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VOLUME 36 NUMBER 3 (SUPPLEMENT 1) MAY 2009

44th Annual Congress of the

Canadian Neurological Sciences Federation

Halifax, Nova Scotia

ABSTRACTS

Halifax
Nova Scotia

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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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Distinguished Guest Lecture
Friday, June 12, 2009

Course generously supported through an unrestricted educational grant from the Neurological Sciences Foundation of Canada

08:30 **Margaret Atwood: A Precision of Language**

Margaret Atwood is a giant of modern literature who has anticipated, explored, satirized -- and even changed -- the popular preoccupations of our time. The Booker Prize-winning author of The Handmaid's Tale and The Blind Assassin, Atwood is the rare writer whose work is adored by the public, acclaimed by the critics and studied on university campuses around the world. Though her subject matter varies, the precision crafting of her language -- she is also a renowned poet -- gives her body of work a sensibility entirely its own.

Based out of Toronto, Atwood has written over forty classic books, which have been translated into over thirty languages. Her novels include Alias Grace, Life Before Man, Oryx and Crake and 2008's Moral Disorder. Her major awards include The Giller and The Governor General's Award (Canada); The Booker Prize (UK); The Dashiell Hammett Award (United States); and the Le Chevalier dans l'Ordre de Arts et Les Lettres (France). In her poem "Spelling," Atwood writes, "A word after a word after a word is power."

Please bring this Abstract book with you to the Congress in Halifax 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.

Volume 36 Number 3 (Supplement 1) May 2009

44th Annual Congress of the

Canadian Neurological Sciences Federation

HALIFAX, NOVA SCOTIA JUNE 9-12, 2009

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CANADIAN NEUROLOGICAL SCIENCES FEDERATION
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ABSTRACTS
AND PROGRAM

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Halifax Nova Scotia

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La Société Canadienne de Neurochirurgie

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La Société Canadienne de Neurophysiologie Clinique

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

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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 AB, Canada T2H 2K6.

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HALIFAX, NOVA SCOTIA JUNE 9-12, 2009

CANADIAN NEUROLOGICAL SCIENCES FEDERATION
FÉDÉRATION DES SCIENCES NEUROLOGIQUES DU CANADA

ABSTRACTS

Halifax Nova Scotia

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

PLATFORM PRESENTATIONS

Wednesday, June 10, 2009

Thursday, June 11, 2009

POSTER PRESENTATIONS

Thursday, June 11, 2009 - Friday, June 12, 2009

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CANADIAN
NEUROLOGICAL
SCIENCES
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DU CANADA

Join us in Halifax,
Nova Scotia for the

44th Annual
Congress of the

Canadian Neurological Sciences Federation

June 9-12, 2009

Halifax
Nova Scotia

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2009 Society Prize Papers

The President's Prize – Canadian Association of Child Neurology

Cerebral arteriopathy in children with neurofibromatosis type 1

JF Brandsema (Toronto), R Askalan (Toronto), D Rea (Toronto), D Armstrong (Toronto), G de Veber (Toronto), D MacGregor (Toronto), WJ Logan (Toronto), PC Parkin (Toronto)*

Background: Cerebrovascular abnormalities are serious but under recognized complications of NF1. We investigated the prevalence, clinical presentation, imaging findings and prognosis of cerebral arteriopathies in childhood NF1. *Methods:* Patients followed at the NF1 clinic at the Hospital for Sick Children between 1990 and 2007 were studied; those with confirmed NF1 and neuroimaging were included. All neuroimaging studies were reviewed for the presence of arteriopathy by two pediatric neuroradiologists blinded to clinical information. Clinical records of children with cerebral arteriopathy were reviewed. *Results:* Among 419 children with confirmed NF1, 266 (63%) had neuroimaging. 17/266 had cerebral arteriopathy for a minimum prevalence rate of 6%. In 35 patients who received MRA, arteriopathy was more common in those with optic gliomas (11/21) compared to those without (4/14). 47% of children developed focal deficits months to years after diagnosis of the arteriopathy. Follow-up at a mean of 7 years post-diagnosis of arteriopathy showed that 35% (6/17) had progression requiring revascularization surgery. Seven patients received aspirin for primary stroke prevention. A mean delay of 51 months to clinical radiographic reporting of these findings was observed. *Conclusions:* The prevalence of cerebral arteriopathy in children with NF1 in this study was at least 6% and was associated with young age and optic glioma. Arteriopathy causes stroke with resultant neurological deficits. Medical and/or surgical interventions may prevent these complications. Therefore, addition of vascular imaging (MRA/CTA) to brain imaging studies for early detection of arteriopathy should be considered in children with NF-1, particularly in young patients with optic glioma.

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

Unique functional pathway detected with MEG and DTI tractography in pediatric epilepsy

RD Bhardwaj (Toronto), S Mahmoodabadi (Toronto), H Otsubo (Toronto), C Snead (Toronto), JT Rutka (Toronto), E Widjaja (Toronto)*

Background: There remains much to learn in how focal aberrant neuronal excitation may affect surrounding and distant brain function and anatomy. The aim of this study was to assess the functional connectivity between areas of abnormal neuronal excitation in children with temporal lobe epilepsy. *Materials and Methods:* We studied a group of six pediatric patients, all of whom had MEG spike sources both within the temporal lobe and the ipsilateral Rolandic region. The mean age of the group (n=6) with epilepsy was 11.5 ± 5.2 years of age, with 3 females and 3 males. All patients had intractable unilateral temporal lobe epilepsy, caused by various brain pathologies. The control group (n=6) was age and sex matched. All patients had diffuse tensor imaging MRI performed between the temporal and frontal lobes of both cerebral hemispheres. *Results:* In all patients with epilepsy, a consistent white matter tract traveling through the external capsule, connecting the temporal and peri-rolandic regions of MEG activity was visualized. However, on the contralateral hemisphere, there was no evidence of a similar fiber tract connection, linking the corresponding identical volumes between the two regions. Of the normal control subjects, there were no corresponding white matter tracts identified in either hemisphere. *Conclusions:* This is the first identification of novel association white matter tract formation through the external capsule, connecting two distant sites of unilateral MEG activity. This finding may highlight the role of active white matter tract reorganization and plasticity within the pathophysiology of epilepsy.

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

A Novel Tissue Engineering Approach Using Endothelial Progenitor Cell-Seeded Biopolymer to Treat Intracranial Saccular Aneurysms

AP Mitha (Calgary), JP Aronson (Boston), CS Ogilvy (Boston)*

Background: Recurrence after coiling of intracranial aneurysms is reported in up to 42% of small aneurysms. Studies suggest the problem underlying aneurysm recanalization is lack of endothelialization across the ostium. This project uses a novel tissue engineering approach to promote endothelialization by seeding endothelial progenitor cells (EPCs) within a fibrin polymer injected endovascularly into the aneurysm. *Materials and Methods:* Aneurysms were created in New Zealand White rabbits using the modified elastase method. Following angiographic confirmation of aneurysm formation, rabbits were left untreated (N=3), or microcatheterization was performed and aneurysms treated with platinum coils (N=3), fibrin biopolymer alone (N=3), or fibrin combined with autologous cultured EPCs (N=4). Efficacy of aneurysm occlusion was assessed angiographically and histologically at 2, 6, 12, and 16-week time points. *Results:* No coil- or EPC-treated aneurysm recurred or recanalized angiographically. At the longest time points used in these studies, coiled aneurysms had loose connective tissue at the neck with only partial neointima formation, while EPC-treated aneurysms had thick neointima with

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an endothelial cell monolayer across the ostium. *Conclusions:* Endovascular treatment of intracranial aneurysms using a tissue engineered autologous EPC-seeded fibrin biopolymer promotes early endothelialization and neointima formation at the aneurysm neck. This novel treatment method may address reasons for the limited durability of standard coil embolization and provides further avenues for the development of improved devices for the care of patients with aneurysms.

Francis McNaughton Memorial Prize - Canadian Neurological Society

Functional MRI study of the primary somatosensory cortex in comatose survivors of cardiac arrest

TE Gofton (London), PA Chouinard (London), GB Young (London), F Bihari (London), MW Nicolle (London), DH Lee (London), MD Sharpe (London), Y Yen (Menlo Park), AM Takahashi (Menlo Park), SM Mirsattari (London)*

Introduction: It is difficult to assess cerebral function in comatose patients. Because earlier functional neuroimaging studies demonstrate associations between cerebral metabolism and levels of consciousness, fMRI in comatose survivors of cardiac arrest could provide further insight into cerebral function during coma. *Methods:* Using fMRI, cerebral activation to somatosensory stimulation to the palm of the hand was measured in 19 comatose survivors of cardiac arrest and in 10 healthy control subjects and was compared to somatosensory-evoked potential (SSEP) testing of the median nerve. Changes in the blood oxygenation-level depended signal (BOLD) in the primary somatosensory cortex (S1) contralateral to the stimulated hand were quantified. Clinical outcome was assessed using the Glasgow Outcome Scale (GOS) and the modified Rankin Scale at 3 months post-cardiac arrest. *Results:* Five out of 19 patients were alive at 3 months. Patients who survived cardiac arrest showed greater BOLD in S1 contralateral to somatosensory stimulation of the hand compared to patients who eventually did not. Greater BOLD was also seen in S1 of patients who retained their SSEP N20 waveforms. There were also positive correlations between BOLD in S1 with both level of consciousness and measures of outcome at 3 months. *Conclusion:* In summary, this study demonstrates that BOLD in the contralateral S1 to somatosensory stimulation of the hand varies with levels of consciousness during coma and that greater BOLD might be associated with better clinical outcome.

Andre Barbeau Memorial Prize - Canadian Neurological Society

Levator palpebrae biopsy has higher diagnostic yield than other biopsy sites for chronic progressive external ophthalmoplegia

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

Background: Chronic progressive external ophthalmoplegia (CPEO) is a mitochondrial syndrome. Diagnosis relies heavily on muscle biopsy and molecular genetic studies, although diagnostic yield is poor. We report that levator palpebrae biopsy has higher diagnostic yield than limb biopsy sites in patients with CPEO. *Methods:* This is a retrospective chart review of 36 patients with a diagnosis of CPEO. Patients had muscle biopsy of their levator palpebrae muscle during oculoplastics procedures, and/or from a limb skeletal muscle site. Histopathology, electron microscopy and genetic studies were performed. *Results:* The diagnostic yield of muscle biopsy histopathology for limb sites was 50% (13/26) whereas it was 85% (11/13) for levator palpebrae specimens. Three patients from our series with negative muscle biopsies from limb sites subsequently had diagnostic levator palpebrae biopsies. Electron microscopy was diagnostic in 47% of limb biopsies and in 100% of levator palpebrae samples. Electron microscopy or genetic studies were positive in seven patients with nondiagnostic histopathology. *Conclusion:* For 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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44th Annual Congress

Preliminary Program
as at April 16, 2009.

CANADIAN NEUROLOGICAL SCIENCES FEDERATION
FÉDÉRATION DES SCIENCES NEUROLOGIQUES DU CANADA

Tuesday, June 9/09

7:15 – 8:30	Residents' Breakfast
8:30 - 5:00	ALS
8:15 - 5:00	Advances in the Neurobiology of Disease ***Chairs: Peter Dirks and Peter Smith***
8:30 - 5:00	Child Neurology Day ***Chairs: Harvey Sarnat and Joe Dooley***
12:00 - 1:30	Lunch
6:00 - 8:00	Epilepsy Video Session ***Chair: Richard McLachlan***
6:00 - 8:00	Movement Disorders SIG ***Chair: Alex Rajput***
6:00 - 8:00	Headache SIG ***Chair: Jonathan Gladstone***
6:00 - 8:00	Neuromuscular SIG ***Chair: Kristine Chapman***

Wednesday, June 10/09

8:00 - 10:00	Grand Opening Plenary-Scientific & Technical Advances in the Clinical Neurosciences: ***Cornelius Tulleken (ELANA)/ Mark Bernstein (Ethics) / Ivar Mendez – Richardson***
10:00 - 10:15	Coffee Break
10:15 - 11:45	Chair's Select Plenary Presentations
11:45 - 12:00	Clinical Trial Announcements
12:00 - 1:30	Epilepsy Co-developed Industry Symposium (UCB Pharma Canada)
12:00 - 1:30	Neuropathic Pain Co-developed Industry Symposium (Pfizer Canada)
1:30 - 5:00	Concurrent Neurovascular Course - Neuroradiology ***Chair: Timo Krings***
1:30 - 5:00	Concurrent Neurovascular Course – Clinical Neurovascular ***Chairs: M. Findlay & G. Gubitz***
1:30 - 5:00	Spine ***Chair: Eric Massicotte***
1:30 - 5:00	Neurocritical Care ***Chair: Jeanne Teitelbaum***
1:30 - 5:00	Epilepsy ***Chairs: Francois Dubeau***
1:30 - 5:00	EMG ***Chairs: Ian Grant and Timothy Benstead***
1:30 - 5:00	Neuro-ophthalmology ***Chair: William Fletcher***
5:00 – 6:30	Opening of Exhibits Reception
6:30 – 8:00	Diabetic Neuropathic Co-developed Industry Symposium (Boehringer Ingelheim)

Thursday, June 11/09

8:00 - 9:30	Plenary-CNS, CACN & CSCN ***Michael Sinnreich–Gloor/Brenda Banwell-Tibbles***
8:00 - 9:30	Plenary-CNSS ***Michael West/Gary Steinberg-Penfield***
9:30 -10:00	Coffee Break
10:00 - 12:15	Platforms (6 simultaneous)
12:15 - 2:00	Lunch/Exhibit Viewing/Digital Mini-platforms
2:00 - 4:30	Platforms (7 simultaneous)
4:30 - 5:30	Digital Poster and Exhibit Viewing
6:00 - 12:00	Maritime Lobster Supper and Kitchen Party

Friday, June 12/09

8:00 - 8:15	Journal Editor's Report
8:15 - 8:30	CBANHC Report
8:30 - 9:30	Distinguished guest lecture - ***Margaret Atwood***
9:30 - 10:15	Coffee break/Exhibit viewing
10:15 - 12:00	Grand Rounds
12:00 - 1:30	Lunch / Exhibit viewing / Digital Mini-platforms
1:30 - 5:00	Peripheral Nerve ***Chair: Raj Midha***
1:30 - 5:00	What's New in Neurosurgery? ***Chair: Ian Fleetwood***
1:30 - 5:00	EEG ***Chair: Seyed Mirsattari***
1:30 - 5:00	Endoscopy ***Chair: Mark Hamilton***
1:30 - 5:00	Dementia ***Chair: Sultan Darvesh***
1:30 - 5:00	What's New in Neurology? ***Chair: Roger McKelvey***
1:30 - 5:00	MS ***Chair: Virender Bhan***

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CANADIAN NEUROLOGICAL SCIENCES FEDERATION
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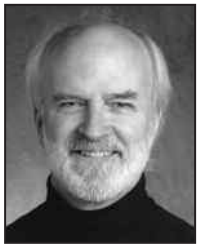

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Platform Presentations

Chair's Select Plenary Presentations

A-01

Cerebral arteriopathy in children with neurofibromatosis type 1

JF Brandsema (Toronto), R Askalan (Toronto), D Rea (Toronto), D Armstrong (Toronto), G de Veber (Toronto), D MacGregor (Toronto), WJ Logan (Toronto), PC Parkin (Toronto)*

Background: Cerebrovascular abnormalities are serious but under recognized complications of NF1. We investigated the prevalence, clinical presentation, imaging findings and prognosis of cerebral arteriopathies in childhood NF1. *Methods:* Patients followed at the NF1 clinic at the Hospital for Sick Children between 1990 and 2007 were studied; those with confirmed NF1 and neuroimaging were included. All neuroimaging studies were reviewed for the presence of arteriopathy by two pediatric neuroradiologists blinded to clinical information. Clinical records of children with cerebral arteriopathy were reviewed. *Results:* Among 419 children with confirmed NF1, 266 (63%) had neuroimaging. 17/266 had cerebral arteriopathy for a minimum prevalence rate of 6%. In 35 patients who received MRA, arteriopathy was more common in those with optic gliomas (11/21) compared to those without (4/14). 47% of children developed focal deficits months to years after diagnosis of the arteriopathy. Follow-up at a mean of 7 years post-diagnosis of arteriopathy showed that 35% (6/17) had progression requiring revascularization surgery. Seven patients received aspirin for primary stroke prevention. A mean delay of 51 months to clinical radiographic reporting of these findings was observed. *Conclusions:* The prevalence of cerebral arteriopathy in children with NF1 in this study was at least 6% and was associated with young age and optic glioma. Arteriopathy causes stroke with resultant neurological deficits. Medical and/or surgical interventions may prevent these complications. Therefore, addition of vascular imaging (MRA/CTA) to brain imaging studies for early detection of arteriopathy should be considered in children with NF-1, particularly in young patients with optic glioma.

