGA can be used for factor release without affecting NSPC proliferation and differentiation. Iron oxide nanoparticles with a concentration <10mM can be employed as a nontoxic cellular probe for MRI.

P-136

A young patient with an unusual myopathy

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Background: Myopathies are differentiated based on clinical features including age of onset, affected muscle groups, course and histopathologic features. Treatment and prognosis of myopathy depends on correct diagnosis. We present a case of progressive disabling myopathy in a 39-year-old caucasian male. Patient presented with progressive muscle weakness starting at the age of 29 with proximal weakness in four limbs, initially predominantly in lower extremities. Bulbar symptoms started 5 years ago with prominent dysphagia. *Methods:* Patient had electrophysiological studies and was assessed for rheumatologic diseases and paraneoplastic syndromes. *Results:* On examination weakness of neck flexion and proximal greater than distal weakness of all limbs were evident. Finger and wrist flexors were spared compared to wrist and fingers extensors. Patient was areflexic and plantar responses were down-going. Sclerodactyly in toes and fingers was evident. Elevated CK, ANA, ds-DNA and SSA levels were measured. Electrophysiology suggested a myopathic pattern. Two muscle biopsies were suggestive of inclusion body myositis (IBM). Genetic testing for M712T mutation of GNE gene for hereditary inclusion body myopathy (HIBM) and paraneoplastic antibody panel were negative. Autoimmune biomarkers and sclerodactyly suggested connective tissue disease but no clear disease was identified. Weakness progressed despite treatment with prednisone, methotrexate, azathioprine, sulfasalazine and IVIG. *Conclusion:* It is very uncommon that IBM starts at young age. Some characteristics of our case such as young age of onset, rapid course and involvement of finger and wrist extensors greater than flexors counterparts and symmetric involvement argue against diagnosis of sporadic IBM and are more suggestive of HIBM.

P-137

Non-inflammatory necrotizing myopathy responsive to steroids

L Shimon (Halifax), I Grant (Halifax)*

Objective: To describe a case of non-inflammatory necrotizing myopathy highly responsive to steroids. *Background:* There are few cases reports describing patients with proximal myopathy, high creatine kinase (CK), and electromyographic changes of myopathy, with myonecrosis on muscle biopsy without evidence of inflammation. *Methods:* Case report. *Results:* A 62-year-old woman was referred for evaluation of asymptomatic elevated CK (600 U/L). Examination was initially normal and EMG showed minimal paraspinal muscle irritability. The CK continued to rise, and she developed progressive proximal weakness over 18 months, resulting in marked disability. EMG showed widespread irritable myopathy. Three muscle biopsies were performed, all showing necrosis without inflammation. Immuno-histochemistry showed patchy staining for

calpain–3, but genetic analysis of the calpain-3 gene was normal. No abnormalities of other muscle proteins were identified. Extensive imaging showed no evidence of malignancy. CK peaked at greater than 5000. Treatment with prednisone (60 mg/day) produced a rapid improvement in strength and declining CK. Low-dose steroids have been required to maintain her remission. *Conclusion:* A trial of steroid treatment is indicated in patients with idiopathic necrotizing myopathy. The response to steroids implies an immune mechanism despite the absence of inflammation.

P-138

Screening for late onset acid maltase deficiency in a neuromuscular clinic

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Background: Classic presentations of late onset acid maltase deficiency (AMD) include weakness of the trunk and girdle muscles, isolated respiratory failure or both. Rarer presentations include elevated creatine kinase (CK), myalgias and exertional intolerance. A screening blood test for α acid glucosidase (GAA) activity became available in 2007. *Methods:* All patients seen in 2008 and 2009 with unexplained proximal weakness or myalgias ± an elevated CK or dyspnea were screened with the dried blood spot (DBS) for GAA activity. *Results:* Reduced GAA activity was found in 2/40 screened (n=19 limb girdle weakness; n=17 myalgias ± elevated CK; n=3 dyspnea; n=1 head drop). Profound reduction in GAA was present in a 39 year old woman with a high pre-test probability (chronic limb girdle weakness with symptoms of ineffective nocturnal ventilation). A 53 year old man with limb girdle weakness had activity just below the lower limit of normal; DNA analysis confirmed a single mutation suggesting he is a carrier. *Conclusions:* DBS for late onset acid maltase deficiency has greatly facilitated screening for this rare metabolic myopathy. A high pre-test probability based on the classic clinical presentation increases the yield. Screening could be deferred until and if progression is evident provided baseline pulmonary function tests and strength is normal.

Trauma, Critical Care

P-139

Accurate insertion of external ventricular drains in ICU setting: a retrospective study

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The monitoring of intracranial pressure (ICP) and maintaining sufficient cerebral perfusion pressure are crucial measures in ICU management after intracranial subarachnoid hemorrhage. The need for external ventricular catheter insertion is one way to achieve those goals. It has the advantage of monitoring the ICP, draining CSF for ICP control, CSF sampling, draining intraventricular blood and occasionally injecting chemotherapeutic agents into the ventricular system. Traditionally, they are inserted through the skull based on external surface landmarks aiming towards the foramen of Monro. However, some ventricular catheters may land or pass into important periventricular structures and may cause neurologic injury. We review the Montreal Neurological Hospital and Institute ventricular catheters insertions in 200 patients, so as to critically review our insertion techniques and guidelines, aiming towards an alternative approach for more accurate EVD insertion.

P-140

Computed tomography versus magnetic resonance imaging of the brain in comatose intensive care unit patients

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Background: Neuro-imaging is often performed on comatose intensive care unit (ICU) patients with various brain disorders. Some of these are detectable with computed tomography (CT) scans, but others are probably better seen with magnetic resonance imaging (MRI). *Objective:* To determine the relative sensitivity of CT scans and MRI with respect to the clinical problem being addressed. This may help in identifying the most appropriate imaging modality in ICU patients. *Methods:* retrospective review of medical records, CT and MRI reports of all ICU patients who have had both procedures done between July 2004-2009, while admitted to one of our adult ICUs. *Results:* The MRI revealed abnormalities relevant to the clinical problem in all 136 patients. In subcategory analysis, MRI revealed additional relevant findings not seen on CT as follows: 23/27 (85%) of hemorrhagic lesions, 33/36 (92%) of ischemic strokes, 19/27 (70%) of traumatic lesions, 8/14 (57%) of CNS infections, 17/25 (68%) of metabolic abnormalities and 7/7 (100%) of neoplastic lesions. *Conclusion:* MRI is more sensitive than CT in comatose ICU patients for answering clinical problems and should be the imaging modality of choice.

P-141

The predictive value of clinical and immunological factors in the development of pneumonia after traumatic brain injury

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Background: Patients with traumatic brain injury (TBI) are at high risk for infection, perhaps due in part to suppressed humoral immunity. We have undertaken a study to determine the relationship between immunoglobulin (Ig) levels and the development of early onset (EOP) and ventilator acquired (VAP) pneumonia. *Methods:* Patients presenting to two Edmonton trauma centres were recruited. Inclusion criteria included: age >18, ICU admission, and ≥1 of the following: initial or hospital admission Glascow coma score (GCS) ≤8, decompressive surgery, evidence of brain herniation on CT, or intracranial pressure monitoring. Ig levels were measured on presentation, day 7 and day 14. ICU records were reviewed to determine development of EOP and VAP. *Results:* Twenty-seven patients with TBI were enrolled (mean age =37.4, mean initial GCS =5). EOP and VAP occurred in 11% and 33.3% of patients respectively. IgG, IgM, and IgA levels were significantly lower on day 1 as compared to day 14. No significant association was demonstrated between admission GCS, age, or IgG/IgA/IgM levels and the development EOP. Higher admission GCS (OR 1.9, p =0.05) was an independent predictor of the development of VAP. Higher IgA levels at day 14 (OR 6.0, p =0.08) were quantitatively but not statistically associated with development of VAP. *Conclusion:* In a population of patients with TBI, a higher triage GCS was an independent predictor for developing VAP. Patients who developed VAP tended to have higher IgA levels at day 14 compared to those

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that did not. For all patients with TBI, Ig levels tended to be lowest at presentation.

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Good functional recovery in a patient with severe anoxic encephalopathy with bilaterally absent N20 somatosensory evoked potentials

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Background: The absence of the N20 somatosensory evoked potentials (SSEPs) is considered an accurate predictor of poor outcome in patients with anoxic-ischemic encephalopathy with no false positives. *Methods:* We report a case of severe anoxic encephalopathy with bilaterally absent N20 SSEPs who made a good recovery. *Results:* The patient was a 29-year-old man with a history of hemophilia and positive HIV status. He suffered a severe hypoxic event on December 14, 2008 from epiglottal hematoma requiring urgent tracheotomy. Post op he had treatment resistant myoclonic status epilepticus. He was treated with Valproate, Clonazepam, Phenobarbital, and Levetiracetam. A brain MRI performed 3 times was unrevealing. EEG monitoring demonstrated continuous spike and wave activity. Continuous EEG was used to monitor and adjust treatment. SSEPs revealed bilaterally absent N20. After prolonged ICU stay he started to have a gradual improvement. He was discharged home on March 5, 2009. On discharge he was awake, alert, oriented, cooperative and able to communicate. *Conclusions:* Bilaterally absent N20 somatosensory evoked potentials have been used to predict death and dependency with reported high degree of certainty in the literature. This case highlights some of the potentials pitfalls of the N20 SSEPs and indicates that one should be cautious in outcome predictions using N20 SSEPs.

P-143

Early tracheostomy – effect on the outcome of severe head injury patients

*RA Shah (Rawalpindi)**

Background: Tracheostomy is a frequently performed procedure in patients with severe head injury. It helps by improving ventilation by reducing dead space. *Aims and Objectives*: To assess the effects of early tracheostomy on the outcome of head injury patients. *Methods:* This study was done in the Department of Neurosurgery, Pakistan Institute of Medical Sciences, Islamabad from December 2006 to May 2007. In this retrospective study data was collected through patients' record books and files. Patients were divided into two groups: 1) Group A – patients with early tracheostomy done within seven days, 2) Group B – patients with late tracheostomy done on day 07 or later. Only patients with isolated severe head injury were included in this study. *Results:* A total of 54 patients were studied. Mean age and male to female ratio were similar in both groups. Mean Glasgow Coma Scale (GCS) in group A was 5.5 and in group B was 5.1. Mean time of tracheostomy in group A was 3.7 days and in group B was 7.9 days. Ventilator support was available in 30% and 50% patients in group A and B respectively. Mean ICU as well as total hospital stay was less in group A as compared to group B. Mortality rate was also reduced in early tracheostomy group. *Conclusion:* Early tracheostomy in severe head injury patients favors good outcome, less need for ventilator support, reduces hospital stay and mortality.

Stroke - Prevention and Treatment

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P-144

Progression of dural aterio-venous fistula: a case report and review of the literature

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Background: Worsening or progression of Dural Arterio-Venous Fistula (DAVF) is rare and difficult to manage. *Method:* We report a case of a 50 year old hypertensive female who presented with aneurysmal SubArachnoid Heamorrhage (SAH) Hunt and Hess grade 2. Her Glasgow Coma Scale (GCS) was 15. No cranial nerve and motor deficits were detected. The initial cerebral angiography showed presence of 3 aneurysms and a Dural Arterio-Venous Fistula (DAVF). The 3 aneurysms are: basilar tip aneurysm (coiled successfully), right posterior communicating aneurysm (not treated) & and left cavernous internal carotid aneurysm (not treated). On post-SAH day 5, she developed vasospasm so milrinone infusion was given. In a course of 8 days and on follow-up angiography, the fistula had changed, presenting intradural venous drainage towards the cranial cavity. *Result:* The cause of progression of the DAVF is unknown. The mechanisms which might explain this worsening are:stenosis or thrombosis of the venous outflow, increased arterial flow, appearance of new fistulae or extension of the initial shunt & hemodynamic changes created by the vasospasm and its treatment. *Conclusion:* we use this interesting case to discuss the mechanisms of progression of DAVF and review the literature.

P-145

Low sensitivity and specificity of Oxfordshire community stroke project classification: a prospective MRI study

N Asdaghi (Edmonton), M Saini (Edmonton), B Hameed (Edmonton), J McCombe (Edmonton), T Jeerakathil (Edmonton), D Emery (Edmonton), K Butcher (Edmonton)*

Background and Purpose: Stroke syndrome classification influences patient investigation and management. The Oxfordshire Community Stroke Project (OCSP) is a commonly used clinical classification tool. We conducted a prospective study of OCSP versus MRI in classifying stroke patients. *Methods:* Patients with stroke symptoms within 48 hours of onset were included. Clinical OCSP classification and MRI classification were completed independently. Diffusion-weighted imaging (DWI) lesion volumes were measured. *Results:* Of 100 patients enrolled, those with stroke were more likely to have lesions with restricted diffusion (64/78) than those with TIA (10/22; $\lambda 2=11.94$, $p=0.001$). Patients were clinically classified as Total Anterior Circulation (TACI) (6), Partial Anterior Circulation (PACI) (50), Lacunar (LACI) (31) and Posterior Circulation (POCI) (13). Clinical OCSP had the following sensitivity (SE), specificity (SP) and positive predictive value (PPV) in correctly predicting DWI lesion location; TACI (SE: 100%, SP: 97%, PPV: 66%), PACI (SE: 73%, SP: 56%, PPV: 44%), LACI (SE: 53%, SP: 83%, PPV: 44%),

POCI (SE: 90%, SP: 98%, PPV: 90%). The positive likelihood ratio of clinical OCSP was 33 (TACI), 1.65 (PACI), 3.11 (LACI) and 45 (POCI). Mean infarct volume in those classified radiologically as LACI (0.94+/-0.68 ml) was significantly smaller than those classified clinically (3.7+/-4.7 ml, p=0.036). *Conclusions:* The OCSP clinical classification system does not accurately discriminate between lacunar and partial anterior cortical infarcts. Mean infarct volume in lacunar syndrome patients is overestimated by clinical categorization. Investigation for stroke etiology should not be based on clinical classification alone.

P-146

Acute perfusion and diffusion abnormalities predict early new MRI lesions after minor stroke and transient ischemic attack (TIA)

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Background: Minor stroke and transient ischemic attack (TIA) are associated with high clinical recurrence rates at one week. We prospectively studied the correlation between baseline perfusion deficit and subsequent ischemic lesion development. *Methods:* Patients with minor stroke (NIH stroke scale score ≤ 3) and TIA (n=44) underwent MRI at admission, 1 and 4 weeks after onset. Acute PWI deficit and DWI lesion volumes were measured planimetrically. *Results:* Baseline DWI lesions were present in 23/44 patients (52%). New lesions developed in 7/44(16%) at 1 week and 3/44 (cumulative10/44 (23%)) at 4 weeks. Patients with normal baseline DWI scans did not develop infarcts at any point. Patients with new infarcts at day 7 were significantly more likely to have baseline DWI lesions ($\lambda 2=6.08$, p=0.014) and larger baseline DWI lesion volumes (16.3+/-8.1 ml) than those without (1.89+/-3.7 ml, p<0.001). Patients with recurrent lesions were more likely to have baseline PWI deficits ($\lambda 2=19.6$, p<0.0001). PWI lesion volumes (Tmax+2s) were larger in patients with recurrent lesions at 7 days (median 52 ml, range 9-79 ml) than those without (median 0 ml, range 0-84 ml, p<0.001). All subsequent lesions were within the PWI deficit territory. Baseline DWI lesion volume (OR=1.52 per ml [1.12, 2.07], p=0.009) and PWI deficit volume (OR-1.05 per ml [1.01, 1.08], p=0.009) predicted recurrence of lesions at day 7. *Conclusions:* Early recurrence of stroke is much more likely in patients with acute perfusion deficits and larger baseline DWI lesions. Recurrence may actually represent infarct completion in originally hypoperfused cerebral tissue.

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Combined full dose IV tPA and IA therapy versus primary IA therapy in proximal vessel occlusions

R Bhatia (Calgary), N Shobha (Calgary), B Menon (Calgary), SP Bal (Calgary), P Kochar (Calgary), J Wong (Calgary), W Morrish (Calgary), M Hudon (Calgary), T Watson (Calgary), M Goyal (Calgary), A Demchuk (Calgary), M Hill (Calgary)*

Background: There is an increasing trend to treating proximal vessel occlusions with IV-IA thrombolysis. We compared the combination of full dose IV tPA and intrarterial (IA) thrombolytic therapy to IA therapy alone. *Methods:* Between 2002-09, we reviewed our CTA database for patients who received full dose IV tPA and endovascular therapy or endovascular procedure alone for acute ischemic stroke. mRS ≤2 at 3 months was used as good outcome. Recanalization was defined as TIMI 2-3 flow on angiography. *Results:* Among 157 patients, 103 patients received IV-IA treatment and 54 patients underwent direct IA therapy. Overall, recanalization was a strong predictor of reduced mortality (RR 0.48 CI95 0.27-0.84) and favourable outcome (RR 2.14 CI95 1.3-3.5). Anterior Occlusions:(n=118).There were 80 patients in IV-IA group, of whom 11 recanalized with IV tPA alone, and 38 in IA along group. Recanalization occurred in 74% with IV-IA therapy and 50% with IA therapy alone (RR 1.48 CI95 1.04-2.1). Recanalization was associated with reduced mortality and greater favourable outcomes. We could not show a convincing association with favourable outcome by IV-IA therapy vs. IA therapy (RR 1.63 CI95 0.8-3.1). Vertebrobasilar Occlusion: (n= 39) There were 23 patients in IV-IA group, of whom 1 recanalized with IV tPA alone, and 16 patients in IA along group. Neither treatment modality, nor recanalization were associated with favourable outcome or death. *Conclusions:* Recanalization is a strong predictor of reduced mortality. Recanalization occurs more frequently with IV-IA therapyin anterior circulation events only. Outcomes were not clearly better with IV-IA therapy vs. IA therapy alone.

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Low rates of acute recanalisation with Intravenous tPA in proximal vessel occlusions

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Background: Acute rates of recanalisation after IVTPA in proximal vessel occlusion have been estimated sparingly. We aimed to study recanalisation rates of IV tPA in CTAngiogram (CTA) proven proximal (ICA, M1 and M2) occlusions. *Materials and methods:*. CTA database of the Calgary stroke program was reviewed for the period 2002-09. All patients of proximal vessel occlusions receiving IV tPA and assessed by a TCD or an angiogram were included for analysis. The cohort was selected by an intent to go to angio. Rates of acute recanalisation as observed on TCD/first run of angiogram. MRS≤2 at 3 months was used as a good outcome. *Results*. Among 1341 patients in the CTA database, 388 patients with proximal occlusion were identified. Of these, 216 patients had received IV tPA. 127 patients underwent further imaging to assess recanalisation. The mean TCD time was 76.15±23.20 (15-120) minutes and the mean tPA bolus to angiogram time was 84.17 ± 45.47 minutes. Among the patients undergoing TCD(n=46) and Angiogram (n=103), only 27 (21.25%) patients recanalised acutely. By occlusion subtype, the rates of recanalisation were: (distal ICA: 1/24 (4.16%), MCAM1+/-ICA neck: 21/65 (32.30%), M2MCA:4/13 (30.76%) and BA: 1/25(4%)) Onset to tPA time was comparable in patients with and without recanalisation. Recanalisation (p<0.0001, RR 2.712369, 95%CI 1.59-4.60) was the strongest predictor of outcome (adjusted for age and NIHSS). *Conclusions:* A low rate of acute recanalisation was observed with IV tPA in proximal vessel occlusions. Recanalisation was the strongest predictor of good outcome.

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Risk factors with carotid intimal media thickness in elderly asymptomatic individuals subjects

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Background: Atherosclerosis is major risk factor for cerebrovascular and cardiovascular disease. Several reported were incriminated carotid intimal media thickness is marker of future risk of cerebrovascular disease. *Aim:* We aim to investigate the carotid Intimal Media thickness (IMT) in individuals more than 40 year age group asymptomatic in frequency and future risk cerebrovascular ischemia. *Material and Methods:* This study was conducted on consecutive individuals > 40years of age attending the out patient Neurology services of Nizam's Institute of Medical Sciences, Hyderabad coming with non-cerebrovascular symptoms. A total of 1392 asymptomatic subjects underwent carotid Doppler examination. IMT on mid common carotid artery (CCA) was measured. All subjects' blood was taken for biochemical examination for fasting blood sugar and lipid profiles. Data was obtained from all subject for alcohol consumption, smoking, and hypertension. *Results:* Out of 1392 asymptomatic subjects, 571 (41%) had abnormal IMT and 821(59%) had normal IMT. On comparison by univariate analysis between the two groups (abnormal IMT and normal IMT), the factors significantly associated with abnormal IMT were mean age ($p<0.0001$), hypertension ($p<0.0001$), diabetes ($p<0.0001$), smoking ($p=0.8$) and hypercholesterolemia ($p=0.0001$). After adjustment of multiple logistic regression Age, (odds 3.2; 95% CI 2.5-4.1) Sex (Odds 1.5; 95% CI 1.1-1.9), hypertension (odds 1.4; 95% CI 1.1-1.8), diabetes (odds 1.3; 95% CI 1.0-1.7) and hypercholesterolemia (odds 1.5; 95% CI 1.1-2.0). *Conclusion:* We found in our study that Age, Sex, hypertension, diabetes and hypercholesterolemia were independent risk factors in abnormal IMT in elderly asymptomatic subjects.

P-150

Invasive cortical near infrared spectroscopy for quantitive assessment of cerebral blood flow

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Background: The ability to measure regional cerebral blood flow during aneurysm surgery is currently limited, and the use of temporary vessel occlusion produces a small risk of ischemic stroke. We have developed a method to serially quantitate cerebral blood flow in regions at risk for ischemia. *Methods:* A supraorbital craniotomy in pigs weighing 10 – 15 kg was performed under general anaesthetic to expose the middle cerebral arteries (MCAs). Two small burr holes were made in the skull overlying the vascular territory of the MCAs for the emission and reception optodes. Intravenous injections of indocyanine green dye (ICG) with concurrent recordings of oxy and deoxy hemoglobin allowed quantitative assessment of cerebral blood flow (CBF). CBF was assessed at baseline, with temporary clip application to the MCAs, and during reperfusion. *Results:* Anatomical variability in porcine MCAs allowed successful measurements in three out of five animals to date. Baseline, ischemic, and restored cerebral perfusion averaged 57.5 +/- 6.5 ml/min, 26.3 +/- 7.2 ml/min, and 62.0 +/- 12.9 ml/min respectively. *Conclusions:* Cerebral blood flow was reliably and reproducibly measured in a porcine temporary MCA clip occlusion model. The current hardware will require revision prior to clinical testing and application.

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"Alien voice" auditory hallucinations as the presenting symptom of acute left middle cerebral artery (MCA) infarction

JG Boyd (Kingston), AY Jin (Kingston)*

Background: Auditory hallucinations are an uncommon feature of stroke, rarely occurring as a consequence of an ischemic infarct, but are not present at the onset of symptoms. *Methods:* Single case report of auditory hallucinations and language disturbance as the presenting feature of acute left MCA infarction. *Results:* A 48 year old right handed woman had complaints of hearing abnormal sounds, including clicks, grunts, and other non-word vocalizations. These auditory hallucinations occurred intermittently for 10-15 minutes, during which time she was unable to speak, but had retained comprehension. Shortly afterwards, the patient developed a severe headache and nausea, without photophobia or phonophobia. Her past medical history was significant for migraines, which were occasionally associated with transient non-fluent aphasia. On exam, she had a very mild language disturbance, with occasional semantic and phenomic paraphasic errors, and impaired naming. Fluency, reading, writing, and comprehension were intact. The remainder of the neurological and general physical exam was unremarkable. Our initial formulation was that the etiology of her symptoms was most likely migraine. However, the CT angiogram showed a filling defect in the distal M2 segment of the left MCA, and the perfusion study was consistent with acute ischemia. On returning from the CT scanner the patient had global aphasia. She was given intravenous tPA with complete resolution of symptoms the following day. *Conclusions:* This case demonstrates the utility of performing multi-modal imaging to identify acute cerebral ischemia, especially in patients with atypical and non-localizing clinical findings.

P-152

Prognostic accuracy of the ICH score on initial evaluation of patients presenting with non-traumatic intracerebral hemorrhage; a systematic review and meta-analysis

*D Agarwal (Rochester), A Surana (Jodhpur), S Chandra (Rochester)**

Objective: To define prognostic accuracy of ICH score in patients presenting with non-traumatic intracerebral hemorrhage. *Methods:* We searched Ovid-Medline and Web of Knowledge databases and hand-searched reference lists of included studies. Independent reviewers selected studies for inclusion and extracted study characteristics, methodological quality criteria, and ICH score data using a standardized data extraction form. We communicated with corresponding authors where ICH score data was not documented. *Results:* ICH score data for quantitative assessment was available in 10 of 13 eligible studies, even after repeated attempt to contact corresponding authors. Five studies validated ICH score prospectively and 5 retrospectively. Studies included in the meta-analysis encompassed 1859 patients from 6 different countries. Of patients with a score ≤2, 14.4% died within 30 days where as 70.9% died amongst patients with >2 ICH score. Cut off point of 2 had sensitivity of 70.9% (95% CI 95; 67.1-74.4) specificity 85.8% (95% CI; 83.7-87.7); positive predictive value of 70.9% (95% CI; 67.1 to

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74.1); negative predictive value of 85.6 (95% CI; 83.5-87.5) in predicting death. *Conclusion:* Our study shows the consistent performance of the ICH score in risk stratifying patients with intracerebral hemorrhage. Cut-off point of 2 has moderate sensitivity and good specificity in predicting mortality in ICH. Though, ICH score is an effective risk stratification tool, it should not be used as the sole mean to determine withdrawal of life support.

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Prognostic utility of ABCD2 score in transient ischemic attack: a systematic review and meta-analysis

*D Agarwal (Rochester), A Surana (Jodhpur), S Chandra (Rochester)**

Objective: To define prognostic accuracy of ABCD2 score in patients presenting with transient ischemic attack (TIA). *Methods:* We searched Ovid-Medline, SCOPUS and Web of Science databases and hand-searched reference lists of included studies. Independent reviewers selected studies for inclusion and extracted study characteristics, methodological quality criteria, and ABCD2 score data using a standardized data extraction form. We communicated with corresponding authors where ABCD2 score data was not documented. *Results:* ABCD2 score data for quantitative assessment was available in 10 of 13 eligible cohorts, even after repeated attempt to contact corresponding authors. Three cohorts validated ABCD2 score prospectively and 7 retrospectively. Studies included in the meta-analysis encompassed 5943 patients from 3 different countries. All the studies defined TIA as per older definition. Of patients with a score <4, 1.7% had stroke within 2 days, 2.1% within 7 days and 4.2% within 90 days of TIA. Patients with ABCD2 score of ≥4, 7.3% had stroke within 2-day, 10.5% within 7-day and 13.2 within 90-day. Cut off score of 4 had sensitivity of 87.7% (95% CI 95; 82.3-91.5) and negative predictive values of 98.3% (97.5-98.9) in predicting stroke within 2 days of TIA. *Conclusion:* Our study shows the consistent performance of the ABCD2 score in predicting occurrence of stroke patients with TIA. Cut-off point of 4 has good sensitivity and negative predictive value. An ABCD2 score of 4 or lower may eliminate the need for observation or hospital admission in patients with TIA.

P-154

Canine aneurysms treated with endovascular flow-diverting stents: testing factors that may predict safety and efficacy

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Background: Flow-diverting (FD) stents are the latest and most promising endovascular tool used to treat intracranial aneurysms. The general principles and parameters predicting the efficacy and safety in terms of aneurysm and branch occlusion are unknown. *Methods:* At the time of this writing, 11 FD stents (Microvention, Inc.) of 57% porosity and pore density of 13 cells/mm2 had been deployed in linear (7) or curved (4) configurations across canine lateral wall (7) or terminal aneurysms (4) with side branches. Angiography was performed immediately, and at 2, 8, and 16 weeks following stenting. *Results:* Peri-procedural thrombosis occurred in the first 3 animals, with two parent vessel thromboses, leading to a change in anti-platelet regimen. In the remainder, FDs led to stagnant aneurysm flow followed by progressive aneurysm occlusion. When the parent vessel remained patent, branch occlusion was not observed. Histopathologic results are pending. *Conclusions:* Endovascular FD stents are promising devices. Preliminary results suggest that under proper anti-platelet coverage, FDs can lead to progressive aneurysm occlusion while sparing "jailed" branches. Our new canine model is suitable for study of the relationships between stent factors (permeability, configuration), anatomic variables (angle and force of blood flow, takeoff angle of branches), and angiographic outcomes.

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The cost of endovascular consumables for the interventional treatment of acute stroke at CHUM Notre-Dame hospital

TE Darsaut (Montreal), V St-Supéry (Montreal), A Weill (Montreal)*

Background: The emergence and development of endovascular technology has changed the way that acute stroke is managed. However, the associated cost of these interventions is not always well-appreciated. *Methods:* We retrospectively determined the cost of the endovascular consumables used in the treatment of all cases of acute stroke at CHUM Notre-Dame hospital (Montreal, Quebec) in 2009. Patient demographics, stroke severity at presentation, angiographic, and clinical outcome at discharge were recorded. *Results:* In the last year, 25 acute strokes were managed by interventional neuroradiology. The mean patient age and NIHSS was 62.7 years and 19.8, respectively. The mean cost of endovascular consumables for these 26 cases was $5693 ($331 – $23173). Sixteen (64%) patients had good vessel recanalization (TIMI 3), whereas recanalization was not obtained in 6 patients (TIMI 0). Discharge mRS was as follows: mRS 1 (1), mRS 2 (3), mRS 3 (5), mRS 4 (7), mRS 5 (1), mRS 6 (8). *Conclusions:* The endovascular management of acute stroke offers the possibility of improved outcomes, but can be associated with substantial cost.

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Time until transfer to rehabiliation center after stroke

P Durand-Martel (Sherbrooke), F Evoy (Sherbrooke)*

Background and objective: The ASA-AHA and the Canadian Stroke Strategy group suggest that post-stroke rehabilitation be initiated as soon and as intensively as possible after the event. In our center, post-stroke rehabilitation consists of a maximum of one daily hour of therapy per therapists until transfer to a specialized rehabilitation center. We wished to evaluate the time until transfer to rehabilitation after acute stroke at our hospital. *Methods:* We conducted a retrospective revision of hospital files for the 100 patients admitted in our neurology department for a stroke between April 1st 2007 and March 25th 2008. We recorded the following dates: admission, discharge and exams that are part of the stroke work-up. We also collected demographic data and information about the type of stroke, evolution, complications and potential causes for delay of hospital discharge. *Results:* The average time from last exam until discharge was 5.7 days for patients that returned to their homes after hospital stay, while the mean time from the request of a transfer to a rehabilitation center until hospital discharge was 11 days (50% of the total length of stay). The difference between these two durations was statistically significant even when demographic data and information about the type, evolution, complications of stroke, as well as potential causes for delay in hospital discharge were taken

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into account by linear regression analysis (p=0.002). A cumulative total of 275 days were spent in hospital waiting for a requested transfer by the 25 patients who were sent to rehabilitation centers.

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Intraoperative angiography during microsurgical resection of arteriovenous malformations in children

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Introduction: Confirmation of successful management of pediatric aretriovenous malformations (AVMs) requires high-quality post-operative angiography. Although the role of intra-operative angiography during microsurgical resection of AVMs is well established in adults, this technique has several limitations including poor image quality and uniplanar image acquisition. *Methods:* The objective of this study was to retrospectively review the demographic, clinical, and radiologic characteristics of all patients who underwent surgical management of an AVM with the aid of high-quality intra-operative cerebral angiography at the Hospital for Sick Children, Toronto, ON. *Results:* Twenty-two children (mean age=13.05 years) underwent surgical management of an AVM using intra-operative cerebral angiography in our image-guidance therapy (IGT) facility. Mean AVM size was 2.55cm with a mean Spetzler-Martin grade of 2.27. Intra-operative angiography in 5/22 (22.7%) patients demonstrated residual AVM requiring additional surgical resection. Procedural complications occurred in 1/26 (3.8%) angiograms. Negative intra-operative angiograms were confirmed with follow-up angiograms in 15/16 (93.75%) patients at a mean of 9.93 months. One patient with a negative intra-operative angiogram demonstrated residual AVM (false-negative rate= 6.25%) on follow-up angiography at 8 months, but had a negative pre-operative angiogram 1 year later in the IGT facility. No patient with a negative intra-operative angiogram required further AVM-directed treatment. *Conclusions:* Intra-operative angiography is a safe and effective adjunct to the surgical management of AVMs in children. This novel approach allows for pre-, intra-, and post-operative acquisition of high-quality images which can help guide the resection of AVMs, especially those of a diffuse or complex angioarchitecture.

P-158

Cavernoma of the third ventricle near the foramen of Monro

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Background: Third ventricular cavernomas are rare and frequently misdiagnosed. We report the case of a patient with such a lesion and discuss the diagnosis and management of these lesions in the light of our experience and the experience of others reported in the literature. *Methods:* The clinical presentation, imaging, treatment, pathology and outcome of our patient are described and compared to similar cases previously reported. *Results:* A 46 year old woman presented with acute hydrocephalus from a 3 cm. lesion of the third ventricle at the foramen of Monro which was diagnosed radiologically as a colloid cyst. A gross total microsurgical, transcallosal resection was achieved and pathological examination revealed a cavernous angioma. The literature on the subject is sparse. Intraventricular cavernomas present more acutely and are diagnosed at a larger size than intraparenchymal cavernomas. MRI can help differentiate them from a colloid cyst. Microsurgery is aided by neuronavigation and intraoperative ultrasonograpy and provides good results. The best predictor of surgical outcome is the clinical status of the patient prior to surgery. *Conclusion:* Intraventricular cavernomas should be included in the differential diagnosis of third ventricular lesions near the foramen of Monro. Microsurgical removal leads to good outcomes in most cases.

P-159

Cerebrovascular challenges in bacterial endocarditis – a case report

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Background: Bacterial endocarditis with cerebral embolism presents an interesting challenge to the Acute Stroke Neurologist. *Methods:* We present a case that demonstrates challenges faced by the Neurologist when bacterial endocarditis presents as acute stroke. We also discuss the rare but serious complication of intracerebral mycotic aneurysm formation. *Results:* A 55 year old woman presented with acutely decreased consciousness and left hemiplegia. She was febrile and NIHSS was 24. CT of the brain revealed hyperdense middle cerebral artery (MCA) and subtle early ischemic changes. CTA confirmed MCA occlusion at the M1/M2 junction and perfusion studies demonstrated large mismatch consistent with penumbra. Subtle hyperintensity over the right frontal convexity was present on CT and thought to be subarachnoid blood. rtPA was withheld. Antibiotics were started and *S.viridans* was isolated from serum. Echocardiography identified mitral valve vegetation. MRI brain showed multiple areas of sub-acute infarction in anterior and posterior circulations. Cerebral angiography 10 days later revealed right M1 aneurysm not seen initially. Conventional angiography confirmed this finding and identified three other areas of dilation consistent with mycotic aneurysms. *Conclusions:* There is no evidence that thrombolysis is safe or effective in acute stroke caused by septic emboli from infected cardiac valves. Intracranial mycotic aneurysms are a rare and potentially fatal complication and are a late complication of cerebral embolism. If present, mycotic aneurysms are associated with an overall mortality of 60% which may be as high as 80% if rupture occurs.

P-160

Towards optimal management of anticoagulation following central nervous system hemorrhage in patients with high thromboembolic risk

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Background: Patients with CNS hemorrhage while on anticoagulation (AC) are a challenge to manage. *Objective:* To inform decisions surrounding the timing and intensity of AC resumption by performing a systematic review. *Methods:* Three reviewers screened publications and extracted data. Hemorrhagic and thromboembolic (TE) complications subsequent to the index hemorrhage were recorded, as was their timing and covariates which might influence their occurrence. *Results:* Data were extracted from 63 publications detailing 492 patients. 7.7% of patients experienced hemorrhagic complications and 6.1% experienced TE complications. Hemorrhagic complications were more common within 72 h of presentation while TE complications were more

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common thereafter. Patients restarted on AC after 72h were significantly more likely to have a TE complication (p=0.006) and those restarted before 72h were more likely to hemorrhage (p=0.0727). Factors associated with re-hemorrhage include younger age, traumatic cause, subdural hematomas, failure to reverse AC and re-initiation of AC at a lower intensity. TE complications were more common in younger patients and those with spinal hemorrhage, multiple hemorrhages, and non-traumatic causes of the index hemorrhage. *Conclusion:* The presented results suggest that it may be prudent to re-initiate AC earlier than previously thought, with the timing and intensity modified based on individual characteristics.

P-161

Predicting complications of radiosurgery for arteriovenous malformation

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Background: Both surgical and radiosurgical risk scores for arteriovenous malformation (AVM) are based on size and cortical eloquence. Radiation changes following treatment are located in the subcortical white matter and occur commonly. We aim to identify predictors of symptomatic T2 signal change based on a retrospective cohort of patients with AVM treated with Gamma Knife radiosurgery. *Methods:* 110 patients with AVMs have been treated at our institution between 2005 and 2009. 85 patients have at least 12 months clinical and radiological follow-up. Any new onset headaches, new or worsening seizures or neurological deficit were considered adverse events. *Results:* There are 17 children and 68 adults in the study cohort, with a mean age of 34 (range 6 – 74). 23 (27%) patients suffered adverse effects, 8 patients with permanent neurological deficit (9.4%). 5 developed fixed visual field deficits. 12Gy volume was the most significant predictor of adverse radiation effects (p<0.001). Occipital and parietal locations were associated with increased risk of adverse events (OR 2.77 and 17.061). Speztler-Martin grade was not a significant factor in the development of complications (p=0.41). Cortical eloquence was not significantly associated with the development of adverse events (p=0.079). *Conclusions:* 12Gy volume is the most accurate predictor of complications. Occipital and parietal location correlates with a higher risk of symptomatic edema. A high percentage of permanent visual field defects in this series suggests the optic radiation is a critical radiosensitive structure.