A-02

The Impact of Endoscopic Third Ventriculostomy on the Neuropsychological Outcome of Patients with Obstructive Hydrocephalus

MG Hamilton (Calgary), C Serrano (Calgary), M King (Calgary), L Partlo (Calgary), W Hader (Calgary)*

Background: Endoscopic third ventriculostomy (ETV) has become the treatment of choice for most pediatric and adult patients with obstructive hydrocephalus. Despite many studies that have confirmed the safety and the shunt-free success rate of ETV, the effectiveness of ETV to treat cognitive dysfunction, a common presenting hydrocephalus complaint, remains unclear. The purpose of this study was to assess the impact of ETV on cognitive function *Methods:* A retrospective review of patients with obstructive hydrocephalus treated with ETV was performed. Patients with preoperative and postoperative neuropsychological assessments were included in the study. The mean long-term neuropsychological follow-up was 20.2 months after surgery. *Results:* A total of 15 patients were identified with age at presentation ranging from 5 to 66 years. Obstructive hydrocephalus was caused by aqueductal stenosis in 11 patients, tectal glioma in 3 patients, and arachnoid cyst in 1 patient. Preoperative assessments identified 13 patients with cognitive impairment and 10 of them had more than one cognitive domain affected. ETV was the primary modality of treatment in 11 patients and there were 4 patients who had previously been shunted. Cognitive improvement was seen in 11 patients (73%) and 4 of them obtained normal cognitive assessments. Cognitive function improved in 2 of the 4 previously shunted patients and one of them obtained a normal cognitive assessment. Two of the 13 patients with preoperative cognitive deficit did not improve after ETV. *Conclusion:* ETV as primary treatment modality or after shunting significantly improves the cognitive impairment for the majority of patients with obstructive hydrocephalus.

A-03

Long-term outcome of children with idiopathic generalized epilepsy with generalized tonic-clonic seizures, not otherwise specified (IGE NOS): a population-based study with a >20 year follow up

PR Camfield (Halifax), CS Camfield (Halifax)*

Background: Children with generalized epilepsy may have a non-specific IGE syndrome (IGE NOS). They are intellectually/neurologically normal with generalized tonic-clonic seizures and interictal EEG showing generalized spike-wave without cause. The prognosis is unknown. *Methods:* Children with IGE NOS were selected from the Nova Scotia Childhood Epilepsy Study - a population-based cohort including children with >1 unprovoked seizure, onset 1977-1985. Follow-up was in 2007-2008 by personal contact. *Results:* Of 692 in the cohort, 39(5%) had IGE NOS. 5 had <5 years follow up and were omitted. Age at onset averaged 6.3 ± 4 years. Follow-up averaged 22.5 ± 7.5 years, at age 29.3 ± 8.5 years. There were 18 females. 26 (76%) had a terminal epilepsy remission (seizure-free and off medication) for 16.7 ± 8.3 years (range 1-31). None was intractable, although 41% had >10 convulsions. Five had learning difficulties. Only one developed Juvenile Myoclonic Epilepsy. There were no deaths. At the end of follow-up, of those >18 years of age (N=29), 17 (58.6%) completed high school, 4 attended university. 38% had mental health visits. 17 lived with a "life partner" and 7 alone. 9 women had ≥1 pregnancy and 7 men fathered a pregnancy. Only 4 were planned, 11 outside a stable relationship. 34.5% were unemployed and 14% received government assistance. 60-65% were satisfied with their lives, friendships and social activities. *Conclusions:* 75% of children with IGE NOS have complete epilepsy remission. 40% have a troubled social outcome, a proportion depressingly similar to other epilepsy syndromes in our cohort.

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A-04

Effects of acute treatment with statins on cerebral vasospasm in patients after aneurysmal subarachnoid hemorrhage: Meta-analysis of the published literature

CD Harraher (Halifax), D Griesdale (Vancouver)*

Objectives: To assess if hydroxsymethylglutaryl coenzyme A reductase inhibitors (statins): 1. Reduce vasospasm following aneurysmal subarachnoid hemorrhage. 2. Improve functional outcomes following aneurysmal subarachnoid hemorrhage using the Modified Rankin Score (MRS) or the Glasgow outcome scale(GOS) Data Sources: Studies were identified using MEDLINE (1966-2007), EMBASE (1974-2007) and Cochrane Central Register of Controlled Clinical Trials (CENTRAL) in the Cochrane Library. *Study Selection:* A total of 76 articles or abstracts were reviewed for details on statin use, subarachnoid hemorrhage and vasospasm; 26 articles were reviewed in depth. Three randomized-controlled trials, one matched controlled cohort study and two retrospective studies were included in the analysis. *Data Extraction:* The study design, age range, gender, primary and secondary outcomes and number of patients enrolled were recorded. Two readers independently extracted data and evaluated validity. *Data Synthesis:* In a random effects model, including all five studies with primary outcome data, the odds of developing vasospasm in the statin group was 0.34 times that of the control group (OR = 0.336, 95% confidence interval 0.120 - 0.951, p=0.04). The secondary outcome data on functional status at discharge showed that the odds of having an unfavorable functional outcome (MRS<3) in patients using statins after SAH is 0.68 times that of the control group (OR = 0.677, 95% confidence interval 0.267-1.718, p=0.412). *Conclusion:* Statins significantly reduce the development of vasospasm in patients following aneurysmal SAH. Although there also appears to be some benefit from statins in terms of functional outcome, this does not reach statistical significance.

A-05

Levator palpebrae biopsy has higher diagnostic yield than other biopsy sites for chronic progressive external ophthalmoplegia

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

Background: Chronic progressive external ophthalmoplegia (CPEO) is a mitochondrial syndrome. Diagnosis relies heavily on muscle biopsy and molecular genetic studies, although diagnostic yield is poor. We report that levator palpebrae biopsy has higher diagnostic yield than limb biopsy sites in patients with CPEO. *Methods:* This is a retrospective chart review of 36 patients with a diagnosis of CPEO. Patients had muscle biopsy of their levator palpebrae muscle during oculoplastics procedures, and/or from a limb skeletal muscle site. Histopathology, electron microscopy and genetic studies were performed. *Results:* The diagnostic yield of muscle biopsy histopathology for limb sites was 50% (13/26) whereas it was 85% (11/13) for levator palpebrae specimens. Three patients from our series with negative muscle biopsies from limb sites subsequently had diagnostic levator palpebrae biopsies. Electron microscopy was diagnostic in 47% of limb biopsies and in 100% of levator palpebrae samples. Electron microscopy or genetic studies were positive in seven patients with nondiagnostic histopathology. *Conclusion:* For 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.

A-06

Mefloquine as a novel therapeutic agent in the treatment of progressive multifocal leukoencephalopathy

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Background: Progressive multifocal leukoencephalopathy (PML) is an incurable white matter disease caused by infection with JC virus. PML most commonly presents in patients with immune suppression particularly from HIV. We describe a case of PML with disease stabilization following administration of mefloquine, an antimalarial medication. *Methods:* A 54 year old woman taking prednisone for symptomatic pulmonary sarcoidosis presented with dysarthria & right sided ataxia. MRI showed a large hyperintense T2 white matter lesion affecting the right cerebellar hemisphere. JC virus was found in CSF and brain biopsy confirmed the diagnosis of PML. Despite discontinuing prednisone and treatment with mirtazapine & cidofovir, the patient worsened clinically and the MRI lesion spread to the brainstem. Mefloquine 500mg/week was initiated. *Results:* Clinical progression stopped immediately and repeat MRIs demonstrated radiological stabilization of the white matter lesions. JC virus became undetectable in CSF. No clinical or imaging evidence of disease progression has occurred over 6 months of follow-up. *Conclusion:* Stabilization of disease progression in PML is rare. There are no clinically proven therapeutic agents effective against JC virus. However, preliminary in vitro data suggest that mefloquine inhibits JC viral DNA replication. This is the first report of successful treatment of PML with mefloquine. The authors have no financial interest in the therapies presented in this case report.

General Neurology

B-01

Rasmussen´s encephalitis: a retrospective analysis of 34 patients

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Introduction: Rasmussen encephalitis (RE) is a rare epilepsy syndrome characterized by unilateral, progressive hemispheric inflammation of unknown etiology. There is a striking lack of large longitudinal case series addressing clinical course, EEG- and MRI findings. *Methods:* We retrospectively studied 34 patients (range 1.8 - 14.7 years at first seizure) of the Bethel-Epilepsy-Centre, Germany (1988-2006). Diagnosis of RE was based on European guidelines (Bien et al., Brain 2005, 128, 460). This project focused on the interrelationship between clinical course (age onset, seizure types, status epilepticus (SE), Todd´s paresis) and serial EEG and MRI evolution. *Results:* We identified 3 distinct clinical phases according to the classification of Bien et al. Brain 2002, 125,1753) in 90% of patients (prodromal=PP, acute =AP and residual phase=RP). The occurrence of status epilepticus as initial symptom implied bad outcome. Focal EEG slowing (in early stages already 76%) and epileptiform activity (EA) were mostly distributed over the fronto-

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centro- temporal region. EA was significant less in the residual phase of RE. Signal increase and atrophy on MRI progressed over time (22% PP, 44% AP, 93% RP) and was initially mainly temporal and later more frontal. Local atrophy was present in 11% of the PP subgroup and 100% when RP was reached. *Conclusion:* Our series is the largest reported study on RE focussing on correlation of clinical course, EEG and imaging. Despite the heterogeneity of the various individual courses we were able to identify characteristic disease patterns with regard to topographical features, functional-structural interrelationships and early indicators for bad prognosis.

B-02

Functional MRI study of the primary somatosensory cortex in comatose survivors of cardiac arrest

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Introduction: It is difficult to assess cerebral function in comatose patients. Because earlier functional neuroimaging studies demonstrate associations between cerebral metabolism and levels of consciousness, fMRI in comatose survivors of cardiac arrest could provide further insight into cerebral function during coma. *Methods:* Using fMRI, cerebral activation to somatosensory stimulation to the palm of the hand was measured in 19 comatose survivors of cardiac arrest and in 10 healthy control subjects and was compared to somatosensory-evoked potential (SSEP) testing of the median nerve. Changes in the blood oxygenation-level depended signal (BOLD) in the primary somatosensory cortex (S1) contralateral to the stimulated hand were quantified. Clinical outcome was assessed using the Glasgow Outcome Scale (GOS) and the modified Rankin Scale at 3 months post-cardiac arrest. *Results:* Five out of 19 patients were alive at 3 months. Patients who survived cardiac arrest showed greater BOLD in S1 contralateral to somatosensory stimulation of the hand compared to patients who eventually did not. Greater BOLD was also seen in S1 of patients who retained their SSEP N20 waveforms. There were also positive correlations between BOLD in S1 with both level of consciousness and measures of outcome at 3 months. *Conclusion:* In summary, this study demonstrates that BOLD in the contralateral S1 to somatosensory stimulation of the hand varies with levels of consciousness during coma and that greater BOLD might be associated with better clinical outcome.

B-03

Event related oscillations in the human subthalamic nucleus and globus pallidus interna during saccadic eye movements

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Background: Oscillatory field potentials occur in the basal ganglia during limb movements, but have not been studied during saccadic eye movements. Deep brain stimulation (DBS) provides opportunity to determine relationships between local field potential (LFP) oscillations in the subthalamic nucleus (STN) and globus pallidus interna (GPi) and saccades. *Methods:* Six patients were investigated: 3 had STN DBS for Parkinson's disease and 3 had GPi DBS for dystonia. Subjects performed visually-cued horizontal saccades while LFPs from quadripolar DBS electrodes, scalp electroencephalogram (EEG), and electrooculogram were recorded using SynAmp amplifiers. Saccade onsets were determined offline. Averaged wavelet spectrograms of the electrode recordings were aligned on saccade onset using Matlab programs. Event-related synchronization or desynchronization of the LFP oscillations in the period prior to, during and post ipsiversive or contraversive saccades were compared to baseline at a $p < 0.05$ significance level. *Results:* Gamma (30-80Hz) oscillation synchronization was recorded in STN and GPi regions around the time of saccade onset in 4 / 6 patients. Gamma oscillations began 200 ms before contraversive saccades, but occurred during and shortly after ipsiversive saccades. In one GPi patient, beta (14-29 Hz) and gamma desynchronization were recorded at the GPi and frontal surface (EEG) for contraversive saccades ~50 ms prior to saccade onset. *Conclusion:* Gamma synchronization just prior to saccade onset suggests a motor role of the STN and GPi during saccade initiation. The late synchronization potentials during ipsiversive saccades might correspond to the stopping of saccades. These oscillatory LFPs implicate specific roles of the STN and GPi in the processing of saccades.

B-04

A Novel ECGF1 Mutation in a French Canadian Patient with Mitochondrial Neurogastrointestinal Encephalomyopathy

R Laforce (Quebec), PN Valdmanis (Montréal), N Dupré (Quebec), GA Rouleau (Montréal), AF Turgeon (Quebec), M Savard (Quebec)*

Mitochondrial neurogastrointestinal encephalomyopathy (MNGIE) is a rare autosomal recessive disorder characterized by gastrointestinal, extraocular muscle, peripheral nerve, and cerebral white matter involvement. Mutations in the nuclear gene ECGF1 encoding for thymidine phosphorylase (TP) cause loss of TP activity, systemic accumulation of its substrates in plasma, and alterations in mitochondrial DNA including deletions, depletions, duplications, and somatic point mutations. To date, more than 30 mutations have been reported in diverse ethnic populations. We present herein the clinical, neuroimaging, neuromuscular, and molecular findings of the first French Canadian patient with MNGIE caused by a novel homozygous invariant splicing site (IVS5 +1 G>A) mutation of the ECGF1 gene.

B-05

Entry demographics and pharmacological treatment of migraine patients referred to a tertiary care pain clinic.

SS Nijjar (Toronto), AS Gordon (Toronto), M Clark (Toronto)*

Background: Many patients referred to pain clinics are at the severe end of the migraine spectrum with disabilities. This often results in significant health care and economic costs. This burden may be avoided if treatment is optimized in a primary care setting. The objective of this study is to examine the pharmacological treatment of patients referred to a tertiary pain clinic. *Methods:* A retrospective review of 100 consecutive migraine patients admitted to our pain center was conducted. Patients included met the 2nd Edition of The International Headache Classification (ICHD-2), for diagnosis of migraine. Data collected included patient demographics, alternative pain diagnoses and pharmacological treatment. *Results:* The mean age of admitted migraine patients was 43.4 years. Of those, 48 percent had tried at least one triptan in the past and only 31 percent were actively using triptan(s). Opiate use was more prevalent; 72 percent of admitted patients were using an opiate and 27 percent used multiple opiates. *Conclusions:* A significant number of patients

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had not yet been tried on a triptan despite meeting the diagnostic criteria for migraine and having significant disability. More education of the general medical community may be beneficial in implementing a stratified care approach to migraine management.