P-162

Morphological changes in residual rat cortex after stroke

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Background: Preclinical studies in rodents provide a model to study impairment and recovery after stroke. Plasticity of perilesional tissue has been indicated as a critical mediator of recovery. Thus, a large body of scientific work has been dedicated to describing electrophysiological, biochemical, and molecular properties of this tissue. Morphological changes are also known to occur in residual tissue after stroke (ie. cortical thinning). However, an exhaustive quantification of these changes has not yet been carried out. Thus, it is not known how these morphological changes may impact current investigations of perilesional tissue function. *Methods:* By measuring cortical thickness from histological tissue and magnetic resonance imaging (MRI) images, the present study describes shrinking and stretching of residual cortex toward the lesion cavity. Long-Evans hooded rats received a unilateral stroke via pial strip devascularization, photothromobsis, or middle cerebral artery-occlusion and were then examined using either histology or MRI at 1 hour, 1, 3, 7, 14, and 31 days post-stroke. *Results:* A gradient of cortical thinning developed over time, extending well beyond the lesion core and even into the intact hemisphere. Thinning was associated with loss of cortical volume and tissue movement toward the cavity. Movement of intact tissue towards the lesion cavity was confirmed using anatomical markers placed in intact cortical tissue at the time of stroke induction. *Conclusions:* The extensive, time-dependent, thinning and movement of cortex toward the infarct must be considered in evaluating plasticity-related cortical changes associated with post stroke recovery of function.

P-163

Exploring the link between stroke and amyloid deposition in subjects participating in the Alzheimer Disease Neuroimaging Initiative

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Background: Animal studies suggest that stroke occurrence in the presence of increased amyloid results in larger infarcts that grow, and more inflammation that exacerbates, compared to controls. This effect was investigated in humans to determine interactions between stroke and amyloid and consequences on brain atrophy. *Methods:* Stroke history (incidental or clinical), amyloid positivity (PiB-positive or $A\beta_{1\text{-}42}$<200 pg/ml) and brain atrophy (ventricular enlargement over 6 months) were available from 87 normal and 209 subjects with mild cognitive impairment or Alzheimer's disease from the Alzheimer's Disease Neuroimaging Initiative. Associations of stroke with amyloid and brain atrophy over 6 months were studied with adjustment for age, gender, and APOE4 using regression analysis. *Results:* Stroke history was not significantly associated with amyloid positivity or brain atrophy in cognitively impaired subjects, while cognitively normal subjects with stroke history trended towards amyloid positivity (p-value=0.09). The relationship between amyloid positivity and brain atrophy was highly significant when grouping all subjects (p-value<0.001) and in MCI subjects alone (p-value<0.05). *Conclusions:* Stroke history in cognitively impaired subjects was not related to amyloid deposition or brain atrophy over 6 months. The trend towards an association between stroke history and amyloid positivity in normal subjects suggests an interaction worthy of further study.

P-164

Quicker and better recanalization in acute ischemic strokes: our initial experience with a self-expanding, fully retrievable stent

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Background: Quicker recanalization results in better clinical outcomes in patients with acute ischemic strokes. We describe our experience with use of a novel self-expanding, fully retrievable stent

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in acute intracranial occlusions. *Methods:* Patients who underwent IA procedures with a self-expanding, fully retrievable stent for acute ischemic strokes at our centre in 2009 were included in this study. Primary outcome was reperfusion (TIMI Grade 2/3) at end of procedure. Secondary end points were vasospasm, rupture of vessels, device related complications, groin complications, post procedural intracerebral hemorrhage (ICH) and all cause mortality. For each case we also assessed times from groin puncture to recanalization, first diagnostic angiography to recanalization, and stent deployment to recanalization. *Results:* Data was obtained from six patients (2 males, 4 females) with median age of 56.5 (range 34-76). Occlusion sites were ophthalmic segment of left ICA (n=1), M1 segment of right MCA (n=2), M2 segment of left MCA (n=1), proximal basilar artery (n=1), and distal basilar artery (n=1). 6/6 patients (100%) achieved successful stent deployment and subsequent TIMI 2/3 reperfusion. All cause mortality was 0%. Post procedural ICH was noted in 1 patient. No major procedural complications were noted. 5/6 had mRS≤2 at 3 months. Mean time from puncture to recanalization and first diagnostic angioraphy to recanalization was 52.4 and 35.4 minutes respectively. Stent deployment to recanalization occurred in less than 1 minute in all cases. *Conclusions:* Use of a novel self-expanding, fully retrievable stent resulted in fast and very high reperfusion rates in acute ischemic strokes with intravascular occlusions.

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International Study of Primary Angiitis of the Central nervous system (I-SPACE): a proposal

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Background: Primary angiitis of the central nervous system (PACNS) is a rare, idiopathic vasculitis of the CNS. Current knowledge of PACNS is derived primarily from small, retrospective studies. Large multicentre prospective registries, (ex. International Study on Cerebral Vein and Dural Sinus Thrombosis) provide valuable insight into rare diseases. The objective of a PACNS registry is to better understand the clinical manifestations, imaging, histopathology, treatment and prognosis of PACNS. *Methods:* Adults diagnosed with PACNS (Calabrese and Mallek criteria) by site physicians within the last year will be approached to participate in the I-SPACE, an international multicentre, prospective registry. Baseline clinical data and investigation results will be collected using standardized, web-based case report forms as will therapeutic interventions, complications and relapses. Angiography, neuro-imaging and histopathology results will be reviewed centrally. New vessel-wall imaging techniques will also be explored. *Results:* This registry will include ≥20 international centres. Approximately 20 patients will be recruited per year for ≥5 years (≥ 100 patients). Patients will be followed for ≥1 year. *Conclusions:* The I-SPACE data will help us reevaluate current knowledge of clinical, radiological and histopathological manifestations of PACNS and suggest optimal therapeutic approaches. To join the I-SPACE, please contact the authors: sylanthier@gmail.com.

P-166

Progressive and diffuse intracranial artery stenoses in Majewski osteodysplastic primordial dwarfism type II – a management challenge

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Background: Cerebrovascular changes of Majewski Osteodysplastic Primary Dwarfism type II (MOPDII) include moyamoya disease, tortuous vessels and aneurysms. It is unclear whether these changes are progressive. *Objective:* To describe progression and discuss management of cerebrovascular changes in MOPDII. *Methods:* Case report. *Results:* A 20 year-old woman with episodes of headaches and left-sided weakness, presented with persistent neurological deficit. She was 3'10" tall and had body dysmorphic features typical of MOPDII. She also had high blood pressure, mild aphasia, and right hemiparesis. Brain MRI revealed chronic infarcts of the right occipital lobe and basal ganglia bilaterally, and an acute infarct of the left centrum semi-ovale. Cerebral angiography showed unilateral, right-sided moyamoya vessels, multifocal stenoses in the anterior and posterior circulation with absent or small distal branches, and multiple aneurysms. She was treated with antiplatelet and antihypertensive agents. She suffered a myocardial infarct 7 months later, followed by a right pedunculo-thalamic then an occipital infarct at 15 and 16 months. MR angiography at 15 months revealed a new, severe and extensive stenosis of the right fetal posterior cerebral artery. *Conclusion:* Cerebrovascular involvement in MOPDII includes progressive and diffuse stenoses of intracranial arteries of all sizes. Due to the small size of the superficial temporal arteries in these patients, encephaloduroarteriosynangiosis and other indirect revascularisation approaches are reasonable management options.

P-167

Immunosuppressive therapy in cerebral amyloid angiopathy with lobar hyperintensities

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Background: Cerebral amyloid angiopathy with lobar hyper-intensities (CAA-LH) associated with perivascular inflammatory infiltrate may respond to immunosuppressive therapy. *Objective:* To describe the clinical and radiological response to immunosuppressive therapy in CAA-LH without evident perivascular infiltrate. *Methods:* Case report. *Results:* A 53 year-old woman with unremarkable medical history presented with a 1-year history of progressive headache and mental slowing. Family history was positive for late-onset Alzheimer's disease. Physical examination was normal. Brain MRI revealed small multi-lobar T2-hyperintensities consistent with chronic infarcts, of unclear etiology despite extensive investigation. Cerebrospinal fluid was normal, except for oligoclonal bands. Brain MRI repeated at 3 months documented growth of previous lesions and appearance of new ones, including a large temporal lobe lesion with vasogenic edema but no diffusion restriction or gadolinium enhancement. Multiple cortical microbleeds were seen on T2*-weighted MRI. Fluorodeoxyglucose PET-scan showed prefrontal focal hypermetabolism. Apolipoprotein-E genotype was ε4/ε4. Two brain biopsies targeting the temporal and

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prefrontal lesions confirmed CAA without evident perivascular inflammation. Impressive clinico-radiological response to prednisone therapy was documented. Ten months after prednisone withdrawal, she experienced recurrence in previously unaffected regions, again responding to prednisone. *Conclusions:* CAA-LH can respond to prednisone therapy even when brain biopsy shows no evidence of inflammation.

P-168

Case report of ruptured intrameatal anterior inferior cerebellar artery aneurysm & review of literature

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Background: Anterior inferior cerebellar artery (AICA) aneurysms are rare, accounting for approximately 0.1-0.5% of all cerebral aneurysms. To date, only 15 cases of intrameatal AICA aneurysms have been reported. We describe such case, with possible operative strategies. *Case Report:* We present the case of a 24-year-old right-handed female who presented with an episode of sudden loss of consciousness, associated with thunderclap headache. Associated were left seventh and eighth cranial nerve palsies. CT demonstrated diffuse SAH, with prominent fourth ventricular component. Serial angiographic imaging revealed enlarging saccular aneurysm with intrameatal portion involving the internal auditory canal. Suboccipital craniotomy with surgical clipping successfully secured the aneurysm. At one-month followup, the patient's neurological status remained stable. *Discussion:* AICA has a highly variable vascular anatomy, with four segments (anterior pontine, lateral pontine, flocculonodular, cortical) as described by Rhoton. The meatal component of the lateral pontine segment is located in the vicinity of the internal auditory meatus. In Mazonni's studies, the meatal segment entered the canal in 40%, was medial to the porus acousticus in 33%, and reached the porus in 27%. Intracanalicular aneurysms belonged to those that enter the canal. Possible operative considerations for these aneurysms include: (1) unroofing of the internal acoustic meatus, and (2) temporary trapping of proximal AICA while separating aneurysm from nerve complex.

P-169

Radiation induced cavernous malformation of the brain: case report and review of the literature

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Introduction: Complications of radiation therapy are well documented. Most of them affect the white matter with resulting cerebral atrophy and cognitive deficit. Vasculitis of small and large blood vessels has also been reported. To our knowledge the radiation induced cavernous malformation and telangiectasia are extremely rare. *Case Report:* A 19 year old presented to us in 1988 with a progressive onset of spastic left hemiparesis of one month duration. CT scan revealed a right thalamic space occupying lesion, both solid and cystic. Aspiration of the cyst followed by shunting procedure for increased hydrocephalus was performed. Radiation therapy was initiated with a total of 6000 cGy given. The patient has been followed regularly up to the present time with regression of the hemiparesis and his last MRI scan showed cryptic vascular lesions with old hemorrhage in them diffusely seen over the brain. *Conclusion:* Radiation induced cavernous malformations and telangiectasia are discussed.

P-170

Familial cerebral cavernous angiomas diagnosed by susceptibility-weighted MRI

AP Masiowski (Saskatoon), EJ Atkins (Saskatoon)*

Background: Multiple cerebral cavernous angiomas in a single patient suggest a familial syndrome. Sporadic cavernous angiomas are usually solitary. Additional asymptomatic cavernous angiomas may be unidentifiable on routine imaging. Patients with familial cavernous angioma syndromes develop new lesions as they age, but may remain asymptomatic for years. *Methods:* Case report *Results:* A 76 year-old man presented with acute onset of left hemi-ataxia and left Horner syndrome. Family history was notable for multiple cerebral cavernous angiomas in his son. CT scan showed two small acute hemorrhages in the left cerebellum and pons, and one in the cerebrum. T1- and T2-weighted MRI confirmed acute and subacute blood in those areas, but was otherwise normal. MRA and CTA were also normal. Susceptibility-weighted MRI showed more than 50 cavernous angiomas scattered throughout the brain. *Conclusions:* Susceptibility-weighted MRI should always be performed in patients who present with one symptomatic lesion, since a syndrome of multiple cavernous angiomas could otherwise go unrecognized. Prognosis and management of patients with multiple cavernous angiomas is different than for those with a solitary lesion. Other family members may be similarly affected, suggesting a hereditary cause which could be confirmed by testing for mutations in the cerebral cavernous malformation (CCM) genes.

P-171

Pipeline embolization device reconstruction of ruptured intracranial aneurysms: report of two cases

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Background: The use of self-expandable stents has revolutionized the management of wide-necked and fusiform intracranial aneurysms. The Pipeline embolization device (PED) is a novel, flow diversion device that has recently undergone investigational evaluation in patients with unruptured intracranial aneurysms. We report two patients with ruptured intracranial aneurysms, treated successfully with PED reconstruction. Technical aspects and peri-operative management strategies will be discussed. *Methods:* Case one was a 38 year old female who presented with WFNS grade 1 subarachnoid hemorrhage (SAH). Angiography revealed a small blister-like aneurysm arising from the distal third of the basilar artery. Initial treatment at an outside hospital with a Neuroform stent failed to obliterate the aneurysm. She subsequently underwent uneventful definitive management of her aneurysm with two PEDs at our institution. A CT-angiogram at two months demonstrated complete closure of the aneurysm with good patency of the basilar artery. Case two was a 30 year old male who presented with WFNS grade 2 SAH. Angiography revealed a fusiform aneurysm of the right A2 segment of the anterior cerebral artery. The aneurysm was repaired with a single PED. No complications were observed in either case. *Conclusion:* Here we present two patients who

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underwent successful endovascular, endoluminal reconstruction of a ruptured intracranial aneurysm with the novel, self-expanding PED. Although our initial results appear promising, long-term outcomes regarding safety and durability await further study in a larger, multi-institutional patient cohort.

P-172

Endovascular treatment of middle cerebral artery aneurysms: the St. Michael's Hospital experience

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Background: Aneurysms of the middle cerebral artery (MCA) represent approximately 20% of all intracranial aneurysms, but are underrepresented in large series of endovascular therapy. The purpose of this study was to evaluate the immediate safety and efficacy, radiographic characteristics, and clinical outcome of endovascular therapy of MCA aneurysms. *Methods:* This is a retrospective review of a prospective database comprising 455 aneurysms treated endovascularly over a 9-year period (2001 – 2009). The study population included 20 patients (13 women, 7 men; mean age, 59.7 ± 25.9 [standard deviation]) with 20 treated aneurysms (9 unruptured, 11 ruptured). *Results:* Similar to findings in large series of endovascular therapy, MCA aneurysms were underrepresented in our study population, comprising only 4.4% of all intracranial aneurysms treated endovascularly. The majority of aneurysms were less than 13 mm in size (90%); however, a significant proportion (45%) demonstrated complex anatomy. Periprocedural complications were documented in 2 patients, including 1 early re-hemorrhage. There was no aneurysm perforation or intra-procedural recognition of thromboembolic events. Follow-up MR angiography was available in 17 patients and demonstrated aneurysm recurrence in 2 patients. A single patient underwent retreatment. Overall, patients faired very well from a clinical perspective with only 1 patient incurring a new neurological deficit attributable to the endovascular procedure, i.e., the patient with early re-hemorrhage. *Conclusion:* Endovascular therapy is safe and effective for the treatment of MCA aneurysms. Their underrepresentation in local endovascular practices should be scrutinized.

P-173

Covered carotid stents as an adjunct in the surgical treatment of carotid body tumors: a report of two cases and a review of the literature

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Introduction: Carotid body tumors (CBT) represent a technically challenging surgical problem, one of the key goals of surgery and often one of the most technically challenging aspects of management involves preservation of the ipsilateral internal carotid artery (ICA). Covered endovascular ICA stents represent a useful adjunct in the surgical treatment of these lesions. *Results:* We report the successful use of covered carotid stents in two patients with CBTs. A 42 year old woman presenting with pulsatile tinnitus was discovered to have bilateral CBTs. An initial attempt at surgical resection was abandoned due to the tight adherence of the tumor to the ICA; because of the bilateral nature of the disease carotid preservation was felt to be an absolute priority. A covered ICA stent was placed and the tumor was successfully resected at a later date without complication. A second case involved a 57 year old female with a CBT with transient ischemic symptoms. The patient failed a balloon test occlusion and therefore ICA covered stenting was undertaken followed by successful tumor resection. Both cases represent scenarios in which the potential ramifications of carotid sacrifice could not be tolerated. To the author's knowledge this has not been described in the literature. *Conclusion:* Covered ICA stenting represents a useful, safe and efficacious adjunct in the treatment of CBTs, particularly when carotid sacrifice is not an option.

P-174

Patients in high clinical grade following an aneurysmal subarachnoid hemorrhage: recent experience

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Background: Aneurysm exclusion is indicated in patients admitted in high clinical grade unless the neurological assessment at admission reveals slim or absent brain activity. We reviewed our recent experience in these severely affected patients. *Methods:* Retrospective study of patients admitted between 2005 and 2007 in high clinical grade (H&H grade 4 and 5)(n=65). Aneurysm treatment was assessed by the neurosurgical and interventional neuroradiology teams. *Results:* Forty-seven were treated of which 19 by surgical clipping and 28 by coiling. The patients operated were younger (mean age: 48 vs 61), in poorer clinical condition (43% of grade 5 vs 29%) and more often harboring an intraparenchymal hematoma (68% vs 21%) than the endovascular group. The endovascular group presented a higher rate of Fisher grade III subarachnoid hemorrhage (SAH). In this series, the clinical outcome was favorable (mRS 1-2) in 47% of treated patients. In general, patients selected for surgery had a better outcome (mRS 1-2: 79%). *Conclusion:* In this series of high grade patients, the joint management led to a favorable outcome in half of the patients. If the high clinical grade is essentially due to a diffuse SAH, the prognosis is less favorable than if the SAH is associated to an intraparenchymal hematoma that can be rapidly drained

P-175

The impact antibiotic impregnated ventricular catheters on infection rates in patients with a subarachnoid hemorrhage

N McLaughlin (Santa Monica), P St-Antoine (Montreal), MW Bojanowski (Montreal)*

Background: External ventricular drain (EVD) infections are frequently encountered in a neurosurgical practice. Subarachnoid hemorrhage (SAH) has been recognized as an independent risk factor for EVD infections. We reviewed our infection rate in this population after implementing the systematic insertion of antibiotic-impregnated catheters. *Method:* Retrospective review of patients admitted at Hopital Notre-Dame from 04-2006 to 03-2009 with a SAH who required an EVD. Only patients with antibiotic-impregnated drains were included. A meningitis or ventriculitis was diagnosed according to the published criteria of the Center for Disease Control and Prevention. *Results:* This study includes 75

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patients in which 97 drains were installed. Seven infections occurred over 1024 drainage days (DD), resulting in a meningitis rate of 6.8 infections/1000DD. No infection occurred before day 9 of drainage and 71% (5/7) occurred after more than 2 weeks drainage. Analysis of our previous data in a similar population with usage of non-impregnated EDV had 17% infections with some manifesting within the first week of drainage. *Conclusion:* Antibiotic-impregnated drains have enabled us to significantly decrease the rate of CSF infection in SAH patients. Furthermore, with these catheters, infections seem to occur in a delayed fashion, reflecting a local tendency to prolong tinted CSF drainage in order to prevent VP shunt insertion.