B-06

Neurological recovery following treatment of aggressive multiple sclerosis with immunoablation and autologous stem cell transplantation (ASCT)

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Background: Our study presupposes that complete immunoablation and reconstitution with hematopoietic stem cells (HSC) will halt further immune-mediated disease. In the absence of damaging inflammation the implanted HSC might stimulate repair by differentiation into cells, including neural cells that could migrate to the CNS. *Methods:* The Canadian MS/BMT trial is a non-randomized phase II trial of immunoablation and autologous HSC transplantation in aggressive MS patients who have failed ≥1 year of standard treatment. Immunoablation involved busulphan, cyclophosphamide and rabbit ATG. Patients were assessed clinically @ 3 months and MRI scanned @ 6 months. *Results:* 6/16 patients with ≥1.5 year of follow-up (range 1.5-8 years) showed sustained EDSS improvements. (3/16 worsened and 7/16 were unchanged compared with baseline.) Improvements varied with the duration of MS prior to the treatment; those showing the earliest changes also had the shortest disease course. Changes in all aspects of Kurtzke Functional System scores were noted; particularly in pyramidal, cerebellar, brainstem and visual systems. Clinical stability was mirrored by the lack of any perceptible MRI activity. T2 lesion volumes remained stable in 7/16 (≤ 10% change), but the majority (9/16) showed overall reductions compared to baseline (range 12-34%). *Conclusions:* Immunoablation and ASCT leads to stabilization or improvement lasting up to 8 years in aggressive MS. The timing of perceived improvement varied widely, but correlated with the duration of MS prior to treatment; patients with longer disease took longer to show any perceived benefit.

B-07

Contribution of Dr. Rajput Senior to Neurology-a tribute on his retirement

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

Objective: To appreciate Prof. Ali Rajput's work in Parkinson's disease on his retirement. *Background:* Dr. Ali Rajput retired a few years ago although he still is Professor Emeritus of Neurolgy at the University of Saskachewan. His work in the field of Movement disorders has been recognized at the national and international level and led to some new standards of practice in neurology. *Methods:* We studied web based information to learn Dr. Rajput's Work. *Results:* Dr. Rajput has done substantial research in the field of Parkinson's disease. He discovered that levodopa prolongs life, is not toxic to humans, and that high-dose treatment is less beneficial than lower doses. Dr. Rajput has been a tireless advocate for people with Parkinson's. He brought levodopa to the province when patients had no access to the drug. He helped found the Saskatchewan Parkinson's Disease Foundation and is a member of the World Health Organization's working group on Parkinson's. He has been member of national and international committees, and published numerous book chapters, articles, and papers. He is a reviewer for many professional journals and granting agencies. He has been honored with many awards including the Saskatchewan Order of Merit in 1993, the Order of Canada (Officer) in 1997, the Morton Schulman Award from the Parkinson Society of Canada in 2001, and the 2002 Distinguished Canadian award from the Seniors' University Group at the University of Regina. *Conclusion:* Prof. Rajput continues to serve the field of neurology, and Parkinson disease tirelessly. His work is unsurpassable.

B-08

Dr. Lewis Yelland: successful healer or evil torturer?

*TJ Murray (Halifax)**

Background: Lewis Yealland was a young Canadian neurologist at the National Hospital, Queen Square, when World War I broke out. The military establishment sought ways to manage the problem of "shell shock" in large numbers of soldiers traumatized by trench warfare. Yealland became prominent as a successful therapist, using an adaptation of German electric shock and powerful suggestive therapy to treat dramatic presentations of aphasia, mutism, paralysis and movement disorders in the soldiers. The military was pleased with his results. He later published a book on his approach with dramatic examples of the success with his aggressive approach. *Methods:* Historical research was carried out at the Wellcome Institute, London, British Library, Imperial War Museum and BBC Archives. *Results:* Other military physicians at the time believed in a more humanistic approach and subsequently Yealland has been demonized in the histories of WW I as a cruel torturer of traumatized young soldiers, portrayed in film and literature as an evil doctor. *Conclusion:* I will put in context the desire of a young physician to please superiors, the apparent success of his approach, the pressures of the military, and the problem of events clouding ethical considerations. Many of the issues and questions surrounding the limits of medical and military approaches are relevant today.

B-09

A pilot program evaluation of the ThinkFirst For Kids injury prevention educational curriculum for grades 7 and 8

C Duquette (Ottawa), M Vassilyadi (Ottawa), MF Shamji (Ottawa)*

Background: Head injury is a major cause of morbidity and mortality in children. The ThinkFirst Foundation of Canada has developed a school curriculum that has been shown to improve knowledge of safe practices and behaviours. It is composed of six teaching modules and a DVD that can be administered by a school teacher. *Methods:* A pilot study was designed to assess the effectiveness of the ThinkFirst For Kids (TFFK) curriculum in grades 7 and 8 in Ottawa. Knowledge acquisition was assessed using a quasi-experimental design and the attitudes, behaviours, and experiences of the students were explored using qualitative strategies. 205 students in four schools answered a questionnaire before and after (early and delayed) administration of the TFFK curriculum by their teachers. All the teachers were interviewed after the questionnaires and focus groups were held for students in two of the schools. *Results:* Significant differences in pre-intervention scores were noted both among schools (ANOVA, $p<0.01$) and for a given school based on the timing of evaluation (Dunn's test,

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α=0.05). The knowledge gain seemed durable over short and long terms. A majority (over 70%) of the students stated that their decision-making and participation in risky behaviors was altered by exposure to the TFFK curriculum. *Conclusions:* The TFFK curriculum for grade 7 and 8 students is effective at increasing knowledge regarding brain and spinal cord injury and injury prevention. Even six weeks after the intervention, the students' decision making and behaviour changes, however, the magnitude and nature of the change is not known.

General Neurosurgery and History

C-01

Neurosurgery in Saskatchewan: A history through changing times

MA Riesberry (Saskatoon), D Fourney (Saskatoon)*

Background: The University of Saskatchewan, Division of Neurosurgery was developed from the unique perspective of a new clinical medical school programme, a new university hospital and the development of Canada's first Medicare. The purpose of this study was to review the development of the programme in this unique context, and to highlight important neurosurgical firsts from Saskatchewan. *Methods:* Surgeons from all time periods were interviewed. A literature review was completed Personal documents, biographies, press releases, and other journal publications were read including those from the University of Saskatchewan Archives and the Osler Library for the History of Medicine. *Results:* From its start it was a comprehensive surgical programme. Research and innovation has been a part of the University of Saskatchewan neurosurgery from its conception. Many firsts in neurosurgical practise were developed or started in Saskatchewan. Saskatchewan has a unique history in Canadian health care. The effects of Medicare on neurosurgical practise and patient care will be discussed. *Conclusions:* From the beginning neurosurgery was a strong department supported by neuroscientists from the top of their fields that has contributed to the community and to neurosurgery.

C-02

Autologous Dendritic Cell (DC) Vaccination Combined With Immune Adjuvant Therapy for Malignant Melanoma Including Patients with Intracranial Metastases

RG Kerr (Cincinnati), H Chen (Edmonton), M Farr-Jones (Edmonton), KC Petruk (Edmonton)*

Background: DCs are powerful immune regulating cells. They have been used to promote strong anti-tumour immune responses against both gliomas and systemic cancers. We report our experience with autologous DC vaccination of patients with AJCC stage III or IV melanoma including those with CNS involvement. *Materials and Methods:* 5 melanoma patients (1 male, 4 female: ages 18 to 65) were treated in this phase I Health Canada approved trial involving 6 vaccinations with autologous monocyte derived DCs primed with autologous tumour peptides extracted from early explant culture cells. Immunoadjuvant therapy included IL-2, IFN a2b, GM-CSF, Retinoic acid, and Celecoxib. Patients were evaluated for one year for adverse reactions, cellular immune responses, and survival. *Results:* Patients experienced limited fever and myalgia after some vaccinations. No CNS or cutaneous autoimmune events occurred. Pathology specimens after vaccination demonstrated robust cytotoxic T-lymphocyte infiltration. Three patients with CNS metastases had median survival of 17 months (8-29). One patient died of disease progression at 3 months. One patient has survived 36+ months. *Conclusions:* Autologous DC vaccination with immunoadjuvant therapy for malignant melanoma, including patients with CNS involvement, is feasible and safe. We observed positive immune response and improved survival (median 17 months versus a natural history of 3 months).

C-03

Mapping the spatial relationship between fMRI and intraoperative electrocortical stimulation data for improved efficacy of surgical brain tumor resection.

MR Stevens (Halifax), RC D'Arcy (Halifax), SD Beyea (Halifax), DB Clarke (Halifax)*

Introduction: Pre-surgical mapping is fundamental to successful removal of a cortical brain tumor. The current gold standard, intraoperative electrocortical stimulation (IES), is performed at time of surgery, and considered invasive. Functional magnetic resonance imaging (fMRI) overcomes both of these limitations, and can image deep brain tissues inaccessible to IES. To become clinically accepted in this role, fMRI must demonstrate validity and reliability. In this study, reproducibility optimized fMRI pre-surgical maps are demonstrated to localize function to the same brain structures as IES. *Methods:* Participants with cortical tumors underwent functional and anatomical MRI imaging on a 4T scanner. Functional tasks, including sensory, motor, cognitive, and language paradigms, were chosen from a precompiled list based on tumor location and planned surgical approach. Participants underwent multiple fMRI sessions to allow receiver-operator characteristic (ROC) curve analysis of reproducibility within and between sessions. At time of surgery, IES is performed using tasks closely matched to those employed for fMRI. The functional MRI and IES data are co-registered to determine the spatial relationship between them. *Results:* In a representative subject with a left frontal tumor, an object-naming task was employed for both fMRI and IES. In the ROC analysis, it was found that a threshold of z=4.3 offered the best compromise between test-retest sensitivity and specificity. This threshold provided 100 percent co-localization of fMRI and IES to within 5 mm. *Conclusion:* Functional MRI images, optimized for reproducibility (sensitivity) without sacrificing specificity, were shown to co-localize to the same brain regions as IES.

C-04

Characterizing the effects of magnetic field strength on specificity in functional MRI: Application in pre-surgical mapping

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Background: Functional MRI can potentially guide surgical planning for neurological disorders (e.g. brain tumors). Despite this, fMRI is not used clinically where sensitivity and specificity are critical. Previous studies have shown that sensitivity to the BOLD

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response measured in fMRI increases with field strength. However, the effect of increased magnetic field strength on specificity has yet to be examined. The current study investigates whether both sensitivity and specificity increase with the magnetic field strength. *Methods:* Three pre-surgical mapping paradigms (finger tapping, verbal fluency and sentence comprehension) were evaluated in a test-retest paradigm. Data were acquired with a 1.5T and a 4T MRI system. Activation maps from two runs at each scanner were used to assess the true positive rate (sensitivity), false positive rate (1-specificity) and the areas under the curve (AUC) using a receiver operating curve (ROC) analysis. *Results:* Results showed that the ROC curve obtained at 4T had a higher classification accuracy than the ROC curve obtained at 1.5T. Activation maps for a representative finger tapping task indicated a greater extent of activation at a field strength of 4T than at 1.5T. *Conclusions:* Activation maps at fixed specificity demonstrated improved sensitivity for 4T acquisitions relative to 1.5T acquisitions. Indeed, the AUC was greater at 4T relative to 1.5T. This trend was relatively consistent across tasks although individual variability was present. More work assessing test-retest reliability of activation maps computed at each field strength and for different paradigms relevant to pre-surgical mapping applications will be explored in the future.

C-05

Endoscopic third ventriculostomy as a first-line treatment for obstructive hydrocephalus: preliminary Lebanese experience

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Introduction: Endoscopic third ventriculostomy (ETV) has been gaining popularity as a first-line treatment for obstructive hydrocephalus (OHC). In our institution, we have started performing ETV in 1998. We present our preliminary experience with this technique in patients with OHC. *Methods:* Between 1998 and 2007, 49 ETV procedures were performed in 46 patients suffering from OHC. Medical records were retrospectively reviewed. ETV success was defined as shunt-free survival. *Results:* The patient population consisted of 29 males and 17 females with a mean age of 23 years (6 months - 65 years). Most common etiologies were aqueductal stenosis in 20 patients (43.5%) and tectal tumor in 9 patients (19.6%). Eighteen patients (39.1%) had previously received cerebrospinal fluid diversion. Early ETV failure during the first post-operative week occurred in 7 patients (15.6%). One patient was lost to follow-up. Among the remaining 38 patients, shunt independence was achieved in 29 patients (76.3%) after a mean follow-up of 37 months (1 - 97 months). Kaplan-Meier survival curve analysis yielded a 70% shunt-free survival rate at 5 years. No variables could predict early or late ETV failure on multivariate analysis. Transient complications occurred in 6 patients (10.9%). There were no ETV-related deaths or permanent morbidity. *Conclusion:* ETV is a safe and effective treatment for OHC leading to a high rate of long-term shunt independence with a low risk of complications. In our experience, ETV rather than ventriculo-peritoneal shunting should be considered the treatment of choice for OHC.

C-06

Trans-nasal endoscopic decompression of the optic nerves-Preliminary experience at McMaster University

K Kamian (Ancaster), K Reddy (Hamilton), D Sommer (Hamilton)*

Objective: To determine the feasibility, safety and efficacy of endoscopic optic nerve decompression for various pathologies of the skull base. The authors review their preliminary experience and examine these factors in retrospective chart review. *Methods:* We reviewed the medical records of 11 patients who underwent endoscopic optic nerve decompression for lesions of the skull base at the Hamilton General Hospital during the past 8 years. Data collected from preoperative and postoperative ophthalmologic examinations as well as operative reports and hospital charts and office charts was analyzed. Outcome evaluation was based on assessment of visual function (Snellen chart for Visual acuity, and documented visual field testing). *Results:* Mean visual acuity improved in most of the patents immediately postoperatively except in one patient in whom other factors may have been involved in the visual deterioration, whom showed recovery after 4 months. *Conclusion:* Endoscopic optic nerve decompression appears to be a safe and effective technique for restoring visual acuity in select patients who present with optic nerve compression and as an adjunct to surgical resection of intracranial masses. The authors present the relevant Surgical Anatomy, operative technique and the results and discuss the results in light of published experience.

C-07

Endoscopic third ventriculostomy for the treatment of post-aqueductal obstruction

M Cote (Québec), G Lapointe (Québec), C Picard (Québec), A Turmel (Québec)*

Background: Endoscopic third ventriculostomy (ETV) is now accepted as an effective treatment for hydrocephalus resulting from aqueductal stenosis. There is, however, a heterogeneous group of patients in which the hydrocephalus results from an obstruction distal to the aqueduct of Sylvius. The indication for ETV in these patients is much less clear cut. *Methods:* Case records of patients treated by ETV for either de novo hydrocephalus or shunt malfuction secondary to post-aqueductal obstruction were reviewed. The outcome parameters included volumetric assessment of ventricle size and stoma patency, evaluated by MRI T2 and gated imaging respectively, as well as freedom from a ventriculo-peritoneal shunt. *Results:* Sixteen patients were included in the study. Etiologies of hydrocephalus were Chiari I (2), Chiari II (5), fourth ventricle tumor (3), cerebellopontine angle tumor (4) and arachnoiditis of the fourth ventricle outlet (2). ETV was successful in 12 (75%) of these patients without complications. *Conclusion:* ETV can be a safe and effective treatment for hydrocephalus resulting from post-aqueductal obstruction. The outcome of these patients is comparable to those with aqueductal stenosis treated by ETV.

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C-08

Application of a flexible fibre CO_2 laser for neurosurgery

RW Ryan (Edmonton), RF Spetzler (Phoenix), SW Coons (Phoenix), MC Preul (Phoenix)*

Background: The CO_2 laser has an excellent profile for neurosurgery with high absorption and low lateral thermal spread, sparing adjacent tissue. Use has been limited by the need for bulky articulating arms with mirrors, as solid fibre optic cables cause scattering and loss of power. Flexible photonic band-gap fibre assembly (PBFA) technology allows delivery of CO_2 laser energy through an easily manipulated, handheld device. We examined and compared the first use of this CO_2 laser fibre to conventional methods on neural tissue. *Methods:* CO_2 laser energy was delivered in pulsed or continuous wave settings for different wattages, time durations and distances to cortex as points or lines to the brains of 6 anesthetized swine and compared to bipolar cautery with standard pial incision technique, and 11 blade incisions without cautery. Tissue was processed for standard histology and scanning electron microscopy (SEM), and lesion measurements made. *Results:* Light microscopy and SEM revealed laser incisions of consistent morphology, with central craters surrounded by limited zones of dessicated and edematous tissue. Increased laser power resulted in deeper but not significantly wider incisions. Bipolar lesions had desiccated and edematous zones but did not incise the pia, and width increased more than depth with higher power. Incisions without cautery produced hemorrhage but minimal adjacent tissue damage. *Conclusions:* The PBFA CO_2 laser produced reliable cortical incisions, adjustable over a range of settings, with minimal adjacent thermal tissue damage. The ease of application under the microscope suggests this laser system has reached true practicality for neurosurgery.

C-09

Microvascular decompression following gamma-knife therapy

AM Ajlan (Montréal), D Sirhan (Montréal)*

Introduction: Microvascular decompression (MVD) is classically considered to provide the best rate of long-term complete pain relief with sensory preservation for trigeminal neuralgia (TGN) sufferers although gamma-knife surgery (GKS) is a competitive alternative. Some patients will recur following first-line GKS. MVD can still be offered as a secondary treatment to these non-responders if they are medically fit. It is unclear if such patients run a higher technical risk with MVD or if their outcomes will be comparable. *Material and Methods:* A retrospective analysis of our most recent cohort was performed using chart and video review. The BNI grading scheme was applied. *Results:* Amongst the 129 patients recently reviewed (2002-2008), only 3 had prior ipsilateral GKS. All were female with ages ranging from 67-79 years. All had undergone similar radiotherapy schemes. Significant improvement was noted by each patient and one had persistently progressive yet tolerable ipsilateral sensory loss which had begun prior to MVD. The only abnormal intra-operative finding was a thrombosed vein adjacent to the trigeminal nerve in one patient. *Conclusion:* Although a more extensive series would prove more robust, this experience suggests that GKS , when preceding MVD, does not portend a more tedious dissection nor a worse surgical outcome although its inherent secondary effects must also be considered.

Pediatric Neurology I

D-01

Parent's Perception of the Role of Loss of Consciousness in the Diagnosis of Concussion

KE Gordon (Halifax), EA Fitzpatrick (Halifax), P Wren (Halifax), JM Dooley (Halifax), EP Wood (Halifax)*

Background: "A player does not need to have lost consciousness to suffer a concussion" is an axiom popularized following the First International Conference on Concussion in Sport. We explored how parents view loss of consciousness as contributing to a diagnosis of concussion. *Methods:* A convenience sample of parents attending a regional pediatric Emergency Department completed a questionnaire (N=2304). Parents were asked to estimate the likelihood of a diagnosis of concussion in two pediatric head injury scenarios, one where all children were unconscious at the time of the injury and the other where none were unconscious. *Results:* 1734 questionnaires were received from eligible respondents (response rate: 75.3%). Missing values for individual questions ranged from 0.1 to 2.1%. Most parents see concussion without loss of consciousness as a subset of head injury (86.1% 95%CI: 83.6, 88.4%). 48.1% of parents see loss of consciousness in the presence of a head injury as sufficient for the diagnosis of concussion (95%CI: 44.7, 51.6%). More parents see loss of consciousness as contributing to the diagnosis of concussion (68.4% 95%CI: 65.7, 70.9%), accounting for a median relative risk of 2.0 (quartiles: 1.7, 3.3). Only 8.8% see loss of consciousness as necessary for the diagnosis of concussion (95%CI: 6.9, 10.8%). *Conclusions:* Our findings suggest that most, but not all parents appreciate the role of loss of consciousness in the diagnosis of concussion. It would appear that for some parents the following axiom should be publicized, "A player who has lost consciousness has a concussion (or worse)"

D-02

Cerebrospinal fluid neurotransmitter and pterins analysis in pediatric patients in British Columbia between 2003 and 2007

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Background: Neurotransmitter (NT) disorders are a group of diseases with a highly variable phenotype. Our aim was to document the prevalence of disorders of neurotransmitters in British Columbia Children's Hospital and to identify clinical criteria that would allow improving the positive predictive value of the investigation. *Methods:* Retrospective chart analysis was done on all patients who had CSF NT measured between 2003 and 2007. *Results:* CSF biogenic amine metabolites were analyzed in 259 children (113 females, 146 males). All presented with neurological symptoms of unknown etiology as follows: combinations of: developmental delay/ mental retardation (74.1%), seizures (53.2%), abnormal movements (49 %), behavioral problems (31.2 %), pyramidal symptoms (29.7%), autonomic dysfunction (22.7%), microcephaly (11.9%) and autism (11.1%). Age of symptom onset was less then 1 year in 181 patients (69.8%). Abnormalities of CSF biogenic amines metabolites were detected in 46 patients (17.7 %). In 5 patients a diagnosis of a primary NT disorder was made (1.93%). Another 5 cases had other primary diagnosis . One patient had abnormalities related to treatment with L-Dopa. Significant differences in between

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the normal and the abnormal CSF NT group were found only in regard to microcephaly (21.7% versus 10.1%) and pyramidal signs (45.6 % versus 26 %). *Conclusions:* Primary NT disorders are under diagnosed due to heterogeneous clinical presentation. We report a yield for a positive primary diagnosis of 1.93%. We are continuing to investigate the patients with abnormal CSF NT results that do not have a primary diagnosis, for other possible NT disorders, including Tyrosine hydroxylase and Sepiapterine reductase deficiency.

D-03

Term intrapartum asphyxia: An analysis of acute non-specific supportive criteria and non-CNS organ injury

*E Pinchefsky (Montreal), N Al-Macki (Montreal), M Shevell (Montreal)**

Objective: The purpose of this study was to describe the frequencies and relationships of non-specific non-essential diagnostic criteria and non-CNS organ system injury in term intra-partum asphyxia. *Methods:* All children with term intra-partum asphyxia encountered in a single pediatric neurology practice with at least two years follow-up and an abnormal neurologic outcome were identified. All children had moderate or severe neonatal encephalopathy (NE), an acidotic cord pH (<7.0) [when available] and the rigorous exclusion of other possible non-asphyxial etiologies. *Results:* A total of 40 children (28 males, 12 females) met the study inclusion and exclusion criteria. Twenty-four had moderate NE and sixteen had severe NE. The mean number of non-specific non-essential diagnostic criteria (out of a possible 7) was 4.75±1.39 SD. Sixty percent had five or more criteria and all criteria were present in only 10% of newborns. There was not a single non-specific marker that was present in every patient. The mean number of non-CNS organ systems affected was 2.88±1.96 SD (out of a possible 6). Ten percent of our sample showed no evident non-CNS organ injury acutely. The number of organ systems affected, the presence of respiratory dysfunction and hypocalcemia were all significantly related to the observed severity of NE. *Conclusion:* Most of these asphyxiated neonates failed to consistently satisfy all elements of present consensus statements for intra-partum asphyxia. An abnormal neurologic outcome can occur subsequent to asphyxia without non-CNS end-organ injury.

D-04

Lead levels in Canadian autistic children

BG Clark (Edmonton), I Buka (Edmonton), B Vandermeer (Edmonton)*

Background: Children with autism are at increased risk for lead exposure and intoxication and have later and more prolonged exposures due to exploratory oral behaviors and pica. The objective was to estimate the mean blood lead levels and prevalence of high blood lead levels (BLL) in a convenience sample of autistic children living in northern Alberta based on CDC standards. *Methods:* 48 children with Autism were recruited and consented. A CBC & differential, ferritin and BLL were requested. Summary statistics were reported. For dichotomous outcomes, proportions were presented. Continuous outcomes for two groups with BLL ≥0.1μmol/L or <0.1μmol/L were compared using an unpaired t-test, while dichotomous outcomes were compared using Fisher's exact test. *Results:* None had levels exceeding 0.48μmol/L. Nine (19%) had BLL ≥ 0.1 μmol/L but < 0.48 μmol/L and 39 (81%) had BLL < 0.1 μmol/L. Those with BLL ≥0.1umol/L had significantly more pica or oral exploratory behaviors. *Conclusion:* Children with pica and oral exploration of objects in northern Alberta may have mildly elevated levels of blood lead. This population needs to be screened for risk factors. Clinicians are more likely to investigate low levels if regulatory standards are aligned with scientific knowledge of harmful effects.

D-05

A female patient with X-linked creatine transporter (SLC6A8) deficiency and intractable epilepsy: successful treatment with arginine and glycine supplementation

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Background: X-linked creatine transporter (SLC6A8) deficiency is characterized by mild to severe developmental delay, speech delay, behavioral problems and seizures in males. Females are either asymptomatic or have learning disabilities. *Case and Results:* Our patient presented with severe global developmental delay, intractable epilepsy and behavioural problems at age 6 years. The seizures were characterized by eye rolling, humming and holding her breath and losing tone at her neck. She failed 8 antiepileptic drugs and ketogenic diet. EEG showed frequent bursts of paroxysmal delta activity, frequent spike-and-slow-wave discharges in the bilateral mid frontal central parietal areas. Cranial-MRI revealed bilateral subcortical hyperintense signal intensity in frontal and parietal lobes. MR-spectroscopy showed decreased creatine peak. A novel missense mutation confirmed diagnosis. She failed oral creatine supplementation. To enhance intra-cerebral creatine synthesis we started L-glycine and L-arginine supplementation after approval of Local Innovative Treatment Committee. Her seizures decreased at 6 months of therapy. She became seizure free at 10 months of therapy. *Discussion:* We present the first female patient diagnosed with severe SLC6A8 deficiency who responded L-glycine and L-arginine supplementation with seizure cessation. We recommend screening of creatine deficiency disorders in patients with treatment resistant seizures, global developmental delay and behavioural abnormalities.

D-06

Extraaxial (extradural/subdural) infections of CNS in paediatric population

S gupta (Toronto), JT Rutka (Toronto)*

Background: Extraaxial infections of the CNS are rare and potentially life threatening. Symptoms are usually progressive, so rapid diagnosis is important, as early institution of appropriate treatment offers the best opportunity for recovery without neurological deficits. *Methods:* We analyzed the medical records of over last 20 years at the Hospital for Sick Children for children with extradural or subdural infections. Only those patients with radiological and/or operative confirmation of the diagnosis of the subdural/extradural empyema were included in the study. The data were analyzed for etiology of infection, predisposing factors, clinical and radiological findings, responsible microorganisms, treatment modality and outcome. *Results:* We identified 38 children who fulfilled the diagnostic criterion of subdural/extradural empyema. The most common etiological factor was otorhinolaryngeal infection (22 patients). Early operative intervention with extensive and adequate debridement gave the best results in these cases. Subdural empyema was found in 10 patients

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following bacterial meningitis and these were found primarily in infants within the first year of life. In these cases, antibiotics alone provide adequate treatment. *Conclusions:* In all cases of subdural/extradural empyema, the identification of the responsible microorganism through direct neurosurgical evacuation of the purulent material, followed by 4-6 weeks of intravenous antibiotics remains the backbone of the treatment. Neurological complications associated with delayed treatment or severity of disease will be discussed.

D-07

The Diagnostic Delay of Childhood Brain Tumors: A Retrospective Review of 20 Consecutive Cases

CH Yeh (Hamilton), SK Singh (Hamilton), T Gunnarsson (Hamilton)*

Background: CNS tumors account for the largest number of cancer deaths in childhood in developed nations. Early diagnosis allows for the most effective use of available treatment modalities. With widespread access to neuroimaging, the period of diagnostic uncertainty should be relatively brief. *Methods:* We reviewed 20 recent consecutive cases of children with brain tumors who were referred to the Division of Neurosurgery at McMaster Children's Hospital. *Results:* There were 12 males and 8 females (18 months - 17 years). The five most common symptoms and signs were: nausea and/or vomiting (65%), headache (50%), abnormal gait or coordination (35%), change in behavior or performance (35%), and lethargy (30%). The average number of weeks from initial onset of signs or symptoms to diagnosis was 22.2 (median 20, range 2.5-104), for nausea and/or vomiting 13.6 (median 6, range 1-44) and for headache 23.2 (median 12, range 3-104). The average duration of symptoms is highly suggestive of raised intracranial pressure (headache and nausea/vomiting) to diagnosis was 13 weeks (median 6, range 1-44). *Conclusions:* The results suggest that, despite wide access to neuroimaging, there is a substantial diagnostic delay between onset of signs and symptoms to the diagnosis of a brain tumor in children. We are planning to analyze this further by detailed interviews in order to further understand where and why this delay occurs as most of the patients had sought medical attention several times before diagnosis. The results may shed light on how to improve the initial management of this patient group.

D-08

Effect of Multiple Acute γ-butyrolactone Hits on Ts65Dn Model for Down Syndrome

M Brown (Toronto), MA Cortez (Toronto), OC Snead 3rd (Toronto)*

Objective: To determine the effect of chronic γ-butyrolactone (GBL) administration on acute epileptic extensor spasms (AEES) Ts65Dn mice. *Background:* The pathophysiology of infantile spasms (IS) in Down Syndrome remains elusive. AEES are observed after a single injection of GBL 100 mg/kg in Ts65Dn mice (Snead et al, Neurology 2007: 68(12) Sup1: pp A211). GBL is a pro-drug of the GABAB receptor (GABABR) agonist γ-hydroxybutyric acid (GHB). The chronic administration of GBL worsen absence seizures via a link to the down-regulation of the glutamate receptor subunit B (GluR2) (Hu et al Epilepsy Research 2001: 44: pp 41-51; Hu et al, Brain Research 2001: 897: pp 27-35). GABABR-mediated mechanism may be involved in the etiology of IS. *Methods:* Ts65Dn mice and age-matched controls were administered three GBL injections spaced 72h apart. Electrocorticography (ECoG) was preformed in freely moving mice during each GBL injection. The brains were harvested for determination of changes in GABAB and GluR2 expression. *Results:* Drug naïve Ts65Dn mice phenotype include spike and wave discharges (SWD) at baseline (n=5) unlike controls with normal EEG activity (N=5). Subsequent administration of GBL produced prolonged and more severe seizure activity with successive GBL injections and a progression of electrodecremental response (EDR) that were more sustained compared to that derived from a single GBL injection. *Conclusion:* Subsequent administration of GBL may be a useful approach to test the severity of AEES in Ts65Dn mice to investigate the role of the GABA B receptor in relation to the down-regulation of the glutamate receptor subunit B.