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Does presence of vascular risk factors and elapsed time from stroke onset affect leptomeningeal collateral (LMC) recruitment in acute ischemic stroke?

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Introduction: We sought to determine the relationship of vascular risk factors to presence of Leptomeningeal collaterals and to test the hypothesis that LMCs decrease with time in acute ischemic strokes. *Methods:* The study population was a cohort of patients with M1 MCA +/-intracranial ICA occlusions presenting with acute ischemic strokes at our centre from 2003-09. LMC score(20 points) is based on scoring a) pial and lenticulostriate arteries(0-not visualized, 1-less, 2-same or prominent when compared to matching region in opposite hemisphere) in the ASPECTS regions(M1-6 + ACA) and in the basal ganglia. Pial arteries in the sylvian sulcus are scored 0, 2, 4. Data on vascular risk factors, stroke onset and CT angiography (CTA) times were collected retrospectively. *Results:* After excluding patients without optimal imaging (n=72) and missing data(n=4) , 138 patients(64 male, median baseline NIHSS 16, median stroke onset to CTA time 162 minutes) were included in the analysis. 37.6% had excellent LMC score (17-20), 40.5% had good (11-16) and 21.7% had poor (0-10) scores. On univariate analysis, no vascular risk factors including age(p 0.22), sex(p 0.36), smoking status(p 0.55), diabetes(p 0.43), hypertension(p 0.47), coronary arterial disease(p 0.34) or previous stroke/transient ischemic attack(p 0.21) was associated with the presence of poor LMCs. Stroke onset to CTA time was also not associated with degree of LMCs(p value 0.25). *Conclusions:* Recruitment of leptomeningeal collaterals in acute ischemic strokes is independent of the presence of vascular risk factors and time elapsed from stroke onset. Genetic factors may possibly play a role.

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Estimation of acute stroke patients' weight for tPA treatment can lead to dose overcalculation and increased risk of hemorrhagic transformation

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Background: The dose given for intravenous thrombolytic therapy in acute ischemic stroke patients is determined using the patient's weight. Given time restrictions and other limitations, the patient's weight is often estimated, rather than actually measured. Underestimating the patient's weight might result in overcalculating the dose of tPA. *Methods:* The weight used to calculate the dose of tPA was compared to the measured weight in patients treated for acute ischemic stroke with intravenous thrombolytic therapy over a four year period at the Hamilton General, Regional Stroke Centre for Central South Ontario. *Results:* 140/164 (85%) of acute ischemic stroke patients treated with IV tPA had a weight documented in the chart following treatment. Of these, 12 patients received >1.0 mg/kg and only one patient received <0.8 mg/kg, based on comparison of the weight used for the tPA dose calculation and the subsequent weight. 4/12 (30%) of the patients treated with >1.0mg/kg of tPA experienced hemorrhagic transformation (compared to 9.9% over the previous five years). There was no difference in three-month mortality observed. *Conclusions:* Estimation of a patient's weight in the acute setting can lead to overcalculation of the tPA dose, leading to an increased risk of hemorrhagic transformation. Further research is required.

P-178

Clinical features, risk factors and outcome in 84 patients with cerebral venous sinus thrombosis

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Objective: To describe the clinical features, risk factors, imaging findings and outcome of a large cohort of patients with cerebral venous sinus thrombosis (CVST). To determine the incidence of hormonal therapy use in CVST. *Background:* There is limited research in large cohorts of patients with CVST. Risk factors for CVST are not yet well understood, and the proportion of patients on hormonal therapy who develop CVST varies widely across studies. *Methods:* We reviewed records of 84 consecutive patients with CVST at a tertiary hospital in Calgary between 1999 and 2008. Characteristics were summarized using descriptive statistics. *Results:* Median age range at presentation was 30-39 years. Common presentations were headache (82%), nausea (51%) and focal neurological deficits (42%). Diagnosis was delayed >24 hours following admission to hospital in 31%. Risk factors included obesity (27%), oral contraceptive use (26%), and concurrent mastoiditis (19%). Complications were frequent, with venous infarction and intracerebral hemorrhage each occurring in 33% of cases. Mortality rate was 8%. Of survivors, 48% were left with neurologic deficits. *Conclusions:* CVST is uncommon but can result in significant morbidity in young people. It is still a diagnosis that can be missed or delayed. Hormone use and infection remain common predisposing factors.

P-179

Self-reported health predicts stroke

L Nobel (Montreal), L Nadeau (Montreal), N Mayo (Montreal)*

Aims: How a person feels over measured health effects has been recognized as predicting all cause and cardiovascular mortality, for both men and women. Self-perceived health was shown in one other study to predict stroke. However, this question has rarely been addressed. The purpose of this study was to estimate whether self-perceived health was an independent risk factor for stroke in women and men. *Methods:* A prospective cohort study was carried out using two waves of the Santé Québec Survey with follow-up to 2007

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through health administrative databases to identify strokes. Cox proportional hazards was used to model time to stroke in relationship to self-perceived health measured as excellent, very good, good, fair, or poor at time of survey adjusting for sociodemographic, medical, life-style and psychosocial variables. *Results:* A total of 17,805 persons yielded over 230,000 person-years and 360 strokes. For women, only a health rating of poor in comparison to good was associated with a hazard ratio (HR) of 2.0 (95% CI: 1.04 to 3.97). For men, the HR for poor was 1.8 and for fair,1.5. *Conclusions:* This is one of the few studies looking at self-reported health and stroke risk and the only one that included measures of emotional health ruling out these as the culprits. Unmeasured here were biological health parameters which would not be represented by measured comorbidity (cholesterol, blood glucose etc.), diet, and fatigue. Even though the mechanism remains unclear, the results of this study confirm the importance of obtaining information directly from persons on their health.

P-180

Stroke units improve outcomes by following stroke best practices

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Background: Stroke patients who are treated on a stroke unit are more likely to be alive, independent, and discharged home. Stroke unit care is typically provided in a geographically defined ward and by a multidisciplinary stroke team. The other components of stroke unit care have not been well defined. (Organized inpatient (stroke unit) care for stroke (Review), The Cochrane Collaboration, 2009) The Canadian Stroke Strategy has provided a framework of standards to ensure that evidence-based best practices are incorporated into stroke care. (Canadian Best Practice Recommendations for Stroke Care, CMAJ, 2008) *Methods:* We compared the application of best practices in 260 stroke patients managed on a medical ward at 2 tertiary teaching hospitals with 283 stroke patients managed on a stroke unit at a 3rd teaching hospital in the same teaching and hospital system in the same city over 1 year. *Results:* Patients treated on the stroke unit are treated by OT, PT, and SLP more often ($P < 0.05$), undergo dysphagia screening more frequently ($P < 0.01$), are investigated for carotid stenosis more frequently ($P < 0.01$), are more likely to be discharged on antiplatelet therapy, statin agent, ACE/ARB, and warfarin for atrial fibrillation. Patients treated on the stroke unit were less likely to die ($P < 0.05$). *Conclusions:* Patients managed on a stroke unit are more likely to receive best practice stroke care and this leads to better outcomes.

P-181

Timing of hemorrhagic and thromboembolic complications in anticoagulant-associated intracranial hemorrhage

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Background and Purpose: Anticoagulant-associated intracranial hemorrhage (AAICH) is associated with high mortlity rates. AAICH patients are at risk for both hemorrhagic (recurrent/continued bleeding) and thromboembolic complications. Guidelines reflect uncertainty with respect to timing of INR reversal and resumption of anticoagulation. We conducted a retrospective chart review of AAICH management at our centre. *Methods:* Demographics, INR management, complications and discharge disposition in patients with AAICH were collected. *Results:* Ninety-nine patients with intraparenchymal (24), intraventricular (6), subdural (68), and epidural (1) hemorrhages associated with anticoagulant use were admitted during the 4 year study period. Hemorrhagic and thromboembolic complications occurred in 15 and 6 patients respectively. Hemorrhagic complications occured at a median of 108.7 (IQR 8.8, 210.4) h after admission. Thromboembolic complications occurred significantly later (257.46 h (129.8, 626.5), p=0.033). Admisssion INR was higher in patients with hemorrhagic (mean=1.96±1.03) versus thrombembolic complications (mean= 1.25±0.24, p=0.027). The median time to INR reversal was 16.5 (8.1, 42.2) h, which was achieved most commonly with vitamin K and fresh frozen plasma (69%). Mortality rates were higher in patients who experienced either type of complication (38%) relative to those without complications (20.5%, $p = 0.038$). *Conclusions:* AAICH is associated with high rates of hemorrhagic complications early after admission. Reversal of INR is generally a slow process and it is possible that more rapid correction of the coagulopathy will reduce complication rates and improve outcome. As thromboembolic event rates begin to rise within days of admission, however, reanticoagulation should be considered prior to discharge from hospital.

P-182

Disabling arterial stroke in two young women within 1 month of starting Yaz (drosperinone and ethinyl estradiol)

AY Poppe (Montreal), Y Deschaintre (Montreal), V Dubuc (Montreal), LC Gioia (Montreal), S Lanthier (Montreal)*

Background: The association between low-dose estrogen oral contraceptive pills (OCP) and arterial stroke remains controversial. Yaz (Bayer) is a fourth-generation OCP containing drosperinone and ethinyl estradiol (30 μg). *Methods:* Report of two cases. *Results:* Case 1: 24 year-old woman with sudden onset of nausea, vomiting, somnolence, facial diplegia, tetraparesis and skew deviation (NIHSS 32). CT was normal. CT-Angiography (CTA) confirmed a mid-basilar occlusion. She was successfully treated with IV tPA and embolectomy using the MERCI device. She had started Yaz 3 weeks prior. mRS and NIHSS were 0 at 90-days. Investigations revealed elevated β2-glycoprotein IgG and Coumadin was given. *Case 2:* 23 year-old woman known for cigarette and cannabis use with sudden onset of headache, dysarthria and left hemiparesis (NIHSS 12) after sexual intercourse. CT revealed a right sylvian fissure hyperdensity. One hour later, CTA revealed no occlusion. IV tPA was given. At discharge, NIHSS was 2 and mRS was 1. She had started Yaz 3 weeks prior, but had previously taken Mirena (levonorgestrel-releasing intrauterine device) for three years. Investigations revealed a PFO. She was treated with ASA and PFO closure. *Conclusions:* In these two patients, the temporal relationship between initiation of Yaz and the occurrence of stroke suggests a possible causal relationship.

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P-183

Outcome of severe arteriovenous malformation (AVM)-related intracranial hemorrhage: the importance of cisternal subarachnoid hemorrhage and early seizures

R Rahme (Montreal), AG Weil (Montreal), MW Bojanowski (Montreal)*

Introduction: Although AVM-related intracranial hemorrhage (AVM-ICH) has a relatively benign course, there is a subgroup of patients that present comatose requiring immediate surgical attention. We sought to determine the outcome and prognostic factors in patients with severe AVM-ICH. *Methods:* Between 2003 and 2009, 16 patients presented with severe AVM-ICH. Medical records were retrospectively reviewed. Outcome was determined using 30-day survival and GOS and mRS at last follow-up. *Results:* There were 7 males and 9 females with a mean age of 32 years (range 6-66). All had GCS 8 or less and most exhibited motor posturing and/or dilated pupils. Fifteen patients had intraprenchymal, ten intraventricular, and four subarachnoid hemorrhage (SAH). Twelve patients underwent hematoma evacuation with concomitant decompressive craniectomy in 11 and external ventricular drainage (EVD) in 6. EVD was the only treatment offered to four patients. AVM excision was never attempted acutely. Three patients died from extensive bihemispheric infarction and refractory intracranial pressure. All 13 survivors improved neurologically and 12 had an acceptable functional outcome (mRS 4 or less) after a mean follow-up of 10 months (range 1-49). Among all clinical, radiological, and operative variables, only cisternal SAH (p=0.007) and early seizures (p=0.018) were significantly associated with death. *Conclusion:* SAH and seizures are poor prognosticators in severe AVM-ICH, possibly because of the associated diffuse brain injury. Irrespective of their initial clinical condition, most survivors of severe AVM-ICH achieve an acceptable functional outcome. These patients should thus be managed aggressively given their remarkable potential for neurological recovery.

P-184

Early rerupture of cerebral arteriovenous malformations: beware the progressive hemispheric swelling

R Rahme (Montreal), AG Weil (Montreal), MW Bojanowski (Montreal)*

Introduction: Early rerupture of cerebral arteriovenous malformations (AVMs) is a rare occurence the determinants of which are still poorly understood. *Methods:* Case report. *Results:* A 62-year old male patient was referred for AVM-related intracranial hemorrhage. Six years earlier, he had been diagnosed with a right temporal AVM following spontaneous intraventricular hemorrhage. On angiogram, the lesion was fed by branches of the middle cerebral artery and had both superficial and deep venous drainage with multiple venous ectasias and aneurysms. A few days prior to his referral, the patient developed sudden headache with left hemiparesis and rapid deterioration of his level of consciousness to a Glascow coma score (GCS) of 8. Head CT revealed a right temporal hematoma with intraventricular extension. The patient was intubated and underwent emergent external ventricular drain (EVD) placement. Over the next few weeks, his condition failed to improve significantly with a persistently normal-high intracranial pressure despite aggressive medical therapy and EVD. Serial head CTs documented progressively increasing perinidal and perihematomal edema and significant right hemispheric swelling. Thrombosis of the draining vein with secondary occlusive hyperemia was strongly suspected. Unfortunately, before a repeat angiogram could be obtained, the patient suffered acute neurological deterioration to a GCS of 6 with right mydriasis secondary to massive AVM rebleed and transtentorial herniation. He underwent emergent decompressive craniectomy, hematoma evacuation, and AVM resection. Post-operatively, he exhibited progressive neurological improvement and resolution of cerebral edema. *Conclusion:* Progressive perinidal/ perihematomal edema may herald imminent AVM rebleeding, possibly as a result of impairment of venous drainage following AVM rupture.

P-185

Aβ-related angiitis of the central nervous system: report of three cases and review of the literature

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Background: Amyloid β (Aβ)-related angiitis (ABRA) is a recently described primary angiitis of the CNS characterized by cerebrovascular Aβ deposition and arteritis. Cerebral Aβ deposition is commonly present in cerebal amyloid angiopathy (CAA) and Alzheimer's disease (AD) but is rarely associated with inflammatory infiltration of vessel walls. ABRA was defined as a distinct clinicopathological entity based on a case series of nine patients and individual case reports in the literature. *Methods:* We present three cases of ABRA managed at our centre. *Results:* All three cases presented with seizures. Two were otherwise asymptomatic and one developed worsening multifocal neurologic findings prior to diagnosis. Brain biopsies in all three cases revealed characteristic features of ABRA consisting of inflammatory arteritis with Aβ deposits in the vessel walls. In one case, there was parenchymal deposition of tau positive neuritic plaques that did not meet full criteria for AD. All were treated with steroids and cyclophosphamide. Two remained asymptomatic with radiographic resolution. One patient had worsening neurologic dysfunction with severe functional impairment at last follow-up. *Conclusions:* Our cases help clarify the clinical spectrum, radiographic findings, response to treatment, and outcome of ABRA. The possible neuropathological relationship between CAA, AD, and ABRA is discussed.

P-186

The proapoptotic BNIP3 is involved in autophagic neuronal death in stroke

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Background: Excessive autophagy has been implicated in delayed neuronal death in stroke. The aim of the present study is to determine the role of BNIP3 in autophagic neuronal death. *Methods:* We performed immunocytochemistry, quantitative Western blotting, cell transfection, RNA interference and electron microscopy to analyze the expression and localization of BNIP3 and autophagy markers in degenerating primary neurons in an oxygen and glucose deprivation (OGD) model of stroke. *Results:* In primary neuronal cultures

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exposed to OGD for 6 hours followed by reperfusion (RP) for 24, 48 and 72 hours respectively, a time course of increase of autophagy was observed as determined by the ratio of LC3-II to LC3-I, an autophagy marker protein. Using PI and MDC double-staining, and electron microscopy we found that the increment in autophagy after OGD and RP injury was accompanied by increased autophagic cell death rates. The death-inducing gene BNIP3 was highly expressed in neurons exposed to OGD. The time course and levels of BNIP3 expression correlated with the expression of Beclin-1, an autophagy related protein. Knockdown of BNIP3 by miRNA reduced OGD-induced autophagy in neurons. *Conclusions:* BNIP3 plays a role in autophagic neuronal death in the OGD model of stroke.

P-187

Baseline NIHSS drives clinical decision making in basilar artery occlusion—Calgary experience

N Shobha (Calgary), R Bhatia (Calgary), SP Bal (Calgary), G Kumarpillai (Calgary), S Tymchuk (Calgary), EE Smith (Calgary), MD Hill (Calgary), M Goyal (Calgary), AM Demchuk (Calgary)*

Background: Prognosis for basilar artery occlusion is quite poor. We chose to compare treatment strategies and outcomes of patients with strokes secondary to basilar artery occlusions with the goal to examine baseline differences amongst different treatment approaches. *Methods:* Patients were identified from the CT Angiography database of the Calgary Stroke Program. Modified Rankin scale score at three months was the primary outcome. Multinomial regression analysis for three months outcome based on the treatment modality while controlling for baseline confounding variables was performed. *Results:* Strokes secondary to basilar artery occlusion were seen in 51 patients. The mean age was 62.6 ± 14.4 yrs; 32 (62.8%) were male. Thirty five (68.6 %) patients received intra-arterial therapy (tPA± mechanical devices), seven (13.7 %) received intravenous thrombolysis, and nine (17.7 %) patients were treated conservatively. The median baseline NIHSS of the three groups were 14(8-26), 8 (4-22) and 5 (2-28) (p=0.05) respectively. The median posterior clot burden scores in the three groups were 4(3-5), 4 (2-7) and 3(2-4) respectively. Favorable outcome at three months (mRS≤2) was seen in 14 (40.0 %) patients who received intra arterial therapy, 1 (14.3 %) patient who received intravenous thrombolysis and 6 (66.7 %) patients who were treated conservatively. No significant differences in outcome according to treatment modality were found (p=0.38) after adjusting for confounding variables. *Conclusion:* Good outcomes were noted in almost half. Presenting NIHSS appeared to influence treatment decision making significantly in the study and may explain the similarity in outcomes between intraarterial and conservatively treated patients.