D-09

Genotypic influence on neuropathology in glutaric acidemia type I

EC Leung (Winnipeg), CR Greenberg (Winnipeg), AA Mhanni (Winnipeg), MR Del Bigio (Winnipeg)*

Background: Glutaric academia type I (GA1) is an autosomal recessive disease usually associated with acute encephalopathy in infancy, causing irreversible striatal damage and a severe movement disorder. It is caused by glutaryl-CoA dehydrogenase (GCDH) deficiency. The majority of published neuropathologic reports of affected individuals document white matter vacuolation. Current animal models have similar pathologic findings. However, North American aboriginals with GA1 homozygous for the unique GCDH IVS-1+5G>T mutation, exhibit a more severe clinical phenotype but lack the diffuse spongiform changes. *Methods:* We report the clinical and autopsy findings of an aboriginal female with GA1 who is a compound heterozygote for 2 known mutations - the IVS-1+5G>T mutation and a 1209delG mutation. *Results:* The clinical course and outcome for this patient was unfortunately similar to that seen in many of our patients homozygous for the IVS-1+5G>T mutation. However, her neuropathological findings included the presence of diffuse white matter vacuolation, not previously been observed in our other aboriginal GA1 patients. Her striatal damage was also slightly less severe. *Conclusion:* Homozygosity of the IVS-1+5G>T mutation is associated with absence of white matter vacuolation. The GCDH IVS-1+5G>T homozygous or heterozygous genotype may confer a more severe phenotype, regardless of neuropathologic findings.

SPINE I

E-01

Immune Stimulation of Pathological Intervertebral Disc Cells Generates a Catabolic Phenotype

MF Shamji (Ottawa), A Helbling (Durham), J Chen (Durham), L Jing (Durham), RE Isaacs (Durham), C Brown (Durham), WJ Richardson (Durham), LA Setton (Durham)*

Introduction: Macrophages and lymphocytes that infiltrate pathological intervertebral disc tissue (IVD) can stimulate and respond to inflammatory cytokines such as interleukin-1 (IL-1) and tumor necrosis factor (TNFα). Activated Th17 lymphocytes release

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IL-17 and can produce catabolic nitric oxide (NOx), prostaglandin E2 (PGE2), and IL-6 production in other tissues. While both lymphocyte products IL-17 and interferon gamma (IFNγ) are found in the degenerative disc, the downstream effect of such stimulation on IVD cells is uncertain. *Methods:* Pathological tissue from degenerative disc disease patients was enzymatically digested to isolate IVD cells. Quadruplicate replicates were treated with media, TNFα, IL-17, IFNγ, or both IL-17 and IFNγ, with a range of IL-17 concentrations evaluated for dose-response effects. Culture supernatant was tested for NOx, PGE2, and IL-6 content and cell survival was quantified at 72 hours. *Results:* Degenerative IVD cells responded to TNFα with increased production of IL-6, NOx, and PGE2. Stimulation with IL-17 alone elevated IL-6 and PGE2 production without changing NOx. With the IFNγ costimulant, IL-17 increased IL-6 and PGE2 production above that of IL-17 or IFNγ alone, and substantially elevated NOx production. Cell survival was equivalent between treatment groups. *Discussion:* Degenerative human IVD cells can respond to IL-17 stimulation by direct production of catabolic mediators that may perpetuate the degenerative process. More robust effects were observed in the simultaneous presence of a second lymphocyte product, IFNγ, potentially representing regulatory control. This information may help develop antagonists blocking NOx, IL-6, and PGE2 production, and further investigation will focus on the signaling cascade underlying this synergy.

E-02

Gait Abnormalities and Sensory Changes Accompany Neuroinflammation in Animal Models of Disc Herniation Radiculopathy

MF Shamji (Ottawa), KD Allen (Durham), SB Adams (Durham), S So (Durham), L Jing (Durham), J Chen (Durham), AH Friedman (Durham), LA Setton (Durham), WJ Richardson (Durham)*

Background: Intervertebral disc herniation causes radiculopathy by mechanical compression and biochemical irritation of nearby neural structures. Animal models of radiculopathy describe demyelination, slowed nerve conduction, and heightened pain sensitivity following application of autologous NP to the DRG. This study investigated how disc-herniation radiculopathy impacts on animal locomotion, an uninvestigated functional outcome. Further, the role of autoimmune reactivity against immune-sequestered NP was evaluated. *Methods:* NP-tretaed animals (n=16) received autologous tail NP placed onto the L5 DRG exposed by unilateral facetectomy, and control animals (n=16) underwent exposure only. Animals were evaluated weekly for mechanical allodynia, thermal hyperalgesia, and gait through digitized video analysis. Serum cytokine content was measured after animal sacrifice, and immunohistochemistry tested DRG tissue for inflammatory and immune mediators. *Results:* Sensory testing revealed mechanical allodynia in NP-treated rats compared with sham animals ($p<0.01$) at all timepoints. Gait analysis reflected functional locomotive consequences of asymmetry ($p=0.048$) and preference to bear weight on the contralateral limb (duty factor imbalance, $p<0.01$) at early time points. Equivalent serum cytokine expression occurred in both groups, confirming the local inflammatory nature of this disease. Immunohistochemistry of sectioned DRGs revealed equivalent post-surgical inflammatory activation (IL-23, $p=0.47$) but substantial early immune activation in the NP-treated group (IL-17, $p=0.01$). *Conclusions:* This study provides evidence of altered gait in a model of non-compressive disc herniation. Systemic inflammation was absent, but mechanical allodynia, local inflammation, and autoreactive immune activation were observed. Future work will involve therapeutic interventions to rescue animals from the phenotype of inflammatory radiculopathy.

E-03

Surgical outcomes for anterior cervical discectomy and fusion patients receiving trabecular metal intervertebral body implants

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

Background: Anterior cervical disectomy and fusion (ACDF) is a common neurosurgical procedure for the treatment of spinal cord and/or nerve root compression. Given the morbidity that has been reported with the use of iliac crest bone graft, surgeons have looked to utilize other materials to situate within the evacuated disc space. At our centre, the practice has been to use trabecular metal (TM) intervertebral body implants for all degenerative ACDF cases. Given the lack of outcomes data in the literature for ACDF patients receiving the TM implant, the objective of this study was to evaluate the safety, efficacy and longterm radiographic appearances of TM in the cervical spine. *Methods:* We reviewed our surgical database and identified all ACDF patients receiving TM implants for degenerative pathology. We reviewed post-operative complications, patient satisfaction outcomes, and follow-up cervical spine x-rays. *Results:* The majority of ACDF patients receiving TM implants experienced a major improvement in symptoms following surgery. Favourable results were obtained even though radiographic subsidence was not uncommon. No cases in our series required surgical revision. *Conclusions:* In our experience, the use of TM implants for ACDF patients was safe and efficacious. While radiographic subsidence was not uncommon, it did not appear to be clinically significant.

E-04

Maintenance of cervical lordosis after anterior discectomy and fusion: a comparison of the Solis cage and the anterior cervical plate

*J Wilkinson (Saskatoon), D Fourney (Saskatoon)**

Objective: Preliminary studies of the Solis cage have used intervertebral bony fusion as the primary measure of surgical success; however, little is known about its effects on spinal curvature. Our objective was to compare the Solis cage to the cervical plate with respect to the maintenance of cervical lordosis at one year. *Methods:* We performed a case-control study of patients treated with ACDF and plating or the Solis cage between January 2003 and April 2006 for single or two-level disc degeneration. The Solis cage was routinely packed with local autograft; plated patients received machined radius allograft as an interbody spacer. *Results:* 56 consecutive patients met criteria for inclusion; however, 14 were excluded because the chart was unavailable or acceptable preoperative x-ray films were not available for comparison, yielding a total study population of 42 (15 treated with the Solis cage and 27 with a plate). Average global lordotic curvature (C2-C7) was decreased by 3.3 degrees for the Solis cage and 4.4 degrees for the plate after an average follow-up of 12.3 and 16.4 months, respectively. Regional average alignment for the Solis and plate were decreased by 2.1 and 3.2 degrees, respectively. Differences did not achieve statistical significance. Bony fusion was observed in all patients. Three patients treated with the plate (11.1%) and 1 patient

treated with the Solis cage (6.7%) developed persistent mild dysphagia. *Conclusions:* The Solis cage is comparable to the anterior cervical plate in the maintenance of postoperative cervical lordosis.

E-05

Immune Activation in Herniated and Degenerative Human Intervertebral Disc Tissue Indicates Involvement of Th17 Lymphocytes

MF Shamji (Ottawa), LA Setton (Durham), W Jarvis (Durham), S So (Durham), J Chen (Durham), L Jing (Durham), RW Bullock (Durham), RE Isaacs (Durham), C Brown (Durham), WJ Richardson (Durham)*

Introduction: Pathological intervertebral disc (IVD) tissues contain macrophages and lymphocytes and express cytokines at higher levels than autopsy controls. The pattern of IL-6, IL-12, and IFNγ suggests a Th1 immune response, but alternative pathways such as Th17 lymphocytes in contributing to IVD pathology remain uninvestigated. This study evaluated expression of IL-17, IL-23, and other inflammatory mediators in degenerative and herniated IVD tissues. *Methods:* Pathological IVD tissue obtained from degenerative disc disease (25 levels) and herniation (12 levels) patients was evaluated by immunohistochemistry for cell markers (CD68 macrophage, CD4 lymphocyte) and inflammatory mediators (IL-4, IL-6, IL-17, IL-23, IFNγ). Cellularity and antigen positivity were consensus graded over 9 fields per sample for each target. Differences in cytokine immunoreactivity (repeated-measures ANOVA) and tissue cellularity (repeated-measures $\chi 2$ test) were tested at the 0.05 level of significance. *Results:* Greater expression of IL-4, IL-6, IL-12 and IFNγ was observed in herniated disc tissue, though positivity for these cytokines was less than 40% of fields. Conversely, the Th17-related cytokines, IL-17 and IL-23, were frequently present (>60% of fields) with expression that did not differ between groups. Macrophages were more prevalent among herniated samples, with lymphocytes expectedly scarcer. Tissue cellularity was higher in herniated tissues. *Discussion:* Herniated IVD tissue exhibits a pattern of Th1-immune activation compared to degenerative specimens, with greater IFNγ-positivity and increased macrophage presence. Conversely, high expression of IL-17 and IL-23 in both pathologies is novel, suggesting involvement of alternative inflammatory pathways. Further work will determine the biological responses of IVD cells to IL-17 stimulation.

E-06

Admission and in-hospital complication rate for patients undergoing outpatient lumbar microdiscectomy: comparing non-spine to spine surgeons

A Fallah (Toronto), EM Massicotte (Toronto), MG Fehlings (Toronto), S Lewis (Toronto), YR Rampersaud (Toronto), M Bernstein (Toronto)*

Objective: It has been demonstrated that high surgeon volume and specialization are generally independently associated with improved outcomes for most types of surgery. This is the first study comparing the immediate success of outpatient lumbar microdiscectomy with respect to in-hospital complication and conversion to inpatient rate. Long term pain relief is not examined in this study. *Methods:* Two separate prospective databases (one belonging to a neurosurgeon, brain tumour specialist, not specializing in spine (NS) and one belonging to 4 spine surgeons (SS)) were retrospectively reviewed. All in-hospital complication as well as admission data of patients scheduled for outpatient lumbar microdiscectomy was extracted. *Results:* In total, 269 patients were in the NS group and 102 patients were in the SS group. Both groups were demographically similar. Chi-square tests performed revealed no difference in in-hospital complication rates [NS(6.7%), SS(5.9%)] ($p>0.05$) while the SS group had a significantly higher admission rate [NS(4.1%), SS(10.0%)] ($p<0.05$) and proportion of patients undergoing repeat microdiscectomy [NS(4.1%), SS(33.3%)] ($p<0.001$). The combined in-hospital complication and conversion to inpatient rate was 6.4% and 5.7% respectively. *Conclusion:* Based on this limited study, outpatient lumbar microdiscectomy can be apparently performed safely with similar immediate complication rates by both non-spine specialized neurosurgeons and spine surgeons. The higher admission rate among the spine surgeons' patients is likely related to the much higher proportion of patients undergoing a repeat surgery.

E-07

The Use of Tripolar Leads in Spinal Cord Stimulation in Axial Back pain, Does it work?

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

Spinal cord stimulation has been used in the treatment of chronic pain disorders since 1967 and the application list is increasing ever since. Spinal cord stimulation (SCS) is an adjustable, nondestructive, neuromodulatory procedure that delivers therapeutic doses of electrical current to the spinal cord for the management of neuropathic pain. The goal of this review is to report on the use of the recently released tripolar lead at the Montreal Neurological Institute/Hospital. The review extended between July 2007 till present and included 23 patients with FBSS. These patients were submitted to surgical implantation of the 5-6-5 configuration tripolar paddle-type lead. Sixty five percent of the patients in this group contributed more than 50% of the overall pain to the back as compared to the leg pain. Fifteen patients representing 65% of the cohort reported more than 50% reduction of the pain with 10 patients experiencing more than 70% reduction of the pain. The trial failure was seen in 10% of the cohort. The short term, available long term results as well as the programming parameters will be reported. This is an excellent outcome in this group of patients. The tripolar lead for spinal cord stimulation broadens the degree at which the neuromodulation could be delivered, allowing for multiple simultaneous programs to take effect targeting different body regions at various intensities tailored to the clinical response, representing a major step into refining the neuromodulation capacity of this highly promising technology for such a difficult to target region such as the axial lower back.

E-08

A systematic review of pre-clinical and clinical studies on the timing of surgical decompression of spinal cord as a key determinant of outcomes after traumatic spinal cord injury (SCI)

JC Furlan (Toronto), V Noonan (Vancouver), MG Fehlings (Toronto)*

Background: The current clinical practice guidelines are vague regarding the timing of surgical decompression of spinal cord of patients with SCI. This systematic review examines the pre-clinical

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and clinical evidence in the literature on this issue. *Methods:* Papers were obtained from Medline and EMBASE databases (1966-2008). Sackett's criteria and Downs & Black's criteria were used to assess the level of evidence and quality of the clinical studies. Two authors independently reviewed and rated all articles. Disagreements were resolved by consensus. *Results:* The search strategy identified 685 publications of which 37 fullfilled the inclusion and exclusion criteria. There were 17 animal studies, which indicate the benefits of early decompression regarding histological, physiological and behavioural outcomes. The clinical evidence was mostly level 4 (18 of 20), but there were 2 level-2 studies. The quality of those clinical studies varied from 7-18 (score range: 0-31). Their results suggest that early surgical decompression (<24 hours) is safe and beneficial regarding clinical and neurological outcomes. *Conclusion:* Our results indicate that there is a biological rationale to support early decompression of spinal cord based on animal SCI models. Moreover, level-2/4 clinical studies suggest that the early surgical decompression of spinal cord is safe and potentially beneficial for patients with acute traumatic SCI.

E-09

Appropriateness of lumbar spine referrals to a neurosurgical service

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

Background: We previously audited a consecutive series of lumbar spine referrals for their apparent appropriateness for surgical assessment. Patients have since been followed in order to determine if referral letter characteristics predict which patients will most likely receive further neurosurgical care. *Methods:* All lumbar spine referrals to ten neurosurgeons were collected over eight weeks (268). Appropriateness criteria were established in advance though consensus from the entire group of neurosurgeons. Referrals were classified as "appropriate, "uncertain", or "inappropriate" for surgical assessment based on the criteria. The Alberta electronic health record was interrogated 10 months following the last referral to determine which patients had been seen in clinic and/or had lumbar decompresive surgery. Chi square analysis was used to test the relationship between referral characteristics and various patient outcomes. *Results:* The apparent appropriateness based on the referral letter did not predict which patients were seen in clinic (P=0.18). Likelihood of surgery was predicted by positive physical findings on exam (P=0.02), though these were seldom reported in the referral (11%). Positive imaging also predicted likelihood of surgery (P=0.007). *Conclusion:* Though some patient features mentioned in the referral are predictive of surgery, these findings are not reported reliably enough to decide which patients should be evaluated by surgical specialists. Attempts should be made to educate referring physicians of those patient and imaging features that are most appropriate for surgical assessment to allow for effective triage of spinal referrals to surgical clinics.