P-188

Ocular tilt reaction and medial thalamic infarction: a case report

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Background: The ocular tilt reaction (OTR) triad has been reported in multiple sclerosis, acute AICA distribution, and meso-diencephalic strokes. We hereby report a case of OTR from medial thalamic infarction. *Methods:* 25-year-old Caucasian healthy male presented with sudden onset of diplopia, head tit, and lateral pulsion. Examination revealed skew deviation with intact extra-ocular movement of each eye, ocular counter-roll, left facial droop, dysarthria, left head tilt, and left dysmetria. *Results:* MRI brain revealed a medial thalamic lesion with restriction on diffusion-weighted imaging. Intensive young stroke workup was unremarkable except a small patent foreman ovale (PFO) without atrial septal aneurysm. *Conclusions:* OTR is a rare clinical presentation. The localization can be anywhere along the otolith pathway, from ipsilateral vestibular nerve and nuclei to contralateral medial thalamus. Medial thalamus is supplied by paramedial artery from P1 segment. Etiology of paramedian infarction is usually embolic. PFO is considered as low or uncertain cause of stroke. Yearly risk of cryptogenic stroke in healthy persons with PFO might be as low as 0.1%. However, paradoxical emboli can account for underlying etiology in cryptogenic strokes. Current literature does not support anticoagulation over antiplatelet therapy. Surgical closure has not shown any benefit.

P-189

Superficial siderosis as a manifestation of a dural arteriovenous fistula

F Signorelli (Montreal), N McLaughlin (Santa Monica), MW Bojanowski (Montreal)*

Background: Symptomatic dural arteriovenous fistula (DAVF) usually present with acute or chronic manifestations of venous hypertension or acute hemorrhage. Symptomatic chronic bleeding due to a DAVF has not been described. *Methods:* We present a rare case of DAVF that presented with symptoms and signs characteristic of superficial siderosis (SS). *Results:* A 69-year-old woman presented with a history of progressive headaches, gait disturbance and sensorineural deafness. Cerebral MRI revealed characteristic findings of SS. Angiography showed a complex posterior tentorial DAVF, the probable source of recurrent bleeding. Attempts at curing the DAVF by embolization were unsuccessful. The DAVF was successfully obliterated by surgery. Although other vascular pathologies have been reported in association with SS such as cavernomas, aneurysms and arteriovenous malformations, intracranial DAVF has not yet been described. *Conclusion:* To the authors' knowledge, this is the first reported case of intracranial DAVF associated with SS. We propose that the tentorial localization as well as the thrombosis of leptomeningeal fragile veins draining into the tentorial sinuses may have favored this unusual clinical presentation. Obliteration of the bleeding source should be sought when possible in order to stabilize and maybe improve patient's symptomatology.

P-190

Surgery of ruptured anterior communicating artery aneurysms of very small size

F Signorelli (Montreal), F Scholtes (Montreal), P Lessard (Montreal), MW Bojanowski (Montreal)*

Background: Ruptured anterior communicating artery aneurysms of very small size (up to 3mm) represent particular technical challenges for both the interventional neuroradiologist and the neurosurgeon. We assessed the outcome of a series of 25 consecutive surgically treated patients. *Methods:* We retrospectively evaluated the clinical and radiological results of a series of 25 patients with ruptured very

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small anterior communicating artery aneurysms operated on between 2005 and 2009. We extracted information regarding intra-operative complications and immediate and long-term outcomes. These were correlated to various parameters such as: gyrus rectus resection, opening of inter-hemispheric fissure, orbitotomy, arterial anatomic variations, and the duration of temporary clipping. *Results:* Very small aneurysms projecting parallel or posteriorly to the pericallosal arteries represent a technical challenge. This is partly due to the fact that the surgical exposure is hindered by the main arterial trunks. Nonetheless, with appropriate surgical strategies, technical complications of surgery are uncommon and the outcome mainly depends upon the clinical grade at presentation. *Conclusions:* These good surgical results must be taken into consideration when selecting the most appropriate intervention for very small aneurysms of the anterior communicating artery.

P-191

Dural branches of proximal ACA: description of a rare embryological remnant

F Signorelli (Montreal), F Scholtes (Montreal), P Lessard (Montreal), MW Bojanowski (Montreal)*

Background: The A1 segment of the ACA does not usually provide dural branches for the anterior skull base. We describe a case of bilateral branching of the A1 supplying the dura of planum sphenoidale. This rarely reported anomaly has not been described in detail. *Methods:* Case report and review of the literature. *Results:* During surgery for an olfactory groove meningioma, an artery branching from the anterior aspect of each A1 segment was identified. Both arteries were supplying the dura of planum sphenoidale. Review of the literature demonstrated that proximal ACA dural branches are under-studied and have not been well described. *Conclusions:* We suggest that these A1 dural branches are remnants of the embryonic olfactory artery. They could be more common than previously thought, because retraction on the frontal lobe can bleach them and they may be mistaken for arachnoid strands. Inadvertent retraction of the A1-AComA complex in the presence of these arteries may result in tearing of these vessels and profuse bleeding. It is important for neurosurgeons to be aware of this vascular anomaly when operating in this area.

P-192

Risk of recurrent aneurysmal subarachnoid hemorrhage after incomplete endovascular coiling of ruptured intracranial aneurysms

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Background: Ruptured intracranial aneurysms may be incompletely coiled after initial treatment thus necessitating close follow-up imaging and/or repeated endovascular procedures. This review examines the clinical and angiographic outcomes in completely and incompletely coiled ruptured aneurysms, with an emphasis on monitoring for angiographic aneurysm recurrence and recurrent hemorrhage during long-term follow-up. *Methods:* Patients with ruptured intracranial aneurysms initially treated with endovascular coiling between January 2002 and December 2006 inclusively were identified. Clinical and radiological information was abstracted in this retrospective single-institution review. Angiographic findings were based on the Raymond-Roy Occlusion Classification (RROC): complete obliteration (class 1), residual neck (class 2), and residual aneurysm (class 3). *Results:* Eighty-six patients with ruptured intracranial aneurysms were identified. Average long-term follow-up of survivors was 33 months. After the initial coiling, 14 aneurysms were completely occluded (RROC class 1) and one patient (7%) required retreatment for asymptomatic aneurysm recurrence. Seventy-two aneurysms were left initially with a residual filling neck or fundus (classes 2 or 3), and 17 of these (24%) required repeat intervention(s). However despite angiographic aneurysm recanalization, recurrent rupture was rare and occurred in only one patient who was incompletely coiled and none in the completely coiled group. *Conclusion:* Although incompletely coiled ruptured intracranial aneurysms have demonstrated greater recanalization rates and require further intervention in some, recurrent rupture is rare. Endovascular coiling confers protection against rebleeding in our series despite less than perfect angiographic aneurysm occlusion.

P-193

Retrospective review of the incidence and presentation of arterial venous malformations of the brain in Saskatchewan

Z Tymchuk (Saskatoon), J Zheng (Saskatoon), ME Kelly (Saskatoon)*

Objective: Arteriovenous malformations (AVMs) of the brain have variable rates of incidence and risk of hemorrhage reported. *Methods:* We retrospectively analyzed patients over a 10 year period (June 1999 to May 2009) presenting with AVMs to a neurosurgery center with a catchment of 550,000. 52 patients were identified. The risk of hemorrhage was calculated using the patient years method for 3 time periods; 1) date of birth to date of presentation (DOB-DOP), 2) date of presentation to date of treatment (DOP-DOT) and 3) date of treatment to date of final follow-up or cure (DOT-DOF). The rate of bleeding with and without treatment and rate of detection was also calculated. *Results:* 42/52 patients had supratentorial AVMs and 10/52 had basal ganglia/cerebellar/brainstem AVMs. 40 patients underwent treatment. Percent risk of hemorrhage from DOB-DOP was 1.68 %; from DOP-DOT was 8.76 %; and from DOT-DOF was 6.81%. Total lifetime risk of hemorrhage was 2.08 % in the treated patients and 2.10% in the untreated patients. Of those presenting with hemorrhage, risk of re-hemorrhage from DOP-DOT was 12.28% and 8.24% from DOT-DOF. Of those patients treated and presenting without hemorrhage, risk of hemorrhage from DOP-DOT was 0.00% and 5.53% from DOT-DOF. The rate of detection during the study period was 0.0069% (6.9/100,000). *Conclusion:* The total lifetime risk of hemorrhage was not significantly different in the treated and untreated groups. Patients presenting with hemorrhage had a greater risk of rebleeding than those presenting without bleeding.

P-194

Treatment of a small P1/P2 posterior cerebral artery aneurysm using a flow diverting stent

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Objective: Flow diverting stents are a new technique being utilized for the treatment of cerebral aneurysms. We report our experience

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using a flow diverting stent to treat a single patient with a small wide-necked posterior cerebral artery (PCA) aneurysm. *Methods:* A 33 year old female presented with headache and was found to have an unruptured 5.8 mm P1/P2 PCA aneurysm. The neck measured 5.7 mm and there was a small perforator vessel originating off the base. It was not suitable for surgical clipping or endovascular coil embolization. The appropriate consent and Health Canada approval were obtained. The patient was preloaded with ASA and clopidogrel. *Results:* A 6 French sheath was placed into the left vertebral artery and a Marksman microcatheter navigated into the left PCA. A 3.75 mm x 12 mm PED was placed. Immediate follow-up angiography showed stasis of contrast within the aneurysm. The patient had no neurological deficits. 3 month angiography showed no evidence of aneurysm filling but moderate instent stenosis. 6 month angiography showed continued occlusion of the aneurysm and a reduction in the degree of instent stenosis. The patient had no neurological sequelae from the instent stenosis. *Conclusions:* Flow diverting stents can provide definitive endovascular occlusion for complex cerebral aneurysms. Instent stenosis can be observed but appears to resolve over time. Currently, the use of flow diverting stents should be reserved for the treatment of aneurysms where surgery or conventional endovascular techniques are unlikely to result in adequate and safe aneurysm occlusion.

P-195

Evaluation of timely accessibility to an outpatient stroke clinic at community hospital

T Stefurak (Toronto), O Veselskiy (Toronto)*, M Barta (Toronto)*

Background: High stroke risk shortly after transient ischemic attack (TIA) has translated into guidelines emphasizing rapid stroke assessment and intervention. This study assesses the quality and efficiency of stroke work-up in an outpatient community setting *Methods:* Standardized stroke clinic intake forms of all new referrals from Jan 2006- Dec 2008 were evaluated for risk factor presentation type, referral and provisional diagnosis, and wait-time. *Results:* Median waiting time to see a neurologist was 5.0 days (average 7.3 + 6.4 days). Of the first182 stroke or TIA patients evaluated only 79 (43.4 %) had vascular events with more than 80% de novo. Among 109 patients referred with TIA, diagnosis matched only in 35 cases (32%); in 13.8% cases of TIA referrals minor stroke was missed. Targeted patients received neuroimaging in 98.7%, carotid imaging 92.4, echocardiogram in 70.9%, and Holter study in 54.4%. Carotid studies were done within 3 days of appointment in 77.8%, with 50% - same day. Cardiac studies required up to 4 weeks. No new vascular events occurred within one month after initial presentation. *Conclusion:* Rapid out-patient intervention can be achieved with significant impact on stroke recurrence in a community stroke clinic setting.

P-196

Quality of life following decompressive hemicraniectomy for malignant middle cerebral artery infarction

AG Weil (Montreal), R Rahme (Montreal), R Moumdjian (Montreal), A Bouthillier (Montreal), MW Bojanowski (Montreal)*

Introduction: Decompressive hemicraniectomy (DH) reduces mortality without increasing the number of patients in a vegetative state following malignant middle cerebral artery infarction (MI). We sought to evaluate the quality of life of this patient population at risk of living with a moderately severe disability. *Methods:* Retrospective study of 14 consecutive patients undergoing DH for MI between 2001 and 2009. The functional outcome was evaluated using the Glasgow Outcome Scale (GOS), modifed Rankin Scale (mRS), and the Barthel Index (BI). Quality of life was evaluated using the Stroke Impact Scale (SIS v3.0). *Results:* There were 5 men and 7 women with a mean age of 44 years (27-57). Etiology of IM was thrombotic (7), embolic (3), dissection (2) and iatrogenic (2). All patients presented with decreased vigilance and significant motor deficit. Interval from MI to DH was 45 hours. Following surgery, two patients died and 1 was lost to follow-up. The majority of survivors had a favorable functional outcome after follow-up of 22 months (1-72). Despite decreased quality of life (n=8), the majority of these patients (n=7) did not regret the procedure. *Conclusion:* DH is associated with an acceptable quality of life despite significant deficit and disability. Dominant hemisphere MI should not be considered a contra-indication to DH.

P-197

Acute subdural hematoma (aSDH) without subarachnoid hemorrhage from a ruptured callosomarginal artery aneurysm

AG Weil (Montreal), M Laroche (Montreal), N McLaughlin (Montreal), P Lessard-Bonaventure (Montreal), MW Bojanowski (Montreal)*

Introduction: Distal anterior cerebral artery (ACA) ruptured aneurysms presenting as isolated aSDH is rare. Subdural blood is found in the interhemispheric fissure and convexity in all previously described cases. This is the first report, to our knowledge, of an isolated convexity aSDH from a ruptured distal ACA aneurysm without an interhemispheric component of SDH. *Methodology:* Case report and review of the literature *Results:* A 51 year-old female patient presented comatose with decerebrate posturing and a blown left pupil. Computed tomography showed a left hemispheric subdural hematoma without subarachnoid, intraparenchymal or intraventricular hemorrhage. She underwent urgent craniectomy, subdural hematoma drainage and ICP monitor. An immediate postoperative angio-CT scan revealed an aneurysm of the callosomarginal branch of the anterior cerebral artery (ACA). The patient underwent successful clipping of the ruptured aneurysm and had a gradual improvement of her neurological and functional status. *Conclusion:* Distal ACA aneurysms may present with isolated convexity aSDH and must be suspected even in the absence of an interhemispheric component of SDH.

P-198

Nec-1 protects against delayed neuronal death in stroke through inhibition of the BNIP3 pathway

J Weng (Winnipeg), J Kong (Winnipeg)*

Background: Previously studies showed that necrostatin-1 (Nec-1), an inhibitor for a caspase-independent cell death (necroptosis), was able to protect neurons from death in in vitro and in vivo models of hypoxia and stroke. Recently we described a BNIP3-induced cell death pathway that played a role in delayed neuronal death following stroke. The present study is to test the hypothesis that Nec-1 protects neurons from delayed cell death in stroke through inhibition of the BNIP3 pathway. *Methods:* We performed immunohistochemistry,

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Western blot, subcellular fractionation and mitochondrial function measurement to reveal the effects of Nec-1 on targets of the BNIP3 pathway. *Results:* Nec-1 significantly increased survival of neurons in the middle cerebral artery occlusion (MCAO) model of stroke in rats and in primary neuronal cultures exposed to hypoxia. Nec-1 attenuated BNIP3-induced mitochondrial dysfunction and prevented BNIP3-induced mitochondrial release and nuclear translocation of apoptosis-inducing factor (AIF) and EndoG. BNIP3 did not affect the levels of BNIP3 expression but prevented integration of BNIP3 into mitochondrial membranes. *Conclusions:* Nec-1 protected against hypoxia-induced neuronal death by targeting BNIP3 in vivo and in vitro. These results suggest that Nec-1 is an inhibitor for BNIP3 and may be a potential therapeutic agent for treating patients with stroke.

P-199

Prospective evaluation of early use of SILK versus pipeline flow-diverting stents

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Background: Flow-diverting stents are a newly available means of endovascular aneurysm repair. To our knowledge, we report the first prospective standardized evaluation of the learning curve associated with the use of these novel devices with an emphasis on technical use. *Methods:* Using qualitative research methods, we developed a questionnaire to evaluate the use of the competing SILK (Balt, France) and Pipeline (ev3, USA) flow-diverting stents for intracranial aneurysms refractory to conventional treatment. Over two-day time periods, eight patients divided into two groups of four were consecutively treated by SILK and Pipeline stents. Technical issues were graded immediately after every procedure by the treating neuro-interventionalists using an ordinal scale (1-5) based upon stent preparation, radiological visibility, positioning, deployment, and wire recapture. *Results:* Stents were successfully used in all except for one case in each group. Both stents were identically very easy to prepare (mean scores 5.0). SILK stents were comparatively more visible radiologically than Pipeline stents (mean score 5.0 versus 3.4, respectively). SILK stents were more difficult to position than Pipeline stents (2.9 versus 3.5) as well as to deploy (1.9 versus 3.5), but final wire recapture was easier (4.0 versus 3.3). No clinical complications occurred in either group. *Conclusion:* In our initial experience, the SILK stent offered the benefits of greater radiological visibility and better wire recapture, but importantly stent positioning and deployment was more difficult than the Pipeline stent. Qualitative research methods are valuable to explore subjective physician experiences and gather insights into the operator learning curve for new medical procedures.

P-200

Gamma knife surgery for cerebral arteriovenous malformations (AVMs): results of treatment of 69 consecutive patients at a single centre

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Background: We report the results of a consecutive series of patients treated with Gamma Knife Surgery (GKS) for cerebral AVMs. *Methods:* We retrospectively reviewed 69 patients treated with GK for cerebral AVMs between November 2003 and April 2009, recording clinical data, treatment parameters, and AVM obliteration rates. *Results:* Ten patients were lost to follow-up. Presentations included: seizure (24), hemorrhage (18), persistent headache (12), progressing neurological signs (10), and incidental (9). In 24 patients (34.8%) treatment planning consisted of digital subtraction angiography (DSA), MRI, and CT angiography (CTA). Currently we rely predominantly on CTA and/or MRI scanning only. Thirty nine patients have been followed for a minimum of 3 years; average age 40.8yr., 56.4% males. Average dose at the 50% isodose line was 20.3 Gy (range 16 to 26.4 Gy). Obliteration was observed in 84.6% by MRI, CT, or DSA. Not all obliteration was confirmed by DSA. Complications occurred in 12 of 59 (20.3%) patients, and in 11 of 39 (28.2%) with 3 year follow-up. Temporary complications for the 59 included symptomatic cerebral edema (7), seizure (2), and hemorrhage (1). Permanent complications occurred in one patient suffering a cranial nerve V deafferentation, and in 2 patients suffering a hemorrhage, one of which was lost to follow-up. *Conclusion:* GKS for cerebral AVM's offers an effective and safe method of treatment, with low permanent complication rate.

P-201

A clinical toolkit to support acute stroke management using Telestroke in Ontario

L Zimmer (Chatham), L Kelloway (Hamilton)**

Background: Telestroke is an emergency telemedicine application providing remotely situated emergency physicians with real-time access to stroke neurologists for support managing acute ischemic stroke patients. Telestroke requires an interprofessional approach for identification and management of acute ischemic stroke patients eligible for thrombolysis within the 4.5 hour window. The Ontario Stroke System(OSS) Acute Telestroke program provides and supports: evidence-based management, effective use of scarce medical resources; reduced patient transfers, improved diagnostic response times; and elimination of geographic barriers to specialized stroke services. The OSS Telestroke Clinical Sub-group coordinated and provided clinical and operational leadership for standardized approach for management of hyper-acute stroke patients. *Method:* A toolkit was developed to assist remote centres with implementation of hyper-acute telestroke programs. Key components include: clinical workflow algorithms, nursing/ physician competencies, education/training flowchart, protocols, technical readiness, evaluation tools and resource contact information. *Results:* Preliminary feedback from pilot sites suggests the tool-kit is facilitating efficiencies and standardization of practice. *Conclusions:* Careful attention to clinical and technological aspects of the initiative enabled achievement of the project goal to support implementation of best practice acute stroke management. Next steps include ongoing evaluation of the effectiveness of the toolkit in the clinical setting.

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Interim Analysis of an Ongoing Canadian Phase IV Prospective Observational Cohort Study of Health Utility in Patients Receiving Botulinum Toxin Type A (BOTOX®) Treatment for Approved Therapeutic Indications (MDs on BOTOX® UTILITY-MOBILITY)

T Wein (Montreal), M Jog (London), R Beauchamp (Vancouver), R Miller (Halifax), M Bhogal (Markham), S Simonyi (Markham)*

Evidence suggest that failure to recognize insular seizures may be responsible for epilepsy surgery failures. Confirmation of insular seizures requires an invasive study in absence of a clear epileptogenic lesion. We sought to investigate two methods of sampling the insula. A retrospective analysis of intracranial studies with insular sampling between 1996 and 2009 was performed. Seventeen patients with suspected insular involvement during epileptic seizures had an intracranial study with insular coverage. The first type of implantation consisted in an unilateral craniotomy, insertion of insular electrodes by micro-dissection of the Sylvian fissure, orthogonal implantation of medial temporal structures with neuronavigation, extensive coverage of the three adjacent lobes with subdural electrodes. The second type consisted of MRI-stereotactic frame-guided depth electrode implantation into the insula and the hippocampus using sagittal axes and insertion of subdural electrodes through burr holes to cover the three adjacent lobes. The first type was used for 15 subjects (total: 25 insular electrodes; 51 insular contacts) and the second type was used in 2 subjects (total: 5 insular electrodes, 27 insular contacts). Insular spikes were found in 9 subjects and insular seizures in 6. Two reversible complications occurred. The insula can be safely explored either by opened micro-dissection of the sylvian fissure or a combined Yale-Grenoble stereotactic implantation. The former is better suited for unilateral insular and high spatial resolution investigation of adjacent lobes while the latter is indicated for unilateral or bilateral insular and adjacent lobes investigation

Stroke - Recovery and Rehabilitation

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Measuring emotional vitality in stroke survivors and their caregivers

SP Barbic (Montreal), LE Finch (Montreal), NE Mayo (Montreal)*

Background: Emotional Vitality (EV) is an emerging concept in health of psychological factors that may facilitate recovery when living with a chronic disability. Little is known about what enables stroke survivors and their caregivers to thrive and be emotionally vital post-stroke, while others fall into a spiral of depression and despair. An impediment to the understanding and advancement of EV is the paucity of items to measure the construct. This study aims to determine whether Rasch modelling methodology can form an item bank to capture EV. *Methods:* 409 caregivers of stroke survivors (aged 66±15 years) answered questions about quality of life, disability, and well-being one-month post-stroke. Rasch analysis was used to determine how 41 items formed an underlying item bank representative of EV. *Results:* A 16-item bank of EV items resulted encompasses 5.4 logits (-2.1 to 3.3). All items and persons fit the model with item precision from 0.10 to 0.24. The concepts of well-being (n=9), energy (n=4), and negative emotion (n=8) were covered. *Conclusion:* This bank of items covers the concept of EV but lacks positive mood items. A revisit of the indices used and focus groups will be conducted to develop more items for the bank.

P-204

Medical aspect, communication and quality of life after Locked-In Syndrome – a review of twenty cases

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Background: Persons afflicted with Locked-In Syndrome (LIS) present with the most severe level of disability that can occur following a stroke. Few Canadian data have documented the functional outcome of these patients. *Methods:* Twenty patients presenting with LIS who were admitted at the Institut de réadaptation Gingras-Lindsay de Montréal since 1984 were evaluated. The review included a medical survey, clinical and functional evaluations in Activities of Daily Life (ADL) and communication. A questionnaire pertaining to quality of life was filled in by the patients and their caregivers. *Results:* Sixteen out of twenty patients were under 40 years of age at the time of their stroke. No patient had developed pain syndrome nor experienced aspiration pneumonia following the rehabilitation phase. ADL independence was directly linked to motor skill recovery. The modes of communication were varied and adapted to the listeners, the contexts and the living environment of the patient. Despite their physical challenge, most of them reached a surprising quality of life. *Conclusions:* Considering the few medical complications presented by those patients, their strong will to live, their involvement in social and familial endeavours, early intervention in communication as well as community-oriented integration programs are recommended.

P-205

Memory rehabilitation in individuals with vascular cognitive impairment

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Background: Up to 65 % of individuals who have sustained a stroke suffer from different degrees of cognitive disorders (Donovan et al., 2008). Beyond episodic memory deficits, persons with stroke show frequent impairments in attention and executive processes. Impairments of the cognitive functions can be severe enough to significantly reduce the individual's autonomy in daily life. We assessed in patients with vascular cognitive impairment (VCI) after a stroke the impact of a cognitive rehabilitation program that targets episodic memory and memory-involved processes (i.e., attention and executive processes) on these specific cognitive functions, and on life habits. *Methods:* Persons with VCI who exhibited memory disorders participated in a rehabilitation program that emphasized the learning of encoding and retrieval strategies, as well as the training of attentional and executive processes. We administrated the cognitive rehabilitation program to 6 persons with VCI that were compared to both untreated patients (n= 5) and healthy controls (n= 6). *Results:* After the cognitive treatment, in comparison to both untreated patients and healthy controls, treated patients improved their learning abilities. Compared to untreated patients, treated

patients also improved their working memory abilities. Finally, cognitive rehabilitation induced a beneficial gain on understanding of financial responsibilities. *Conclusion:* Persons with VCI seem to benefit from cognitive rehabilitation efforts, with a transfer to the most complex life habits.

P-206

A cohort study of personally valued activities and well-being

M Egan (Ottawa), C Dubouloz (Ottawa), CG Davis (Ottawa), L Kubina (Ottawa), D Kessler (Ottawa)*

Background: A critical question for stroke survivors is how to live "a good life" despite stroke-related impairments. A good life includes personally-valued activities. Approximately 75% of stroke survivors report "inability to occupy one's time in a manner appropriate to one's age, sex and background". Stroke-related impairments explain less than half the variance in activity engagement. *Methods:* We report on an ongoing study of personally valued activities post stroke. The goals of this cohort study are to determine i) the impact of engagement in valued activities on physical and emotional well-being, ii) characteristics of activities which enhance engagement and iii) how individuals re-engage post stroke. Follow-up periods are 9, 12-, 18- and 24-months post stroke. Measures include Personal Projects Analysis (PPA) (reflecting current personally valued activities), Reintegration to Normal Living Index, General Health Questionnaire, General Well-being Questionnaire, and 2-minute walk test (physical function). *Results:* Fifty-two individuals are currently enrolled in this cohort. We will present an analysis of the data from the first 3 waves of follow-up including: patterns of re-engagement, the impact of re-engagement on well-being, and the process of re-engagement. *Conclusions:* We introduce our methods to study re-engagement in personally-valued activity and its reciprocal effects on health and well-being.

P-207

Development of a clinically-oriented instrument to identify the biomechanical characteristics and strategies adopted by stroke subjects during the timed "up and go" test – Part I: content validity and reliability

C Faria (Belo Horizonte), LF Teixeira-Salmela (Belo Horizonte), GE Laurentino (Recife), S Nadeau (Montréal)*

Background: Despite the well established changes of some biomechanical characteristics and strategies adopted by stroke subjects during the Timed "Up and Go" (TUG) test, the only existing outcome is the time spent to perform the test. Therefore, the aim of this study was to develop a clinically-oriented instrument to identify biomechanical characteristics and strategies adopted by stroke during the TUG. *Methods:* The instrument was elaborated based upon the extensive and systematic analyses of three different sources of information: The literature, the opinion of rehabilitation professionals, and the exhaustive observations of the videotaped TUG performances of stroke and healthy subjects. An expert panel investigated its content validity and the intra- and inter-rater reliability was investigated by two independent examiners. Kappa Coefficients were calculated to evaluate the levels of agreement. *Results:* From the resulted 24-item instrument with three response categories, 21 items showed adequate content validity with levels of agreement ranging from 0.72-1.00 and 19 showed significant intra- and inter-rater reliability ($0.36 \leq k \leq 1.00; p \leq 0.04$). *Conclusions:* The first version of the instrument was established with the 19 items which showed adequate validity and reliability. Before the instrument be employed in clinical and research settings, it is necessary to establish its criterion and construct validity.

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Development of a clinically-oriented instrument to identify the biomechanical characteristics and strategies adopted by stroke subjects during the timed "up and go" test – Part II: criterion-related validity

C Faria (Belo Horizonte), S Nadeau (Montréal), GE Laurentino (Recife), PA Araújo (Belo Horizonte), LF Teixeira-Salmela (Belo Horizonte)*

Background: A first version of a clinically-oriented instrument to identify the biomechanical characteristics and strategies adopted by subjects with stroke during the Timed "Up and Go" (TUG) test was previously developed. Therefore, the aim of this study was to investigate its criterion-related validity and establish the final version of the instrument. *Methods:* Two independent examiners employed the third version of the instrument to assess the TUG performance of 13 hemiplegic subjects (63.4±13.1 years) by analysing two different sources of information (motion analysis system/Optotrak® 3020 and real time videos). The measures provided by both examiners were compared by Kappa statistics ($\alpha < 0.05$) to investigate the criterion-related validity and to establish the final version. *Results:* Of these 19 items of the first version, 15 demonstrated adequate criterion-related validity ($0.29 \leq k \leq 1.00$; $p \leq 0.037$) and were selected for the final version of the instrument. *Conclusions:* The final version of the instrument was established with the 15 items, which showed adequate criterion-related validity: Three items related to the sit-to-stand, five to gait, four to turning, and three to the stand-to-sit. Before the final version of the instrument can be employed in clinical and research settings, it is necessary to establish its content validity and reliability.

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Development of a clinically-oriented instrument to identify the biomechanical characteristics and strategies adopted by stroke subjects during the timed "up and go" test – Part III: construct validity and reliability of the final version

C Faria (Belo Horizonte), LF Teixeira-Salmela (Belo Horizonte), GE Laurentino (Recife), S Nadeau (Montréal)*

Background: The aim of this study was to investigate the construct validity and reliability of the final version of a clinically-oriented instrument to identify the biomechanical characteristics and strategies adopted by stroke subjects the Timed "Up and Go" (TUG) test. *Methods:* The construct validity was investigated by the known groups; the convergence of the correlations of the scores of the instrument and the time spent to perform the TUG; the discriminant analyses, with a sample of 48 subjects with stroke and 48 healthy subjects; and the clinimetric properties by 14 physical therapists, who employed the instrument in their clinical settings. The inter-rater reliability was investigated by both direct observations and real-time video analyses by two independent examiners. *Results:* The final version was able to differentiate hemiplegic from healthy subjects ($p < 0.001$), demonstrated significant correlations with the

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time spent to perform the TUG (Spearman=0.852;p<0.001), and correctly classified 97.9% of the stroke subjects (p<0.001). In addition, its construct validity in clinical applications was also verified. Furthermore, it demonstrated significant reliability for both the direct (0.24≤k≤1.00;p≤0.0006) and the real-time video observations (0.15≤k≤0.94;p≤0.010). *Conclusions:* The developed instrument demonstrated appropriate psychometric and clinimetric properties and provided findings which supported the theoretical assumptions employed for its development.

P-210

Observation and treatment of coprophagic behavior in a stroke patient: a two-patient case study

C Forbes (Montreal), D Pina (Montreal), G Georgiana (Montreal), D Mona (Montreal), G Fabienne (Montreal), T Caterina (Montreal), M Susan (Montreal), L Carl (Montreal), T Alexander (Montreal), E Jessica (Montreal)*

Background: Coprophagic behavior has been documented in animals, or on a case-study basis in patients having suffered psychological trauma resulting in significant psychiatric illness. Working within a large university teaching hospital, our stroke team witnessed repeated coprophagic behavior in two patients with large middle cerebral artery infarcts, one right-sided and one left-sided. The onset of behavior occurred between 3 and 8 weeks following the stroke. Both patients were described by family members as being excessively preoccupied with bodily cleanliness and appearance prior to their strokes. *Methods:* A multidisciplinary team approach was used to address the behavior, and behavior modification strategies were attempted (e.g., regular toileting, and use of wrist restraints, mittens, and full body pajamas). Further consultation was undertaken with psychiatry. *Results:* Behavior modification strategies showed limited success when used alone. After 10 days on a selective serotonin reuptake inhibitor (SSRI), the behavior was successfully resolved. Both patients attended in-patient rehabilitation programs and returned home with assistance. *Conclusions:* It was possible to successfully treat this behavior using a multidisciplinary team approach, including psychiatrists, and the use of SSRIs. The team firmly believed in these patients' potential to rehabilitate, and this guided the team's decision-making in caring for them.

P-211

Aphasia and cognitive communication rehabilitation: state of the evidence

R Graham (London), R Teasell (London), K Salter (London)*

Background: It is estimated that 21-38% of left-hemisphere stroke survivors experience aphasia. As well, over 80% of brain injury survivors experience some degree of cognitive-communication impairment (CCI). For these individuals, an important part of rehabilitation involves the identification, assessment and treatment of their language/communication impairment(s). Speech-language pathologists rely on evidence and clinical expertise to maximize the efficacy of therapy and in turn, patient rehabilitation gains. However, the aphasia and CCI rehabilitation literature has be often been described as 'challenging' due to the extensive number of heterogeneous studies, many of which rely on small samples and are poorly designed, or are of overall low quality. *Methods:* Aggregate data from the Stroke Rehabilitation Evidence-Based Review 12th edition and the Evidence-Based Review of Acquired Brain Injury 5th edition were examined. Primary outcomes were: 1) Number of randomized controlled trials (RCTs); 2) Number of non-RCTs, 3) literature quality and 4) levels of evidence. *Results/Conclusions:* There were 115 studies (including 39 RCTs) examining aphasia rehabilitation and 64 studies (5 RCTs) examining CCI rehabilitation. The most evidence-supported interventions were: Social communication skills training, computer-based language training and trained volunteer conversation partners.

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Can vision be used to compensate for deficits in limb position sense following stroke?

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Background: Several studies have found correlations between position sense and motor function during stroke recovery. However, most of these studies have been conducted with clinical assessments of sensation that are observer-based and have poor reliability. We have recently developed a new test to assess position sense using robotic technology. The present study reassesses the relationship between position sense and upper limb movement following stroke. *Methods:* We prospectively assessed position sense and motor impairment in 54 inpatient stroke rehabilitation subjects and 135 age-matched control subjects. All subjects completed quantitative assessments of position sense and visually-guided reaching using the KINARM robotic device (BKIN technologies Ltd. Kingston, Ontario). Subjects also completed clinical assessments including: handedness, vision, Purdue Peg Board, Chedoke-McMaster Stroke Impairment Scale and FIM. Stroke subjects underwent neuroimaging for lesion localization. *Results:* There was no statistically significant relationship between performance on the robotic measures of position sense and reaching. Importantly, performance on both of these sensory and motor tasks was found to have a relationship with FIM (Fisher's test and Spearman's correlation). *Conclusions:* Our data support the concept that sensory deficits are functionally relevant and points to the importance of assessing sensory and motor impairments independently when planning treatment strategies.

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Advancing assessment and management of balance and mobility: integrating research in 'everyday' practice

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Background: Stroke significantly impacts on safe and independent walking. Few individuals regain independence in the community and up to three-quarters of stroke survivors fall after discharge from rehabilitation. Significant advances in technology and understanding have the potential to advance clinical diagnosis and treatment of balance, mobility and fall risk. This organization has developed a novel Clinic to accelerate research into practice by integrating

researchers and clinicians. *Methods:* The Clinic assessment integrates advanced technology (forceplates, accelerometers, pressure-sensitive mats, etc) with clinical measures. Assessments are part of routine care. Clinicians and researchers collaboratively review the assessment, develop a shared understanding of the patient-specific factors influencing balance, mobility or fall risk and identify appropriate therapeutic interventions. *Results:* Forty patients have been assessed in the Clinic to date. Examples will be presented of how these assessments have informed clinical decision-making, providing details of patients' perturbation-evoked balance reactions, quantity, intensity and quality of gait in daily life. *Conclusions:* This novel clinical model of care facilitates integration of advanced techniques into practice in the area of balance, mobility and fall risk after stroke. The clinic also serves as an excellent platform for testing of novel measurement and interventions for balance.

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La prise en charge des soins et l'aide à domicile après la réadaptation auprès des personnes âgées victimes d'un accident vasculaire cérébral

*G Kashindi (Ottawa)**

Toile de fond : Au cours des dernières années, la prise en charge des soins et l'aide à domicile après la réadaptation auprès des personnes âgées victimes d'un accident vasculaire cérébral (AVC) a été peu étudiée. Les recherches qui y sont consacrées traitent les conséquences négatives, et peu l'ont abordé sous l'angle des interactions sociales entre différents acteurs. Dans cette recherche, la question suivante a servie de prélude à savoir : " Comment se structure les soins et l'aide à domicile après la réadaptation suite à un AVC". *Méthodologie :* Une recherche qualitative basée sur la méthode ethnographique a été réalisée. Les participants (n=12) sont 5 hommes et 7 femmes âgés entre 18 et 65 ans et plus, recrutés à Montréal. Les entrevues semi structurées ont servies pour la collecte des données. L'analyse du verbatim a été faite a l'aide du Logiciel QSR NVivo 7 sur base des codes prédéfinis. *Résultats :* Les thèmes identifiés par les participants sont : conflits, controverses, ententes, support social, changements des rôles et altérations des relations sociales. Ces thèmes démontrent les changements positifs et négatifs dans les interactions sociales, et la difficulté de vivre à domicile avec une personne âgée victime d'un AVC. *Conclusion :* Les changements dans les interactions sociales permettent de mieux comprendre les problèmes qui surviennent pendant la prise en charge des soins et l'aide à domicile après la réadaptation, et éventuellement d'identifier des pistes d'actions afin d'améliorer les rapports humains. *Mots clés :* Prise en charge, soins et aide, domicile, AVC, réadaptation.

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"Virtual" home safety assessment after stroke in remote aboriginal communities

E Linkewich (Huntsville), K Harrington (Hamilton), A Oikonen (Hamilton)*

Background: Following a stroke, changes in functional abilities may impact the survivor's safe performance of activities of daily living at home. This pilot research explored the clinical utility of using video-streaming technology and standardized tool (SAFER-Home) to complete an occupational therapy home safety assessment for a stroke survivor living in a remote Aboriginal community. *Methods:* This research was conducted in collaboration with KO-Telemedicine and Keewaytinook Okimakanak Tribal Council. Occupational therapists (OTs) (3) simultaneously completed a virtual home safety assessment using the SAFER-Home. Subsequently, support staff (3), OTs and client completed researcher-designed questionnaires. OTs also participated in a focus group. Content analysis was conducted on qualiative data to identify themes. Quantitave data provided descriptive statistics. *Results:* All OTs (5-10 years experience) reported confidence in making recommendations using the SAFER-Home via video-streaming. A need to "sense" the client in a different way was identified. The client and OTs all recommend virtual assessment. Audio quality was problematic. *Conclusions:* Overall, the SAFER-HOME and video-streaming technology improved access and demonstrated clinical utility for an OT home safety assessment for a client after stroke. Technological challenges indicate the need for supplementary training and support. Additional validity testing of the SAFER-HOME tool for virtual assessment is needed.