Stroke/Cerebrovascular Surgery I

F-01

A Non-Human Primate Model of Microembolic Stroke

DJ Cook (Toronto), L Macdonald (Toronto), L Teves (Toronto), D Mikulis (Toronto), W Foltz (Toronto), A Goldstein (Toronto), M Madden (Toronto), H Sun (Toronto), M Tymianski (Toronto)*

Despite the efforts of numerous researchers and funding in excess of billions of dollars, no drug, other than the fibrinolytics, has been translated from success in rodents to efficacy in humans. Commonly used animal models are an identified shortcoming in previous preclinical studies. This suggests there is a need for a better model of stroke to bridge the gap between "mouse and man." We hypothesized that a nonhuman primate (NHP) model of stroke has the highest likelihood of predicting results in humans. However, there have been few attempts to develop such a model. Therefore, the goal of this research is to develop a representative, reproducible and cost-effective NHP model of stroke. Five male cynomolgus macaques underwent general anesthesia and a transfemoral, endovascular approach to catheterize the right middle cerebral artery. Escalating concentrations and sizes of polystyrene microspheres were injected to produce a dose response curve. Magnetic Resonance Imaging was undertaken at 4, 24 hours and 2 weeks to perform serial counts of stroke number and volumetric analysis of diffusion lesions. Animals underwent a maximum total of 5 procedures each. The optimum number and size of emboli injected were 20, 100 micrometer spheres to generate a mean of 11(±2) strokes with a mean total volume of 43mL (±7mL). Histological correlation to imaging was undertaken following sacrifice. This model is representative of human microembolic stroke and yields reproducible stroke number and volume.

F-02

Hematoma expansion in intracerebral hemorrhage: a clinically relevant defintion.

D Dowlatshahi (Calgary), AM Demchuk (Calgary), ML Flaherty (Cincinnati), M Ali (Glasgow), P Lyden (San Diego), EE Smith (Calgary)*

Hematoma expansion following intracerebral hemorrhage (ICH) is a promising therapeutic target. Prior studies used various definitions of expansion; to date, no published reports have correlated the degree of hematoma expansion with clinical outcomes. We sought to determine an optimal definition for hematoma growth based on its correlation with clinical outcome. ICH patient data was obtained from the Virtual International Stroke Trials Archives. Poor clinical outcome was defined as 90-day mRS>4. Receiver operating characteristic (ROC) curves were used to identify the degree of expansion that best predicted poor clinical outcome. The cohort consisted of 354 patients with ICH; 24% had a poor outcome. The area under the ROC curve for absolute growth definitions was larger than that for relative growth definitions (p=0.03). The optimal definition of absolute growth was 10ml, predicting poor outcome with 34% sensitivity, 88% specificity, positive predictive value (PPV) 48%, negative predictive value (NPV) 81%, and 75% accuracy. By contrast the 33% expansion definition yielded 41% sensitivity, 77% specificity, PPV 36%, NPV 80% and 68% accuracy. Absolute growth of 10ml predicted early neurologic worsening

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(ENW) with 55% sensitivity, 86% specificity, PPV 28%, NPV 95%, and accuracy 84%. Patients with≥10 mL hematoma growth had a 2.9-fold higher odds of poor outcome (p=0.001) and 6.9-fold higher odds of ENW (p<0.001), controlling for other predictors by logistic regression. Using a data-driven approach, we found that absolute hematoma growth of 10 ml is a clinically relevant definition for hematoma expansion and provides a slightly better correlation with outcome than 33% hematoma growth.

F-03

Plastic reorganization in pediatric stroke and the effects of rTMS

A Kirton (Calgary), G deVeber (Toronto), C Gunraj (Toronto), S Friefeld (Toronto), R Chen (Toronto)*

Background: Arterial ischemic stroke (AIS) causes neurological disability in children. Transcranial Magnetic Stimulation (TMS) maps plastic reorganization. Interhemispheric inhibition (IHI) imbalance predicts poor outcome in adult stroke, representing a therapeutic target. We hypothesized that IHI from normal to stroke hemisphere (IHINS) is excessive in chronic subcortical pediatric stroke and reduced by inhibitory rTMS. *Methods:* Eligible patients included: (1) subcortical AIS with transcallosal pathway sparing, (2) age >7 years and >2 yrs post-stroke, (3) hand motor impairment, and (4) no seizures/dyskinesia/medication. TMS employed figure-eight coils with electromyography from bilateral first dorsal interosseous. Measures included motor thresholds and stimulus response curves (SRC). Paired-pulse TMS studied bidirectional IHI. Pairs matched for age and weakness were randomized to contralesional inhibitory rTMS (1Hz/20min/1200stimuli) or sham for 8 days with repeat neurophysiological measures. *Results:* Ten children were enrolled (12.4 yrs, 4 female) with hand weakness of mild(4), moderate(2), or severe(4) intensity. Stroke-side motor thresholds were increased (rest 76.1 vs 54.1, p<0.01) and decreased with age (r2=0.892). Baseline IHINS was evident at 10ms(-17%) and 40ms(-46%) interstimulus intervals. IHISN was less at both intervals (10ms:+4%,p=0.02; 40ms:-28%,p=0.05). Following rTMS, thresholds were unaltered but stroke-side motor-evoked potential amplitudes increased (+1.52 vs +0.09mV, p=0.01). SRC slope increased in rTMS patients (0.82 from 0.48, p=0.02). IHINS decreased in treated children (10ms:+14%;40ms:-15%) while IHISN increased (10ms:-13%;40ms:40%). IHINS and IHISN were comparable to baseline in the sham group. *Conclusion:* TMS measurement of plastic reorganization is feasible in children with stroke. Preliminary evidence supports the IHI imbalance model in children and offers a potential target for neurorehabilitation.

F-04

Cerebral Venous Sinus Thrombosis and Common Childhood Illness

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Objective: To determine the incidence and contribution of common childhood illnesses to CSVT in children. *Methods:* The Canadian Pediatric Ischemic Stroke Registry enrolled children from January 1, 1992-January 1, 2002 at the 16 pediatric tertiary care centers in Canada. Children (0-18 years) with symptoms and radiographic confirmation of CSVT were analyzed. *Results:* From 1992-2001, 317 consecutive children with CSVT were enrolled including 116 neonates (39%); 295 were analyzed. The incidence of CSVT in children <16 years of age was 0.51 case/100,000/year (95% CI 0.45, 0.58) and 3.5 cases/100,000/year for neonates alone (95% CI , 2.56, 4.41). Mean presentation age was 4.6 years and 55% were male. Children presented with seizures, focal and diffuse neurologic signs. Identified risk factors included head and neck disorders (32%, n=94/295), acute systemic illness (45%, n=133/295), chronic systemic diseases (42%, n=123/295), anemia (26%, n=72/295), and prothrombotic states (26%, n=77/295). Common childhood illnesses present in 36% of non-neonates affected by CVST (n=64/178) included otitis media/mastoiditis, iron-deficiency anemia, sinusitis, urinary tract and upper respiratory tract infections. Many children (60%, n=177/295) received acute anticoagulation therapy, either low molecular weight heparin (39%), unfractionated heparin (22%), coumadin (19%), or acetylsalicylic acid (4%.) 273 of 295 children were followed for 1.2±1.9 years (range 0-12 years). Despite anticoagulation in most, neurologic deficits were present in 31% at last follow-up and 28 children (10%) died. *Conclusions:* CSVT results in residual neurologic sequelae or death in 41% of affected children. Early treatment of common childhood illnesses frequently underlying pediatric CSVT could reduce the morbidity and mortality from this disorder.

F-05

Unilateral transverse sinus stenting for patients with refractory idiopathic intracranial hypertension.

M Bussiere (Ottawa), R Falero (London)*, D Nicolle (London), D Pelz (London)*

Background: The pathophysiology of idiopathic intracranial hypertension (IIH) remains obscure. Transverse sinus stenoses have been observed in a high proportion of patients. Stenting to remove this potential obstruction to venous outflow has been proposed as a treatment option for patients with IIH refractory to medical treatment. *Methods:* Retrospective review of the clinical presentation, treatment and outcome of patients with refractory IIH evaluated for venous sinus stenting at the University Hospital in London, ON. *Results:* Eleven female patients with refractory IIH were evaluated for sinovenous stenting. Moderate sinus stenoses with normal intrasinus pressures were found in 3 patients and therefore stenting was not performed. Eight patients had elevated intrasinus pressures (gradient across stenosis 14-40 mmHg) which normalized following unilateral transverse sinus stenting. Headaches improved or resolved in six patients and papilledema improved or resolved in seven. There were no major peri-procedural complications. *Conclusions:* In this small case series, restoring the patency of stenotic venous sinuses with a stent in patients with refractory IIH resulted in symptomatic improvement in 75% of treated patients. The safety and efficacy of this procedure should be evaluated in a randomized controlled study to determine its role within the armamentarium of therapeutic options for patients with IIH.

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F-06

Cost Analysis and Clinical Outcomes for Coiling Versus Clipping of Intracranial Aneurysms: The Hamilton Health Sciences Experience

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Objective: To compare the costs, clinical outcomes and length of stay for patients who underwent neurosurgical clipping versus endovascular coiling of ruptured and unruptured aneurysms over a one-year fiscal period (2007-2008). *Methods:* A retrospective review was completed for inpatients with diagnosis of aneurysmal subarachnoid hemorrhage (SAH) and unruptured cerebral aneurysm for fiscal period 2007-2008. Length of stay and modified Rankin score were obtained at discharge. The cost of treatment related to equipment, nursing care and location (ICU/ward), operating room staff, and diagnostic imaging staff were abstracted. *Results:* Of the 113 aneurysmal SAH admitted, 51 patients had their aneurysms treated —37 were surgically clipped and 14 were coiled using endovascular treatment with a mean length of stay (mLOS) of 20 days and 12 days, respectively. The average cost of surgical clipping for ruptured SAH aneurysms was $67,720 / case versus at $48,494/case for coiling. Modified Rankin score averaged at 3. Forty-one inpatients with unruptured cerebral aneurysms were admitted, of which 16 patients were clipped and 25 coiled, with mLOS of 8 days and 2 days, respectively. *Conclusions:* Even with the high procedural cost of endovascular coiling in patients with ruptured aneurysms, overall cost of coiling was approximately $20,00 less than the total costs of surgical clipping due to increased use of human resource and mLOS in surgically clipped patients. The cost for treatment of unruptured cerebral aneurysms is similar, but the mLOS is 6 days less with coiling which is significant given increasing patient numbers and current bed limitations.

F-07

Sliding Dichotomy and Other Statistical Approaches to Reduce Sample Sizes for Subarachnoid Hemorrhage Clinical Trials

R Macdonald (Toronto), J Spears (Toronto), D Ilodigwe (Toronto)*

Background: Clinical trials for prevention of vasospasm after aneurysmal subarachnoid hemorrhage (SAH) seldom have improved overall outcome. Our prior analysis suggests sample sizes may be inadequate. One approach to reducing sample sizes is to use other outcomes than the dichotomous patient-centered clinical outcome (Glasgow outcome score [GOS] or modified Rankin scale [mRS]). *Methods:* Here we use data from the tirilazad and clazosentan studies of SAH to determine whether sliding dichotomy, ordinal logistic regression or other methods would have made these studies significant on the patient-centered clinical outcome. *Results:* A sliding dichotomy to classify patients into 3 prognostic groups based on age, admission neurological grade and subarachnoid clot thickness had no effect on outcome in the tirilazad or clazosentan results. Sample sizes would not be substantially altered. Ordinal logistic regression using the 5 categories of the GOS also did not alter the final outcomes. In conclusion, alternate statistical methods to classify the outcome of clinical trials targeting vasospasm and using traditional patient-centered outcome did not reduce the very high sample sizes required to demonstrate effects on the GOS. *Conclusion:* These clinical trials therefore will be costly, time-consuming and impractical. This will hinder development of new treatment strategies.

F-08

Incidence of Aneurysmal Subarachnoid Hemorrhage in Nova Scotia

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Background: Published incidence of aneurysmal subarachnoid hemorrhage (aSAH) ranges from 9 to 22 per 100,000 person-years with considerable variation reported between populations. Calculated incidence of aSAH is influenced by study design, case ascertainment, census population data, and definition of aSAH. *Methods:* This population-based study investigated the incidence of aSAH from 1999-2008 in Nova Scotia, a census-defined geographic catchment area with a single quaternary care neurosurgical centre. A prospective cerebrovascular database maintained within the Division of Neurosurgery (Halifax Infirmary) cross-referenced with autopsy records was used to identify all Nova Scotia residents experiencing aSAH. *Results:* Over ten years, 414 residents experienced aSAH with 11 identified exclusively from autopsy records. Age-adjusted incidence of aSAH was 4.5 (95% CI: 4.0-5.1) per 100,000 person-years. Incidence of aSAH in women (6.1/100,000 person-years, 95% CI: 5.2-6.9) was approximately double that experienced by men (2.9/100,000 person-years, 95% CI: 2.2-3.6). Peak incidence occurred in both sexes between 55-64 years of age. *Conclusion:* This is one of the largest aSAH incidence studies and the first in a Canadian population. Incidence was stable over the study period and is lower than in most previous reports. Methodological comparison to prior reports and implications for further study will be presented.

F-09

The impact of distance from the treating neurosurgical centre on outcomes following aneurysmal subarachnoid hemorrahage

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Background: In the management of subarachnoid hemorrhage (SAH), the potential for early complications and the centralization of limited resources often challenge the delivery of timely neurosurgical care. We sought to determine the impact of proximity to the accepting neurosurgical centre on outcomes following aneurysmal SAH. *Methods:* Using administrative data, we analyzed patients undergoing treatment for aneurysmal subarachnoid hemorrhage at neurosurgical centres in Ontario between 1995 and 2004. We compared mortality for patients receiving treatment at a centre in their county (in-county) versus those treated from outside counties (out-of-county). We also examined the impact of distance from the patient's residence to the treating centre. *Results:* The mortality rates were significantly lower for in-county versus out-of-county patients (23.5% vs. 27.6%, p=0.009). This advantage remained significant after adjusting for potential confounders (HR = 0.84, p=0.01). The relationship between distance from the treating centre and mortality was biphasic. Under 200km, mortality increased with increasing distance. Over 200km, a survival benefit was observed, suggesting selection of favourable prognosis patients for long distance transfer. *Conclusions:* Proximity to the treating neurosurgical centre impacts survival after aneurysmal SAH. These results have significant implications for the triage of these critically ill patients.

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EPILEPSY I

G-01

Single-subject voxel-based T2 relaxometry in focal epilepsy of uncertain origin.

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Background: Voxel-based relaxometry (VBR) is a whole-brain statistical analysis of T2 values from magnetic resonance imaging that can identify abnormalities not easily visible on routine scans. VBR may provide important information in patients with focal epilepsy of uncertain origin. Our objective was to use single-subject VBR to corroborate, or refute indeterminate seizure localization. *Methods:* We assessed 51 patients and 25 healthy controls. Scanning was performed at 3T with a Carr-Purcell-Meiboom-Gill sequence. Initial diagnoses were based on history, video-EEG, and structural MRI. Patients were classified as having suspected but unconfirmed epilepsy (SE), known epilepsy with unknown focus (KE) or known epilepsy with a suspected focus (SF). The SF group were determined to have a suspected lobe (SF-L), or a suspected lobe and side of origin (SF-LS). VBR was performed with SPM2 (α = 0.05, uncorrected). VBR severity scores were based on abnormal findings in 13 predefined regions, classified as high (>6 areas), medium (3-6), low (1-2) or no VBR abnormalities (0). *Results:* Seventeen of 27 SF patients (63%) showed VBR abnormalities in the suspected focus, confirming seizure localization. The SF-L group showed the highest proportion of patients with high or moderate VBR scores. Patient groupings exhibited more VBR abnormalities than controls, where for example, the average number of VBR abnormalities was 1.96 for controls versus 5.55 for the SF group. *Conclusions:* Single-subject VBR can help identify or confirm seizure localization in patients in whom seizure localization is uncertain based on conventional investigations.

G-02

The effect of contact size on high frequency oscillations (HFOs) detection in human intracerebral EEG recordings.

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Background: HFOs are discrete electroencephalographic events described as ripples (80-250Hz) or fast ripples (250-500Hz), suspected to play a role in epileptogenesis. The generators of HFOs are believed to be very small: small electrodes may record them better if they are near but large electrodes may provide better spatial sampling. The purpose of this study was to assess detection rates of HFOs from clinical contacts of different sizes. *Methods:* Hybrid intracerebral depth electrodes containing pairs of adjacent large and small contacts were used in 10 patients undergoing invasive recordings (9 patients with locally manufactured electrodes, 1 with commercially manufactured electrodes). Spikes, ripples and fast ripples were marked independently in a 5 minute EEG segment, and the marker was blinded to the contact size. *Results:* Local electrodes: ripples were significantly more frequent in the large contacts compared to the small contacts. Spike and fast ripple rates were not different in contacts of different sizes. Commercial electrodes: spike and ripple rates were not significantly different. Only very rare fast ripples were recorded. *Conclusions:* Ripples seem to be better detected using the larger of the two contact sizes. Larger contacts likely provide a broader spatial sampling and are therefore more efficacious in detecting ripples.

G-03

The Spectrum of Complexity Underlying “”noise”“ in Brain Dynamics

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Introduction: Background “noise” captures the integrated dynamical activity of cellular sources, manifesting as subthreshold fluctuations in membrane potential. Tracking these sources offers a novel means of identifying brain state transitions such as those arising during epileptic seizures. In this context, our objectives were to characterize the dynamics of subthreshold neuronal fluctuations via electrophysiological and mathematical methods, with particular focus on synaptic channels and gap junctions as potential “noise” sources. *Methods:* Whole-cell, patch-clamp recordings of CA3 interneurons and pyramidal cells from the whole-intact hippocampus extracted from C57/Bl mice (P8-12) were collected under normal conditions and following synaptic and/or gap junction blockade. Recordings were subjected to various neurodynamical tests of complexity. *Results:* Signal analysis confirmed dynamical changes in the complexity underlying background neuronal fluctuations following pharmacological blockade. “One-over-f” noise architecture (measuring stochasticity) was diminished following blockade; in contrast, the correlation dimension (describing system determinism) was increased. These findings reflect increased complexity in the system despite simplification with pharmacological blocking agents, and directly implicate the contributions of synaptic channels and gap junctions to generating noise-like fluctuations observed in brain dynamics. *Conclusions:* Overall, we conclude that subthreshold “noise” arises from the contributions of synaptic channels and gap junctions. Simplification of the cellular system with pharmacological blockade resulted in increased system complexity, measured using deterministic and stochastic tools. These findings imply that “noise” has hidden meaning pertaining to cellular and network activity, and that order at higher levels may arise out of the synchronization of underlying sources of complexity.

G-04

Role of combined preoperative functional MRI and intraoperative electrocortical stimulation for language mapping in surgery for medically intractable temporal lobe epilepsy

A Wang (London), S Mirsattari (London), A Parrent (London), D Steven (London), D Lee (London), F Bihari (London), T Peters (London)*

Background: Accurate localization of language can minimize surgical deficits in patients with medically refractory temporal lobe epilepsy (TLE). We studied the role of combined presurgical functional magnetic resonance imaging (fMRI) and intraoperative electrocortical stimulation (ESM) for mapping the language areas in such patients. *Methods:* Eleven patients (6 males; mean age 40.1±12.2 years) with left TLE and twelve healthy control subjects

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were enrolled in this study. FMRI was performed using two covert language paradigms (sentence completion and verb generation) with voxel-based whole brain analysis for each subject ($p<0.001$). ESM was carried out intraoperatively to elicit the language areas in the left inferior frontal and temporal lobes. ESM and fMRI maps were overlaid on high resolution 3D anatomical MRI. *Results:* FMRI activation was mostly localized to the left inferior and middle frontal gyri while ESM showed additional language areas in the left superior temporal gyrus. Verb generation fMRI and ESM maps correlated 100% and 53.6% in the left frontal and temporal lobes, respectively. The corresponding values were 77.8% and 47.8% for sentence completion fMRI and ESM. The concordance between fMRI and ESM was 90.9% for left hemispheric dominance. *Conclusion:* Combined fMRI and ESM is helpful for language mapping in patients with left TLE. ESM complements the low sensitivity of fMRI for language sites in the left temporal lobe.

G-05

Parasagittal and mesial hemispheric intractable epilepsy

BS Kumar (London), WT Blume (London)*

Background: Parasagittal and mesial lobe epilepsies present diagnostic and therapeutic challenges during presurgical evaluation. This is particularly so when nonlesional, where only a single modality of investigation such as scalp electroencephalogram (EEG) or metabolic scan showed potential foci. This study evaluated the clinical semiology and EEG characteristics of epilepsies at any antero-posterior location within the mesial and or parasagittal locations. *Methods:* One hundred patients with parasagittal and or mesial hemispheric epilepsy confirmed by scalp and or subdural EEG and or imaging evaluated from January 1973 till December 2008 defined this cohort. *Results:* Over 90% had motor seizures; history and or videotelemetry disclosed asymmetrical motor features in the majority. Visual phenomena heralded 15 of 20 (75%) of mesial occipital seizures, but occurred very rarely elsewhere. Seizures arose simultaneously in mesial and parasagittal regions in at least one-third of this series. *Conclusions:* As mesial hemispheric-parasagittal seizures arising anywhere from anterior frontal to occipital areas share many common features, subdural EEG and imaging are essential for precise localization of epileptogenesis.

G-06

Determinants of QOL in Patients undergoing Epilepsy Surgery

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Background: Studies reporting QOL after epilepsy surgery focus on different predictors of this important outcome. Our aim is to evaluate pre- and post-operative determinants of QOL in adults undergoing epilepsy surgery. *Methods:* We systematically searched the literature for studies reporting measurable factors that influence QOL after epilepsy surgery in adults. We searched Medline, Embase and the Cochrane library (1950 and 2008). Two reviewers independently assessed eligibility and extracted data. *Results:* Of 39 eligible studies, 61.5% were longitudinal and one was randomised. ESI-55 and QOLIE-89 were the most frequently used QOL instruments. Six preoperative and 12 postoperative determinants were identified. Seizure outcome and mood were the most frequent postoperative predictors of QOL (90% of studies). Other important predictors were employment status (10%), AEDs, adverse events (10.25%) and verbal memory problems. Age at surgery, duration of epilepsy, IQ, and preoperative seizure frequency were not found to affect QOL. Methods of assessing QOL also played an important role. *Conclusion:* Seizure outcome is an important determinant of QOL after epilepsy surgery. However, clinicians need to be mindful of other important factors. Identifying and dealing with these factors can guide clinical decision making and help fine tune expectations and guide counselling.

G-07

Outcome of epilepsy surgery in patients investigated with subdural strip electrodes

DA Steven (London), KW MacDougall (Calgary), RS McLachlan (London), JG Burneo (London)*

Background: Intracranial electrodes (IE) are an important part of the workup in many patients being considered for epilepsy surgery. Because IE are usually reserved for cases where seizure localization is ambiguous, one might expect that the outcome of surgery would be worse in this group of patients. The purpose of this study was to examine patients who underwent insertion of IE, and to assess the eventual outcome in those who went on to have surgery. *Methods:* All cases admitted for IE between January 2000 and June 2005 were reviewed. Surgical outcomes were reported using the Engel classification and a multivariate analysis was used to determine which factors were associated with successful surgery. *Results:* 177 IE implantations were performed in 172 patients. Of these, 130 patients had surgery. 47% of patients were seizure free at 1 year. Predictors of good outcome included having a temporal lobectomy or SMA resection. Older age was a major predictor of poor outcome with only 21% of patients over age 40 becoming seizure free. *Conclusions:* Good results from resective surgery can be achieved in patients needing IE. Younger patients with temporal lobe epilepsy seem to have the highest likelihood of seizure freedom.

G-08

Cranial MRI findings associated with status epilepticus

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Background: Status epilepticus (SE) is a neurological emergency that can result in transient and/or permanent brain injury independent of its cause. There is limited information on the neuroimaging changes that may result from SE. The objective of this study was to characterize the abnormalities associated with SE in cranial magnetic resonance imaging (MRI) of patients with SE and to evaluate their clinical significance. *Methods:* We retrospectively reviewed our clinical records and electronic EEG database over eight years and identified 35 patients with SE. Inclusion criteria included seizures lasting a minimum of 30 minutes or recurrent seizures without recovery in between them for at least 30 minutes including nonconvulsive electrographic seizures. The MRI changes were not attributed to an underlying primary neurological disorder including the condition that precipitated the SE. *Results:* Seven patients (3 female; mean age 36.9 ± 9.6 SD years) met the inclusion criteria. MRI findings included increased T2 signal changes in the grey and/or white matter and diffusion-weighted abnormalities in the absence of reduced apparent diffusion coefficient (ADC) values affecting one cerebral hemisphere (n=1), bilateral cortical-

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subcortical region (n=6), perilesional and homologous region (n=1), hippocampi (n=2) and cerebellum (n=3).The MRI findings were irreversible in all cases. *Conclusions:* SE results in focal, multifocal, hemispheric and generalized changes in the brain that are mostly irreversible. Greater attention to such MRI findings may reduce the extent of investigations for alternative causes.

G-09

Prospective assessment of the safety and diagnostic yield of early discontinuation of antiepileptic drugs, and sleep deprivation in video-EEG telemetry unit

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Background: Video-electroencephalography (VEEG) telemetry is the simultaneous recording of the ictal EEG pattern and paroxysmal behavior. The main indications of VEEG-telemetry include investigation of the nature of paroxysmal events and also identification of candidates for epilepsy surgery. We performed a prospective study to asses the safety and diagnostic yield of early discontinuation of AEDs and sleep deprivation in VEEG-telemetry. *Methods:* Over a 2.5-year period, 50 patients with indications for VEEG-telemetry were admitted by an epileptologist to neuro-observation units with continuous monitoring, nursing coverage and EEG technicians' support during working hours and on-call thereafter. AEDs were tapered daily by 50% (25% if history of status epilepticus) and 76% of patients had sleep deprivation. We assessed prospectively the outcomes related with safety (falls, status epilepticus, fractures/injuries, seizure clusters), as well as diagnostic yield of the VEEG-telemetry unit. *Results:* Our monitoring answered the study question in 88% of the patients and no events were recorded in the remaining 12%. Our results changed the management in 74% of cases and potentially improved quality of life by decreasing the AEDs consumption and number of seizures per month. Over all, 22% of patients received epilepsy surgery and their seizures discontinued or became non-disabling. Our method significantly decreased the duration of hospital admission with minimal complications (8%). *Conclusions:* Our unique method for short VEEG monitoring has a high diagnostic yield, minimal complications and is cost effective (shorter admission). These qualities, together with good surgery results validate our method for the investigation and treatment of refractory seizure cases.

G-10

Unique functional pathway detected with MEG and DTI tractography in pediatric epilepsy

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Background: There remains much to learn in how focal aberrant neuronal excitation may affect surrounding and distant brain function and anatomy. The aim of this study was to assess the functional connectivity between areas of abnormal neuronal excitation in children with temporal lobe epilepsy. *Materials and Methods:* We studied a group of six pediatric patients, all of whom had MEG spike sources both within the temporal lobe and the ipsilateral Rolandic region. The mean age of the group (n=6) with epilepsy was 11.5 ± 5.2 years of age, with 3 females and 3 males. All patients had intractable unilateral temporal lobe epilepsy, caused by various brain pathologies. The control group (n=6) was age and sex matched. All patients had diffuse tensor imaging MRI performed between the temporal and frontal lobes of both cerebral hemispheres. *Results:* In all patients with epilepsy, a consistent white matter tract traveling through the external capsule, connecting the temporal and peri-rolandic regions of MEG activity was visualized. However, on the contralateral hemisphere, there was no evidence of a similar fiber tract connection, linking the corresponding identical volumes between the two regions. Of the normal control subjects, there were no corresponding white matter tracts identified in either hemisphere. *Conclusions:* This is the first identification of novel association white matter tract formation through the external capsule, connecting two distant sites of unilateral MEG activity. This finding may highlight the role of active white matter tract reorganization and plasticity within the pathophysiology of epilepsy.

Multiple Sclerosis/Dementia

H-01

Unexpectedly Rapid and Direct Transport of APP to the Lysosome in Neuronal SN56 cells observed by Laser-Scanning Confocal Microscopy

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Background: Beta-Amyloid, the toxic protein in Alzheimer's disease, is made by cleavage of the Amyloid Precursor Protein (APP). Although most evidence suggests that this cleavage occurs in subcellular compartments of the endosomal/lysosomal system, there is currently no consensus as to where beta-amyloid is generated. We have previously demonstrated that APP is highly enriched in the lysosomes in the rat liver, suggesting that this compartment may be important for the production of beta-amyloid. The goal of this study is to characterize the distribution and trafficking of APP in neuronal cells using confocal microscopy. *Methods:* We have prepared expression vectors containing an APP cDNA fused to a fluorescent protein tag on its C-terminal (intracellular) end. We have also introduced an HA (hemmaglutinin) epitope tag on the N-terminal (extracellular) end of the protein, which allows labeling of APP at the cell surface with a fluorescent antibody. We also prepared a panel of fluorescent-tagged compartment markers proteins. These plasmids were then cotransfected into SN56 neuronal cells and images were captured on a Zeiss LSM510 laser-scanning confocal microscope. *Results:* In static images, APP is present in many cellular compartments but appears most highly enriched in the lysosome. Although proteins labeled at the cell surface are expected to arrive in the lysosome only after in 30-60 minutes, APP labeled at the cell surface is rapidly internalized into lysosomes within minutes, possibly bypassing other compartments. *Conclusion:* This unexpectedly rapid transit of APP into the lysosome suggests that this compartment might be responsible for the generation of beta-amyloid.

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H-02

Bone marrow transplantation in multiple sclerosis reveals a novel mechanism of NK cell regulation of Th17 responses

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Objective: We hypothesized that after ablative immunotherapy and autologous haematopoetic stem-cell transplantation (AHSCT, a form of bone marrow transplantation), regulatory cells actively inhibit pro-inflammatory Th17 cells. *Background:* Patients with aggressive multiple sclerosis (MS) treated with AHSCT, exhibit abrogation of clinical and MRI disease activity. We previously found that this dramatic decrease in new CNS inflammatory events is associated with decreased Th17 responses. The mechanism underlying diminished Th17 responses is unknown. *Design/Methods:* We assessed putative regulatory subsets such as regulatory T cells (Tregs) and natural killer (NK) cells by flow cytometry. We established a novel ThIL17 polarization assay, based on activating purified memory T cells and autologous monocytes. Putative regulatory cell subsets were added and IL-17 was measured by ELISA. *Results:* Tregs reconstituted more quickly than effector cells; however, by 12 months the proportion of Treg to effector cells could not explain the persistently low levels of IL-17 responses. Both CD56bright NK cells and CD56dim NK cells reconstituted rapidly post AHSCT, to frequencies that were higher than pre-treatment levels (from 1% to 5% p =0.01; and from 10% to 15%, p=0.06, respectively). The increased proportion of NK cells following AHSCT significantly correlated to the reduced IL-17 responses (R2=0.5219; p=0.0215). In vitro, we confirmed that NK cells significantly inhibited IL-17 production by memory T cells by up to 50%. *Conclusion/Relevance:* We describe a novel immune regulatory mechanism whereby NK cells inhibit Th17 responses. Our data provides a potential mechanism for the observed decreases in new MS disease activity following AHSCT.