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Neural correlates of semantic feature analysis in chronic aphasia: a multiple single-case study

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Background: Anomia is one of the most striking and persisting deficit in aphasia. Semantic feature analysis (SFA) intends to elicit word production by activating semantic networks, and has proven to be efficient in single-case studies of chronic aphasia, but remains to be shown in multiple single-case studies. This event-related fMRI (er-FMRI) study aims to look at brain plasticity changes induced by SFA therapy, associated with anomia recovery, in nine participants with chronic aphasia. *Methods:* All participants suffered from a unique stroke in the LH, 4 to 25 years prior to the study; they were all right-handed and presented a moderate to severe aphasia. They benefited from an intensive SFA therapy, in which 20 objects and 20 verbs were trained. Therapy efficacy ans generalization were measured. Before and after the therapy, all participants underwent an er-FMRI session, and activation maps of spontaneously named words before therapy and trained words after therapy were compared. *Results:* All participants showed a significant improvement in their naming. In general, participants showed a contraction of brain networks sustaining naming improvement post-SFA, in comparison to the extended pre-therapy networks involved in spontaneous correct naming. The fact that recovery with SFA resulted in the recruitment of semantic processing areas suggests that adaptive brain plasticity can be modulated by the nature of the therapy provided. *Conclusions:* Improvement following SFA in all patients provides evidence for long-term adaptive brain plasticity in aphasia. More multiple-single case studies are necessary in order to better understand the cerebral plasticity in chronic aphasia.

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The effect of tPA administration on rehabilitation outcomes: does thrombolysis facilitate functional recovery?

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Background: Acute administration of tissue plasminogen activator (tPA) after ischemic stroke has been shown to increase the likelihood of favourable outcomes at 3 months and 1 year post stroke. This study aimed to evaluate the effects of tPA on patient function during post-acute stroke rehabilitation. *Methods:* A pair-matched retrospective cohort study was performed. Patients from the Registry of the Canadian Stroke Network (RCSN) who experienced an ischemic stroke and received post-acute inpatient rehabilitation between April 2003 and March 2008 were included. Cases consisted of patients who received tPA and controls were patients who met all of the criteria for tPA but arrived at hospital >2.5 hrs from symptom onset. Comparative groups were formed controlling for initial Canadian Neurological Scale (CNS) score, age, sex, history of stroke, and pre-stroke residential status (rural vs. urban). Rehabilitation indicator variables included time from stroke onset to rehabilitation admission, admission and discharge Functional Independence Measure (FIM™) scores, FIM™ gain, LOS and discharge destination. *Results:* In total, 484 tPA patients and 354 controls were identified; of which 408 could be pair-matched. The tPA group displayed improved mean and median values for each of the indicators measured. However, only LOS amongst the most severe stroke patients (CNS <5) reached statistical significance (37.2±22.2 vs 57.0±44.1 days, p=0.019). *Discussion:* The consistent trend toward improved functional recovery, shorter LOS, and improved discharge home may provide further evidence for the potential benefits of tPA administration after ischemic stroke. Further study is warranted.

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Moving stroke patients along a health continuum: implementing an acute care rural stroke program. The challenge to improve quality of life, the human side of stroke – a patient's story

D Misner (Kentville), D Mander (Kentville)*

There is strong evidence that patient outcomes following a stroke/transient ischemic attacks (TIA) are significantly improved when signs and symptoms of stroke/TIA are recognised early and prompt medical intervention is provided (National Stroke Foundation, 2007). The stroke multidisciplinary model offers an opportunity to introduce an advanced role into the management of stroke and TIA in a team environment. In conjunction with a team approach, the patient is moved through a continuum of care from presentation of the acute onset of stroke in the emergency department, admission to the stroke unit, rehabilitation to discharge and follow up in a risk assessment clinic. The stroke team primarily focuses on:

• Early assessment and management of acute stroke/TIA patients in the emergency department including the initiation of relevant investigations, consultation with internal medicine, and discussion with patient/family regarding a plan of care
• Holistic care of the patient while on the stroke unit
• Follow up of TIAs and minor strokes in a risk assessment clinic
• Education and policy development relating to acute management of stroke/TIA
• Individualizing care plans to meet the patient's needs and optimize the quality of life for those patient's at risk.

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Instrumented cane for treadmill walking post-stroke

CF Perez (Montreal), J Fung (Montreal)*

Background: Despite the common and extensive use of canes in people with stroke, there has been little attempt to incorporate canes into current gait training technologies. Recently, an instrumented cane device was developed for use with a self-paced treadmill and virtual reality locomotor system. This study investigates the effects of using the novel device in people post stroke. *Methods:* Nine people with stroke, who were able to walk 40m without aid, participated. Subjects walked on a self-paced treadmill while viewing a virtual scene with and without the use of a cane that was instrumented with a triaxial force transducer and affixed with a ball and socket joint. Gait strides in the middle 20m with and without cane use were compared using two-tailed Student's t-tests. *Results:* Gait variability, measured by the coefficient of variation of stride duration, and step width were significantly reduced ($p<.01$) when subjects walked with the treadmill cane. Additionally, an increase in stride length and gait speed (mean change 13%) was observed. *Conclusions:* Spatial and temporal gait parameters improved in people post-stroke during treadmill walking with the instrumented cane compared to walking unaided. This innovative device provides benefits comparable to overground cane use and adds to the realism of the virtual environment.

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Increasing best-practice management of post-stroke unilateral spatial neglect

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Introduction: Unilateral spatial neglect (USN) is a prevalent post-stroke impairment for which there is a known gap between actual management and best practice (1). According to the "Knowledge-to-Action" model (2), interventions that increase the use of best practices are optimized when based on pinpointed facilitators and barriers faced by therapists treating a specific clientele in a specific setting. This study identified the specific facilitators and barriers to evidence based practice in the treatment of post-stroke USN. *Methods:* Qualitative methodology using two focus groups of occupational therapists working in stroke (n=9). Clinicians described perceived barriers and facilitators to evidence-based detection and management of USN. Data was validated and analyzed using thematic qualitative analysis. *Results:* The identified facilitators include: a multidisciplinary stroke team, recent graduation, and having access to several educational days annually. Barriers include lack of time, equipment, and personal motivation to change current practices and habits. *Conclusion:* Having identified specific barriers and facilitators it is now possible to proceed to Phase 2 in which a tailored knowledge translation intervention will be developed and piloted on stroke rehabilitation clinicians. If

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useful, the intervention will be framed into a knowledge translation toolkit specific to USN detection and treatment.

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Neuromuscular coordination patterns of stroke survivors through sit-to-stand movement

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Background: To investigate the neuromuscular coordination patterns of both lower limbs in stroke survivors through sit-to-stand (STS) movement. *Methods:* Participants stood up from a chair while the electromyographic (EMG) activity of both lower limbs was recorded. Student's t-tests and one-way ANOVA were carried out for data analyzes. *Results:* Seventeen subjects were included. All paretic and nonparetic muscles showed prolonged EMG activity and negative differential latencies. Earlier activation of hamstrings and higher EMG quantification of tibialis anterior, soleus and quadriceps muscles occurred on the non-paretic leg. Two abnormal recruitment patterns were found on the paretic leg, while concurrent onset activity occurred for all non-paretic muscles. The time to seat-off was different from the time to peak activity for all muscles ($p<0.01$). *Conclusions:* Neuromuscular coordination abnormalities were observed on both lower limbs. The paretic leg was unable to recruit muscles in the adequate amplitude and time for execution of the movement, while significant compensations happened on the non-paretic leg.

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Verbal instructions for sit-to-stand movement in hemiparetic subjects

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Background: To investigate the effects of using different verbal instructions during the STS movement in chronic hemiparetic subjects. Methods: Twelve hemiparetic (ages 65 to 75 years) were included in the study. All subjects had significant differences between the paretic leg (PL) and the non-paretic leg (NPL) regarding muscular torque ($p<0.01$). Subjects were instructed to "stand-up as fast as they could (A); "stand-up as fast as they could with their body weight distributed on both legs" (B); and "stand-up as fast as they could with their body weight distributed on their weakest leg" (C). Mean outcome measures included accelerometric measures for investigation of movement time (MT); electromyographic activity of the PL; body rising index (RI); and weight-bearing asymmetry. Results: MT was higher for instruction C in comparison to the other instructions ($p<0.05$). It was observed great variability of the paretic muscular activation pattern between subjects. RI was higher for the instruction A than for C ($p<0.05$). For instruction C, 66.7% of subjects tended to distribute their weight mainly on the PL or to decrease the percentage of weight bearing on the NPL. Conclusions: These findings suggested that training STS movement with instruction C may result in better use of the PL.

P-223

Speech-language pathology in the home: the role and experiences of home-based speech-language pathologists in stroke rehabilitation

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Background: The role of Speech-Language Pathologists (SLP) working with adult stroke survivors in Alberta has traditionally been facility-based. Minimal SLP services were available for working with stroke survivors in their home. The role and experiences of the SLPs who were involved in a home-based stroke rehabilitation pilot project will be discussed. *Methods:* The Canadian Occupational Performance Measure was utilized and communication prompts were included in order to assist with clients identifying their own goals. *Results:* The role of the SLP in the client's home was very different than the experience of that in a facility. Traditional paper-and-pen tasks, that are common in facility-based rehab, were not the norm. Not only did the SLP work in assisting the client in meeting their goals, but the SLP had to move beyond the goal. This included marrying impairment-based assessments to functional goals identified by the client, environmental modification in order to make the home and community linguistically accessible and ongoing education to both family and team members about effective communication strategies. *Conclusions:* This pilot project was effective in demonstrating the role SLPs have in home-based stroke rehab. Recommendations for the ongoing role of the SLP in home-based stroke rehabilitation will be shared.

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Upper extremity function in stroke subjects: relationships between the international classification of functioning, disability and health domains

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Background: This study aimed to determine the relationships between variables related to the International Classification of Functioning, Disability and Health domains, regarding upper limb (UL) function. *Methods:* Fifty-five community-dwelling chronic stroke subjects participated (arm stage ≥3 on the Chedoke). Body function/structure domain included measures of motor recovery, spasticity, strength, dexterity, shoulder pain, and sensations. The activity domain included performance-based and self-reported measures, whereas, participation was assessed by measures of quality of life (QL). *Results:* Significant correlations were found between measures of bodily function/structures and activity. Grip strength, motor recovery, and dexterity were most strongly related to the activity measures. Grip and pinch strength, shoulder pain and finger dexterity had significant, but weak relationships with participation measures. Hand dexterity accounted for 80% of the variance of the performance-based measures, whereas pain

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explained 34% of the variance of the self-reported activities. For the participation domain, shoulder pain accounted for 18% of its variance, whereas the self-reports explained 29%. *Conclusions:* Hand dexterity and motor recovery showed the strongest relationships with the performance-based measures, and hand dexterity best explained UL performance in activities of daily living. Shoulder pain best explained UL self-reports. Shoulder pain and self-reports showed weak relationships with QL measures.

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Creation and validation of the self-efficacy scale for performing life activities post-stroke

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Background: Self-efficacy is "a person's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (1). While self-efficacy is a predictor of functional performance, there is currently no stroke-specific scale to measure this construct. The objective of this study was to create and content validate this new scale. *Method:* Item generation was performed based on an extensive literature review of existing scales measuring activity and participation. The tool was generated and content was validated using a focus group approach for eliciting expert opinion. *Results:* The LIFE-H (2), a scale that measures activities and participation, emerged as covering the constructs important for those with stroke. Response options were altered to elicit self-efficacy responses. Most items from the LIFE-H were deemed appropriate by the panel of expert for inclusion in the new scale. *Conclusion:* It is well documented that a mismatch between a patient's perceived self-efficacy and the challenges of the tasks used during rehabilitation can negatively affect treatment effectiveness. This scale fills a gap in the assessment process undertaken by clinicians when setting goals for rehabilitation post-stroke by enabling accurate measurement of self-efficacy.

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P-226

Baseline characteristics of patients enrolled in a large ongoing Canadian phase IV prospective observational cohort study (MDs on BOTOX® UTILITY – MOBILITY) of botulinum toxin type A (BOTOX®) for approved therapeutic indications

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Background: Little is known about the impact of Botulinum Toxin Type A (BOTOX®) treatment on health utility in patients receiving the drug for approved therapeutic indications. *Methods:* Prospective observational cohort study in patients receiving BOTOX® for approved indications. Demographic, diagnostic and treatment data are collected at baseline. Health-related quality of life is measured at baseline and subsequent visits. *Results:* 608 of 917 patients enrolled to date were included in this week-4 interim analysis (93% Caucasian, 67% female 13% treatment-naive). Indications include: adult focal spasticity (AFS), 27%; cervical dystonia (CD), 24%; hyperhidrosis (HH), 11%; 7th cranial nerve disorders (CND), 9%; cerebral palsy (CP), 6%; blepharospasm (BPS), 5%; and other, 18%. Treatment-naïve patients are younger than previously-treated patients (mean age 47yr vs 54yr). Mean age varied with indication: AFS, 56yr; CD, 57yr; HH, 35yr; CP, 26yr; BPS, 63yr. The mean treatment duration ranged from 14mo (HH) to 80mo (BPS) in non-naive patients. The median BOTOX® dose in all patients was 200U, was highest in AFS patients (300U, range 100-900U) and lowest in BPS patients (50U; range 15-125U). *Conclusions:* This interim analysis shows that a diverse group of patients receive BOTOX® for approved therapeutic indications, of which AFS is the most common.

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Activation of indoleamine 2,3-dioxygenase in post-stroke depression patients

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Background: Post-stroke elevations in pro-inflammatory cytokines have been demonstrated. Cytokine elevations may upregulate indoleamine 2,3-dioxygenase (IDO) activity, shunting tryptophan (TRP) metabolism from the serotonin pathway into the kynurenine pathway, leading to decreased serotonin synthesis and increased concentrations of the neurotoxic kynurenine (KYN) metabolites. However, increased IDO activity has not been demonstrated post-stroke. We hypothesize that patients with post-stroke depression (PSD) will have higher mean KYN/TRP ratios compared to non-depressed patients. *Methods:* Participants were assessed for depression severity using the Center for Epidemiological Studies Depression Scale (CES-D≥16 marks depressive symptoms) and diagnosed with depression using the Structured Clinical Interview for the DSM-IV (SCID-IV). Stroke severity was assessed using National Institute of Health Stroke Scale (NIHSS). Blood tryptophan, kynurenine, large neutral amino acids (LNAAs compete with TRP and KYN for transport into the brain) and cytokines were assayed and compared. *Results:* Fifty-five (mean age=69.9±15.2, %male=52.7, mean NIHSS=7.3±4.6) patients within 28.9±40.3 days of stroke were separated into two groups: non-depressed (n=39, CESD=4.96±0.79) and those with depressive symptoms (n=16, CESD=26.75±10.80). Groups were comparable for demographics, but the proportion of subjects with hypertension was higher in the depression group. ANCOVA showed a significantly higher mean KYN/TRP for the depression group (non-depressed=73.4±44.6 vs. depressive symptoms=78.3±42.0, F1=3.49, p=0.022) after controlling for LNAA (p=0.021) and hypertension (p=0.039). *Conclusion:* Higher mean KYN/TRP were demonstrated in stroke patients with depressive symptoms. As the KYN/TRP indicates decreased serotonin and increased neurotoxic kynurenine metabolites, both mechanisms may play an etiological role in PSD. Future studies should evaluate the time course of elevations.

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Stroke - Systems Change Policy and Knowledge Translation

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Use of eco-maps in evaluating community reengagement post stroke

SM Gray (Owen Sound), M Solomon (Owen Sound)*

Standard 17 of the Ontario Consensus Panel on the Rehabilitation System 2007 requires the facilitation of community supports and engagement for individuals experiencing stroke. It charges interdisciplinary teams to facilitate linkages to services and supports in the community. The Community Stroke Rehabilitation Teams (CSRT) in Southwest Ontario, are interprofessional teams, with a mandate to assist stroke survivors with the attainment of their personal goals, including reintegration into their communities. The challenge is measuring this increased integration. This conceptual presentation shares the journey of the CSRT in investigating the use of ecomaps to resolve this challenge. Eco maps provide a simple visual representation of an individual's social and support network. A pre-intervention eco map developed jointly by a client and CSRT therapist should provide an illustration of the degree of the client's reintegration and extent of his/her support networks. This baseline would then also serve as a comparator for a similar post treatment drawing. The eco map enables an evaluation of the extent and success of client integration as directed by Standard 17. It will also gauge effectiveness of the CSRT program in meeting its goal to assist its clients, as they resume their lives post stroke.

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Supporting the implementation of stroke care clinical practice guidelines through online self-directed learning

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Online self-directed learning has the potential to distribute evidence-based recommendations to a wide audience at a low cost to clinical practice guidelines (CPG) developers. An online self-learning portal was developed to support the implementation of CPGs for the urinary continence care of stroke survivors developed as part of a previous study. It includes interactive learning modules integrating evidence-based recommendations, case scenarios, learning assessments, and links to supporting information, such as assessment tools and protocols. The self-learning portal uses a Wordpress Blogging Platform which allows participants to comment on the modules and seek feedback on urinary continence care. The relative low cost of this platform might be of particular interest to health settings interested in using online self- learning tools, while limiting learning expenditures. An evaluation of the online self-learning portal concludes in February 2010. The research team partnered with national and international nursing associations to recruit nurses to participate in the evaluation. Participants were asked to complete the online self-learning portal, as well as surveys assessing baseline knowledge, post-intervention knowledge, and evaluating the online self-learning portal. This poster will provide an overview of the findings of this evaluation and discuss the implications for clinical education.

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Knowledge translation strategies for promoting best practices in stroke rehabilitation

A Menon (Toronto), N Korner-Bitensky (Montreal), M Kastner (Toronto), AK McKibbon (Hamilton), SE Straus (Toronto)*

Objectives: To examine the effectiveness of single or multi-component knowledge translation interventions for improving knowledge, attitudes, and practice behaviors of rehabilitation clinicians. *Methods:* Systematic review of 7 databases was conducted to identify studies evaluating KT interventions specific to occupational therapists or physical therapists. *Results:* 12 studies met the eligibility criteria; there were no studies involving stroke rehabilitation clinicians specifically. For physical therapists, participation in an active multi-component knowledge translation intervention resulted in improved evidence-based knowledge and practice behaviors compared to passive dissemination strategies. These gains did not translate into change in clinicians' attitudes towards best practices. For occupational therapists, no studies have examined the use of multi-component interventions; studies of single interventions suggest limited evidence of effectiveness for all outcomes measured. *Conclusion:* The growing realization that KT does not occur without intense efforts has led to a new field of research and this first-ever systematic review aimed at identifying the most effective KT interventions for rehabilitation clinicians. Attendees will learn about which KT interventions can potentially enhance their knowledge and practice behaviors, with the ultimate goal of increasing their use of best practices and empowering them to become the next generation of "critical thinkers" in rehabilitation.

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An academic half-day in stroke prevention developed for the family medicine residency training program at the University of Toronto

DJ Sahlas (Hamilton), C Whitehead (Toronto), D Chan (Toronto), J Hopyan (Toronto), L Casaubon (Toronto), D Selchen (Toronto)*

Background: Stroke prevention is a major part of primary care. However, family medicine residents receive little if any formal training in stroke prevention. The three Toronto Stroke Regions prepared an academic half-day curriculum in stroke prevention for the Family Medicine residency training program at the University of Toronto. *Methods:* A core committee comprised of a lead stroke neurologist, lead family physician, and a clinician educator developed a four-hour curriculum based on a needs assessment and pilot session held at one of the ten family residency training sites. The agenda consisted of a pre-test, introductory lecture on knowledge translation, case-based small group sessions, a large group interactive session, and a post-test. The use of published clinical tools paired with relevant cases and involvement of local and regional stroke experts together with family physicians as faculty were key features. *Results:* The academic half-day in stroke prevention was held at seven of the training sites, involving 121 residents. Feedback from participants was overwhelmingly positive. The post-test revealed an increase in the uptake of several best practices in stroke prevention. *Conclusions:* An academic-half day in stroke prevention for family medicine residents is an effective means of knowledge translation for best practices in stroke prevention.

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Knowledge to action: implementation, process and outcomes in the use of Holter monitors for acute stroke patients

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Background: The detection of atrial fibrillation (AF) is fundamental in the prevention of recurrent strokes. Evidenced-based guidelines recommend continuous cardiac monitoring in acute stroke patients, but the best type and duration of such monitoring remains unknown. However, the method must be easily implemented, efficient, and cost-effective given the limited resources of most Canadian stroke units. The purpose of this study is to report on the implementation process of Holter monitors usage on an acute stroke unit as well as the degree of detection of cardiac arrhythmias. *Methods:* A review of the implementation process was described and evaluated. A retrospective chart review of all acute stroke patients hospitalized since the implementation of Holter monitoring was conducted from February 2009-January 2010 to determine patients' profile and the presence of cardiac arrhythmias. *Results:* Reorganization of patient management, standardization of equipment and leadership were required for implemention of cardiac monitoring. Holter monitors detected 10% of patients with new onset of AF and 65% with a variety of other cardiac arrhythmias. The average length of stay was fifteen days. *Conclusion:* Holter monitoring seems to be a feasible and effective method to detect AF and other cardiac arrythmias in acute stroke patients. Further studies would be required to determine relative cost effectiveness.

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Self-management in theory and practice – a guide for healthcare providers

G Tomaszewski (London), S Mytka (London)**

Background: One in three adult Canadians reports having at least one chronic condition (Health Council of Canada, 2007). Current health care provider skills may prove inadequate to care for clients with chronic disease. Stroke is particularly challenging as it presents with many co morbidities. Self-management support is a key component of the Ontario Chronic Disease Prevention Management (CDPM) framework. One of the priorities of the South West (SW) Local Health Integration Network's (LHIN) Integrated Health Services Plan is preventing and managing chronic illness. Through its 2007/2008 Health Service Improvement Process, the SW LHIN targeted funds for the development of a guide. *Methods:* The guide expands health care providers' understanding of the various self-management approaches, and consists of four modules: Background; Foundations for Effective Self-Management; Self-Management Approaches; and Getting Ready. This resource complements an interactive toolkit website: www.selfmanagementtoolkit.ca *Results:* Several launches of the toolkit website and guide have occurred, with high interest among health care providers. As well, a Self-Management Advisory Committee has been charged with the development of a self-management strategy for the SW LHIN. *Conclusions:* Implementation of a self-management approach should include attention to the development of health care provider skills in person-centred communication that fosters behaviour change.

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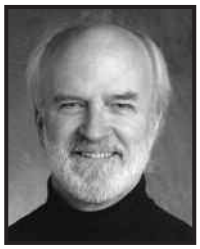

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Maxalt®

rizatriptan benzoate tablets

Maxalt RPD®

rizatriptan benzoate wafers

Prescribing Summary

Patient Selection Criteria

THERAPEUTIC CLASSIFICATION: 5-HT_1 Receptor Agonist

INDICATIONS AND CLINICAL USE

Adults

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

Pediatrics (<18 years of age)

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

Geriatrics (>65 years of age)

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

Special Populations and Conditions

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

CONTRAINDICATIONS

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

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

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

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

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

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

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

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

Safety Information

WARNINGS AND PRECAUTIONS

General

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

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

Psychomotor Effect

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

Cardiovascular

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

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

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

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

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

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

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

Cardiac Events and Fatalities Associated with 5-HT_1 Agonists

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

Premarketing Experience with MAXALT®

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

Postmarketing Experience with MAXALT®

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

Cerebrovascular Events and Fatalities Associated with 5-HT_1 Agonists

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

Special Cardiovascular Pharmacology Studies with Another 5-HT_1 Agonist

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

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

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

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

Other Vasospasm-Related Events

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

Increase in Blood Pressure

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

Endocrine and Metabolism

Phenylketonurics

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

Hepatic/Biliary/Pancreatic

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

Immune

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

Neurologic

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

Seizures

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

Ophthalmologic

Binding to Melanin-Containing Tissues

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

Renal

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

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

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

Special Populations and Conditions

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

ADVERSE REACTIONS

(see Supplemental Product Information for full listing)

Adverse Drug Reaction Overview

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

Long-Term Safety

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

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

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

DRUG INTERACTIONS

Ergot-Containing Drugs

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

Monoamine Oxidase Inhibitors

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

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

Nadolol/Metoprolol

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

Oral Contraceptives

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

Other 5-HT_1 Agonists

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

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

Propranolol

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

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

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

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

Food

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

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Administration

DOSAGE AND ADMINISTRATION

(see Product Monograph for complete information)

Dosing Considerations

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

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

Recommended Dose and Dosage Adjustment

ADULTS

MAXALT® Tablets and MAXALT RPD® Wafers

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

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

Redosing

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

Patients receiving propranolol

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

Renal Impairment

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

Hepatic Impairment

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

Patients with Hypertension

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

OVERDOSAGE

No overdoses of MAXALT® were reported during clinical trials.

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

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

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

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

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

Supplemental Product Information

WARNINGS AND PRECAUTIONS

Special Populations and Conditions

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

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

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

Impairment of Fertility

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

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

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

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

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

Monitoring and Laboratory Tests

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

ADVERSE REACTIONS

Clinical Trial Adverse Drug Reactions

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

Experience in Controlled Clinical Trials with MAXALT®

Typical 5-HT_1 Agonist Adverse Reactions

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

Acute Safety

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

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

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

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

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

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

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

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

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

†Data from Studies 039 and 049.

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

Other Events Observed in Association with the Administration of MAXALT®

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

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

Body as a Whole

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

Cardiovascular

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

Digestive

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

Metabolic

Infrequent was dehydration.

Musculoskeletal

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

Neurological/Psychiatric

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

Respiratory

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

Special Senses

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

Skin and Skin Appendage

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

Urogenital System

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

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

Post-Market Adverse Drug Reactions

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

The following adverse reactions have also been reported:

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

Nervous System: serotonin syndrome.

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

Musculoskeletal: facial pain.

Special Senses: Dysgeusia.

Vascular disorders: Peripheral vascular ischemia

Drug Abuse and Dependence

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

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Product Monograph available at
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Friday June 11, 2010
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2010 CONGRESS-AT-A-GLANCE

tuesday june 8

07:45 - 17:00	Advances in the Neurobiology of Disease - ***Peter Smith, Zelma Kiss***
07:50 - 17:30	Epilepsy Review Course for Neuroscience Residents - ***Jose Martin del Campo***
08:00 - 17:00	Neurosurgery Resident Review Course: Neurovascular Disease - ***J. Max Findlay, Shobhan Vachhrajani***
08:30 - 17:00	ALS - ***David Cameron***
08:30 - 17:00	Child Neurology Day - ***Cecil Hahn, Michelle Demos***
12:00 - 13:30	Co-developed Industry Symposium (Stroke)
18:00 - 20:00	Epilepsy Video Session - ***Richard McLachlan***
18:00 - 20:00	SIGS (Movement Disorders - ***David Grimes, Alex Rajput***, Headache - ***Werner Becker***, Neuromuscular Diseases - ***Kristine Chapman***)

wednesday june 9

06:30 - 08:00	Co-developed Symposium (Headache)
08:00 - 10:00	Grand Opening Plenary -Scientific & Technical Advances in the Clinical Neurosciences: ***Jim Rutka*** *(Penfield Lecture)*, ***Anthony Lang*** *(Richardson Lecture)*, ***Josep Dalmau*** *(Tibbles Lecture)*
10:00 - 10:15	Break
10:15 - 11:45	Chairs' Select Plenary Presentations
12:00 - 13:30	Co-developed Symposium (Epilepsy)
12:00 - 13:30	Co-developed Symposium (Neuropathic Pain)
13:30 - 17:00	Headache - ***Jonathan Gladstone***
13:30 - 17:00	Stroke - ***Ariane Mackey***
13:30 - 17:00	Neurovascular Surgery - ***R. Loch MacDonald***
13:30 - 17:00	Epilepsy - ***S. Nizam Ahmed***
13:30 - 17:00	Neuro-oncology - ***David Eisenstat***
13:30 - 17:00	Multiple Sclerosis - ***Francois Emond***
17:00 - 19:30	Exhibitors Reception

thursday june 10

08:30 - 10:00	Plenary-CNS, CSCN, & CACN Neurology- ***Cam Tesky*** *(Gloor Lecture)*, ***John Stewart***
08:30 - 10:00	Plenary-CNSS Neurosurgery - ***Stephan Mayer, Ziya Gokaslan***
10:00 -10:15	Break
10:15 - 12:30	Platforms (7 simultaneous)
12:30 - 14:00	Lunch/Exhibit Viewing/Digital Mini-platforms
14:00 - 16:30	Platforms (7 simultaneous)
16:30 - 18:30	Digital Poster and Exhibit Viewing

friday june 11

08:00 - 08:15	Journal Editor's Report
08:15 - 08:30	CBANHC Report
08:30 - 09:30	Distinguished guest lecture - ***James Orbinski***
09:30 - 09:45	Currently Active Canadian Clinical Trials
09:45 - 10:15	Break/Exhibit viewing
10:15 - 12:00	Grand Rounds
12:00 - 13:30	Lunch / Exhibit viewing / Digital Mini-platforms
13:30 - 17:00	Neuro-ophthalmology - ***William Fletcher***
13:30 - 17:00	Interventional Neuroradiology - ***Alain Weill***
13:30 - 17:00	What's New in Neurosurgery - ***Pascale Lavoie***
13:30 - 17:00	Neurocritical Care - ***Draga Jichici, Jeanne Teitelbaum***
13:30 - 17:00	Neuromuscular Diseases - ***Annie Dionne, Chris White***
13:30 - 17:00	Spine - ***Eric Massicotte***
13:30 - 17:00	What's New in Neurology - ***Nicolas Dupre***
13:30 - 17:00	EEG - ***Seyed Mirsattari***

CANADIAN NEUROLOGICAL SCIENCES FEDERATION
FÉDÉRATION DES SCIENCES NEUROLOGIQUES DU CANADA

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2010 Programme Preliminaire

mardi 8 juin

07h45 - 17h00 Avancées dans la neurobiologie des maladies - ***Peter Smith, Zelma Kiss***
07h50 - 17h30 Revue des notions acquises sur l'épilepsie destinée aux résidents en neuroscience - ***Jose Martin del Campo***
08h00 - 17h00 Étude destinée aux résidents en neurochirurgie, la maladie vasculonerveuse - ***Max Findlay, Shobhan Vachhrajani***
08h30 - 17h00 SLA - ***David Cameron***
08h30 - 17h00 Journée de la neurologie pédiatrique - ***Cecil Hahn, Michelle Demos***
12h00 - 13h30 Symposium de secteur élaboré conjointement (accidents vasculaires cérébraux)
18h00 - 20h00 Séance vidéo sur l'épilepsie - ***Richard McLachlan***
18h00 - 20h00 Groupe d'intérêt (les troubles du mouvement - ***David Grimes, Alex Rajput***, les céphalées - ***Werner Becker***, les maladies neuromusculaires - ***Kristine Chapman***)

mercredi 10 juin

06h30 - 08h00 Symposium élaboré conjointement (les céphalées)
08h00 - 10h00 Séance plénière d'ouverture - Progrès scientifiques et techniques dans le domaine des neurosciences cliniques: ***Jim Rutka*** *(Penfield Lecture),* ***Anthony Lang*** *(Richardson Lecture),* ***Josep Dalmau*** *(Tibbles Lecture)*
10h00 - 10h15 Pause
10h15 - 11h45 Présentations de séance plénière sélectionnées par le president
12h00 - 13h30 Symposium élaboré conjointement (épilepsie)
12h00 - 13h30 Symposium élaboré conjointement (douleur neuropathique)
13h30 - 17h00 Les céphalées - ***Jonathan Gladstone***
13h30 - 17h00 Accidents vasculaires cérébraux - ***Ariane Mackey***
13h30 - 17h00 Chirurgie vasculonerveuse - ***R. Loch MacDonald***
13h30 - 17h00 Épilepsie - ***S. Nizam Ahmed***
13h30 - 17h00 Neuro-oncologie - ***David Eisenstat***
13h30 - 17h00 Sclérose en plaques - ***Francois Emond***
17h00 - 19h30 Réception des commanditaires et des exposants

jeudi 11 juin

08h30 - 10h00 Séance plénière - SCN, ACNP et SCNC - ***Cam Tesky*** *(Gloor Lecture),* ***John Stewart***
08h30 - 10h00 Séance plénière - SCNCH - ***Stephan Mayer, Ziya Gokaslan***
10h00 - 10h15 Pause
10h15 - 12h30 Séances-platformes (7 simultanées)
12h30 - 14h00 Dîner/Visite de l'exposition/Mini-platformes numériques
14h00 - 16h30 Séances-platformes (7 simultanées)
16h30 - 18h30 Visionnement des affiches numériques et visite de l'exposition

vendredi 12 juin

08h00 - 08h15 Rapport du rédacteur en chef du journal
08h15 - 08h30 Rapport du CBANHC
08h30 - 09:30 Conférencier émérite invité - ***James Orbinski***
09h30 - 09h45 Actuellement - tests cliniques canadiens actifs
09h45 - 10h15 Pause/Visite de l'exposition
10h15 - 12h00 Tables rondes
12h00 - 13h30 Dîner/Visite de l'exposition/Mini-platformes numériques
13h30 - 17h00 Neuroophthalmologie - ***William Fletcher***
13h30 - 17h00 Neuroradiologie - ***Alain Weill***
13h30 - 17h00 Les nouveautés en neurochirurgié - ***Pascale Lavoie***
13h30 - 17h00 Soins neurologiques intensifs - ***Draga Jichici, Jeanne Teitelbaum***
13h30 - 17h00 Les maladies neuromusculaires - ***Annie Dionne, Chris White***
13h30 - 17h00 Colonne vertébrale - ***Eric Massicotte***
13h30 - 17h00 Les nouveautés en neurologie - ***Nicolas Dupre***
13h30 - 17h00 EEG - ***Seyed Mirsattari***

CANADIAN NEUROLOGICAL SCIENCES FEDERATION
FÉDÉRATION DES SCIENCES NEUROLOGIQUES DU CANADA

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The Canadian Neurological Sciences Federation is pleased to recognize those Sponsors who have already committed to supporting the 2010 Congress. These organizations partner with CNSF to determine the causes of, and develop treatment for diseases and injuries of the nervous system, and in the care of patients with these diseases and injuries. Along with support of the Canadian Journal of Neurological Sciences and other initiatives the CNSF maintains throughout the year, these organizations graciously provided educational grants to the Annual Congress, this year in Quebec City, Quebec, June 8-11, 2010.

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OUTSMARTING MIGRAINE DÉJOUÉE

CLINICAL CROSSFIRE: EVIDENCE-BASED OPINIONS ON IMPORTANT QUESTIONS RELATED TO MIGRAINE.

CO-DEVELOPED SYMPOSIUM

WEDNESDAY, JUNE 9TH, 2010 • 6:30-8:00 A.M.

PROGRAM CHAIR

WERNER BECKER, MD, FRCPC

PROFESSOR FOR THE DEPARTMENTS OF CLINICAL NEUROSCIENCES AND MEDICINE
DIRECTOR CHAMP PROGRAM, FACULTY OF MEDICINE, UNIVERSITY OF CALGARY

Migraine diagnosis and management remain a challenge for health care professionals, thus the importance of understanding pathophysiologic factors implicated in migraine attacks. Once the diagnosis is made, health care professionals are then faced with multiple considerations when selecting appropriate and optimal therapy for their patients.

Experts will provide you with their interpretation of the most up-to-date, evidence-based data on important clinical questions related to migraine:

SHOULD TRIPTANS BE FIRST LINE TREATMENT FOR MIGRAINE ATTACKS?

DOES CORTICAL SPREADING DEPRESSION OR A RELATED PHENOMENON INITIATE ALL MIGRAINE ATTACKS?

Please join us, **Wednesday, June 9th, 2010 from 6:30-8:00 a.m.,** at this very exciting and interactive breakfast clinical crossfire program. Hear expert opinions and contribute your own in a collegial setting.

DÉBAT CLINIQUE : OPINIONS FONDÉES SUR LES PREUVES TOUCHANT DES QUESTIONS IMPORTANTES RELIÉES À LA MIGRAINE.

ACTIVITÉ DE DÉVELOPPEMENT PROFESSIONNEL CONTINU CO-PARRAINÉE

MERCREDI, 9 JUIN 2010 • 6 H 30 – 8 H.

PRÉSIDENT

WERNER BECKER, M.D., FRCPC

PROFESSEUR DÉPARTEMENTS NEUROSCIENCES CLINIQUES ET MÉDECINE
DIRECTEUR PROGRAMME CHAMP, FACULTÉ DE MÉDECINE, UNIVERSITÉ DE CALGARY

Le diagnostic et la prise en charge de la migraine sont un défi pour les professionnels de la santé, d'où l'importance de bien comprendre les facteurs physiopathologiques intervenant dans les crises migraineuses. Une fois le diagnostic posé, les professionnels de la santé doivent considérer un ensemble de facteurs quand vient le moment de choisir l'option thérapeutique optimale pour leurs patients.

Les experts donneront leur avis sur les données probantes les plus à jour touchant des questions importantes reliées à la migraine :

DOIT-ON ADMINISTRER LES TRIPTANS EN PREMIÈRE INTENTION DANS LES CRISES DE MIGRAINE ?

LA DÉPRESSION CORTICALE PROPAGÉE, OU UN PHÉNOMÈNE DU MÊME TYPE, EST-ELLE À L'ORIGINE DE TOUTES LES CRISES MIGRAINEUSES?

Venez assister le **mercredi 9 juin 2010, de 6 h 30 à 8 h**, à un déjeuner interactif où sera présenté cet intéressant débat clinique. Écoutez l'opinion des experts et participez à la discussion en toute collégialité.

This event is co-developed by The Canadian Neurological Society and Merck. / Cette activité a été élaborée conjointement par la Société canadienne de neurologie et Merck.

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