H-03

Discovery of an Anti-Aggregant Agent for Alzheimer's Disease

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Alzheimer's disease (AD) is the most common form of dementia. Currently, there are no disease modifying agents available for the treatment of AD. Protein misfolding is an important target in the design of disease modifying agents for AD. To identify an agent that may be of therapeutic utility in the treatment of AD, we devised a model of an Alzheimer's disease drug receptor; this model is termed the BBXB model (where B is a basic, cationic amino acid residue within beta-amyloid). Using this model, we used computer-aided high throughput in silico screening techniques to evaluate a library of 11,000,000 compounds. Based upon this screening program, we identified a bi-aromatic compound as a putative anti-aggregant for AD. The ability of this compound to inhibit the aggregation of beta-amyloid was verified using a battery of in vitro tests: thioflavin T assay, circular dichroism assay, MTT cell viability assay, and electron microscopy aggregation assays. The challenges of applying modern drug design techniques, including high throughput screening, to the task of drug discovery for AD will be discussed within the context of this drug discovery program.

H-04

Butyrylcholinesterase activity in neuroinflammatory and neurodegenerative lesions of multiple sclerosis and Alzheimer's disease

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Background: Butyrylcholinesterase (BuChE) is involved in hydrolysis of acetylcholine, lipids, other esters and amides and in nervous system development. BuChE is expressed in white matter, glia and neurons. BuChE is associated with neuropathological features of Alzheimer's disease (AD) that has both inflammatory and neurodegenerative components. We hypothesized that BuChE may also be involved in multiple sclerosis lesions since this disorder also exhibits neuroinflammation and neurodegeneration. *Methods:* Post-mortem MS, AD and control brains were obtained from the Maritime Brain Tissue Bank. Sections were stained for BuChE, AChE, astrocytes, microglia, macrophages, myelin basic protein and luxol fast blue/cresyl violet. *Results:* In AD, BuChE was associated with neuritic plaques and neurofibrillary tangles, as observed previously. In MS plaques, there was generalized loss of BuChE activity but the remaining activity was associated with cells or processes with abnormal morphology. In hypercellular peri-plaque regions of active plaques, there was increased BuChE activity. Normal-appearing white matter contained patches showing either loss of BuChE or a prominence of BuChE-stained cells with microglial profiles. *Conclusions:* We find changes in BuChE activity in both MS and AD brain tissues as compared to controls that suggests a role for this enzyme in neuroinflammatory and neurodegenerative processes in the CNS.

H-05

Validation of the Hospital Anxiety and Depression scale for use in patients with multiple sclerosis

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Background: Depressive and anxiety disorders are common in patients with multiple sclerosis (MS). The Hospital Anxiety and Depression (HAD) scale is a self-report scale that omits potential somatic confounders of mentation. Despite being widely used in MS research, the HAD has not been validated for use in this population. *Methods:* 180 MS patients meeting the Poser or McDonald criteria for MS were interviewed for the presence of major depression and anxiety disorders with the Structured Clinical Interview for DSM-IV disorders (SCID-IV). All subjects completed the HAD. Receiver Operating Characteristic (ROC) analysis was undertaken to assess which HAD cut-off scores most closely reflected the diagnoses of major depression and generalized anxiety disorder. *Results:* The point prevalences of major depression and generalized anxiety disorder were 16.1% and 11.0%, respectively. A cut-off score of 7/8 on the HAD-depression subscale provided a sensitivity of 90% and specificity 87.3% with a ROC area under the curve of .938. A cut-off score of 8/9 on the anxiety subscale gave a sensitivity of 85.7% and a specificity of 85.8% with a ROC area under the curve of .913.

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Conclusions: The study confirms the usefulness of the HAD as a marker of mood and anxiety in MS patients. The validation data also reveal that the optimal cut-off points for anxiety and depression differ slightly from one another. This finding has implications both for clinicians and researchers using the scale.

H-06

Progression of multiple sclerosis in patients with other autoimmune diseases

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Background: To determine the effect of other autoimmune diseases (AiD) on disability progression in multiple sclerosis (MS). *Methods:* Using the Dalhousie Multiple Sclerosis Research Unit clinical database, merged with health services utilization data from the Nova Scotia Department of Health, records of 1643 definite MS patients with complete data on their clinical course were searched for diagnoses of AiD. Times to reach clinical disability endpoints EDSS 2, 3, 4, 5, 6 and 8 were compared using univariate and multivariate analyses for patients with and without AiD. *Results:* Using multivariate analyses, for all patients combined, AiD were not associated with faster progression. When analyzed separately by MS class, only relapsing-remitting patients with AiD had significantly faster progression to EDSS 2, 3, 4, 5 and 6. Secondary progressive patients with AiD did not progress faster than those without. Primary progressive patients with AiD and males with AiD had significantly faster progression to EDSS 3, 4, 5 and 6 but only on univariate analyses. *Conclusions:* Significantly faster progression of neurologic disability was associated with AiD in relapsing-remitting MS patients. The presence of AiD early in the course of relapsing-onset MS may have implications for treatment decisions and for selection for therapeutic trials.

H-07

Referral delay is longer for primary-progressive than relapsing-remitting multiple sclerosis patients in British Columbia, Canada

AL Leung (Vancouver), E Kingwell (Vancouver), P Rieckmann (Vancouver), H Tremlett (Vancouver)*

Background: Referral delay represents the time between recognition of MS onset symptoms and first consultation with an MS specialist neurologist. *Methods:* We conducted a retrospective review of the British Columbia (BC)-wide MS database, which captures 80% of the BC MS population. We compared the referral delay for primary-progressive (PP) and relapsing-remitting (RR) onset patients. Inclusion criteria were: definite or probable MS (Poser or MacDonald criteria); onset at age ≥16 years; and an initial visit to a BC MS clinic between 1985-2004. Comparisons were made using the Independent T-test or Mann-Whitney U-test. *Results:* 6266 individuals met inclusion criteria. RR patients had a shorter referral delay than PP patients (mean±SD [years]: 8.2±8.84 [RR] vs. 9.4±8.73 [PP], p=0.002). Patients older at onset (age ≥45) had a shorter referral delay than those younger, in both disease cohorts (p<0.001). Mean referral delay decreased over time, between 1985-1994 and 1995-2004, in RR (10.8% decrease; p<0.001) but not PP patients (0.4% increase; p=0.97). Within the RR cohort, this decrease was primarily driven by women age ≥45 at onset (data not shown). The median initial EDSS (disability) score was higher for patients with a longer referral delay (≥4 years vs. <4 years, p<0.001). *Conclusions:* RR patients exhibited a shorter referral delay than PP patients. Delay decreased overtime for the RR patients only. Onset age and gender also influenced delay. As longer referral delay was associated with greater disability, further work is needed to elucidate modifiable factors that could reduce delay, hence maximizing the opportunity for early intervention.

H-08

The Effectiveness of Natalizumab Monotherapy in Canadian Patients with Relapsing-Remitting Multiple Sclerosis

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Background: Our objective was to report on the effectiveness of natalizumab in Canadians with relapsing-remitting multiple sclerosis (MS). *Methods:* Subjects receiving natalizumab for MS were followed from start of therapy to 31Dec2008. Efficacy was assessed at month 3, 6, and 12 using the MSIS29. Safety was assessed by spontaneous reports. *Results:* A total of 170 subjects were enrolled, 77% of patients were female, mean age was 39.8 years. Mean duration of therapy for the 114 (67%) subjects still receiving therapy was 331 (SD 180) days. Subjects who discontinued did so after a mean of 226 (SD 183) days. Baseline MSIS physical and psychological scores were 43.9 (SD 27.3) and 34.9 (SD 23.0) respectively. The physical components of the MSIS-29 decreased by 11.6 (p=0.010) and 23.3 (p=0.002) after 3 and 6 months respectively. The psychological component of the MSIS-29 decreased by 12.4 (p=0.001) and 15.0 (p=0.005). On average subjects improved on 27 (93%), 29 (100%) and 24 (83%) of the twenty nine MSIS-29 components at 3, 6 and 12 months respectively. At 6 months all MSIS-29 items improved, the items with the most improvement were heavy arms/legs (72%); ability to use hands in everyday tasks (68%), and grip strength (66%). The MSIS-29 items with the least improvement were mental fatigue (14%), confidence (16%), and toilet urgency (16%). *Conclusions:* MS subjects who receive up to 6 months of natalizumab report improvements in disease severity as measured by the MSIS-29 suggesting that the beneficial effect of natalizumab seen in clinical trials occurs in the real-world setting.

H-09

25 (OH) Vitamin D levels in MS satellite clinic Sydney Nova Scotia patients

M Maharaj (Sydney), C Blanchard (Halifax)*

Background: An inverse relationship exists between 25 (OH) D, MS risk and disability. Vit D supplementation data in MS is limited and experts' recommendations are higher than Health Canada's recommendation of 200-600 IU daily. Vit D status is represented by serum 25 (OH) D. We measured insufficiency (<75 nmol/L) in a MS clinic cohort. *Methods:* 42 consecutive MS patients were seen in fall 2008. Vit D daily intake, basic demographics, EDSS scores were recorded and 25 (OH) D were measured. *Results:* There were 32 females and 10 males (ratio 3.2:1) with 25(OH) D levels available in 29 patients. Mean EDSS scores were 3.3 (range 0-7.5). Insufficient levels were found in 58.6%. Four groups were identified based on Vit D intake: Nil, 400, 1000, 2000 IU. Serum 25 (OH) D were

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insufficient in 8/17 in group 1; 2 /2 in group 2 ; 3/5 in group 3 ; 2/5 in group 4 (means were 72.3, 51.5, 70.4; and 70 respectively). Groups were collapsed into low dose (400 IU) or no supplement and high dose supplement (1000-2000 IU); 25 (OH)D means were 67.4 (SD 15.82) versus 70.16 (SD = 25.56) respectively. T-test= t (27) = 4.97, p = .03. *Conclusions:* Insufficient Vit D was common in this population. Even 2000 IU is inadequate to elevate Vit D levels.

Movement Disorders/Neuromuscular

I-01

12-Month European phase III clinical study of SNT-MC17/idebenone in the treatment of Friedreich's ataxia: baseline demographic data

JB Schulz (Aachen), GL Holder (Liestal), T Meier (Liestal), The MICONOS Study Investigators (Aachen)*

Background: Friedreich's ataxia (FRDA) is the most common recessively inherited ataxia. In a placebo-controlled study of children with FRDA, idebenone promoted dose-dependent improvement in neurological function and was well tolerated. Idebenone is a short-chain analogue of ubiquinone that modulates ATP production by the respiratory chain complex and acts as an antioxidant. *Methods:* This double-blind, multicenter study has randomized 232 FRDA patients aged ≥8 years to 4 treatment arms. Patients ≤45 kg (>45 kg) receive placebo or idebenone 180 (360), 450 (900), or 1350 (2250) mg/day. The primary end point is change in International Cooperative Ataxia Rating Scale (ICARS) score from baseline to week 52. Secondary end points include Friedreich's Ataxia Rating Scale (FARS) and measures of cardiac anatomy and function. Safety is assessed by adverse events, electrocardiography, blood and urine laboratory analyses, and clinical assessments. *Results:* Of 232 patients randomly assigned to date, 118 (50.9%) have completed the study at abstract submission date. Mean age of patients was 30 years. Baseline data for demographics, neurological function scores (ICARS, FARS), and activities of daily living and blinded interim safety and tolerability results will be presented. *Conclusion:* This study will further characterize the safety and tolerability of idebenone in patients with FRDA.

I-02

6-month US phase 3 clinical study of SNT-MC17/idebenone in the treatment of Friedreich's ataxia: preliminary safety data

DR Lynch (Philadelphia), S Perlman (Los Angeles), GL Holder (Liestal), T Meier (Liestal)*

Background: Idebenone has a dual mode of action: as an electron carrier supporting mitochondrial ATP formation and as a potent antioxidant. A placebo-controlled study of 48 children with Friedreich's ataxia (FRDA) showed that idebenone treatment was safe and well tolerated, with improvement in neurological function and activities of daily living. *Methods:* A multicenter, double-blind, placebo-controlled study recruited 70 ambulatory FRDA patients (aged 8 to 17 years) with mild to moderate neurological impairment. Patients were randomly assigned to receive placebo or idebenone 450/900 mg or 1350/2250 mg daily (adjusted for body weight ≤45 kg/>45 kg) for 6 months. Safety assessments included adverse events (AEs) and clinical and laboratory data. *Results:* Blinded interim data from 46 patients (median age, 12 years) show that gastrointestinal disorders were the most frequent class of AE: 24 (19%) of 127 events reported. Most AEs (88%) were mild in nature. No discontinuations were reported. Two serious AEs occurred: chest pain and idiopathic thrombocytopenic purpura in two patients with histories of these conditions. Both events were considered unrelated to study drug. Laboratory analyses, electrocardiography, and vital signs indicated no significant changes. *Conclusions:* Preliminary safety data are consistent with previous findings that idebenone is safe and generally well tolerated.

I-03

Relation of Arm Dystonia in Corticobasal Degeneration with Handedness

A Rana (Toronoto), A Al Saraawi (Toronoto), F Khan (Toronoto)*

Objective: We wanted to study the relation of arm dystonia seen in corticobasal degeneration with handedness. *Background:* Corticobasal degeneration is an infrequent cause of atypical Parkinsonism. Unilateral arm dystonia may be the presenting symptom in some patients. There has been no definite correlation reported between the side of arm dystonia in corticobasal degeneration and the handedness of patients. *Methods:* We did chart review of corticobasal degeneration patients seen in our Parkinson's disease clinic. Four of the patients with corticobasal degeneration seen in our clinic presented with unilateral arm dystonia during the course of their illness. *Results:* All four of these patients with corticobasal degeneration were right handed. All of them had arm dystonia on the left side with typical rigid stiff arm presentation making their left arm useless. *Conclusion:* Although number of our patients was very small and this correlation may be just incidental. But this does raise a question, is arm dystonia seen in corticobasal degeneration more common on the contralateral side of the dominant hand? Further observation is needed to study any correlation like this if it ever exists.

I-04

Isolated Facial Tremor- Is this Tic, Tremor or Myoclous?

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

Objective: To report a case of isolated facial tremor, which is an essential tremor variant and could be a diagnostic challenge *Background:* Isolated facial tremor is an essential tremor variant which is very infrequently seen even in the movement disorders clinic. Patients usually report a bilateral facial tremor with half hearted smile. Isolated facial tremor may be mistaken as bilateral hemifacial spasm and may lead to unnecessary imaging of brain and treatments. Isolated facial tremor usually responds to alcohol intake. Treatments includes propranolol, primadone and other drugs which are helpful in the essential tremor syndrome. *Methods:* We present a case of 37 year old male who developed bilateral facial tremor on half hearted smile. He was seen by first neurologist and a diagnosis of bilateral hemifacial spasm was entertained. Second neurologist could not conclude a diagnosis and referred him to the movement disorders clinic where propranolol was initiated with a good response. *Results:* Patient responded to propranolol. *Conclusion:* Isolated facial tremor could be a diagnostic challenge and history of alcohol response should be asked carefully.

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I-05

Jumping back- a Midline Truncal Tremor in MS

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

Objective: To report a case of midline truncal tremor associated with multiple sclerosis. *Background:* Multiple sclerosis causes formation of demyelinating plaques in the central nervous system. Involvment of the cerebellum may result in ipsilateral limb tremor which is not uncommon in MS patients. Truncal tremor due to midline cerebellar involvement is quite infrequent and very resistant to treatment. *Methods:* We report a 62 year female with history of multiple sclerosis for last 16 years. Two years ago she developed an intention tremor of upper extremities but later she developed the postural and kinetic tremor of upper extremities as well. On examination she was found to have intention, postural and kinetic tremor of both upper extremities and a significant truncal tremor which was being conducted to her head. *Results:* She did not notice any significant improvement of tremor with primadone but objectively amplitude of tremor was noticed to be less intense. *Conclusion:* This is an interesting case of an MS patient with midline tremor of trunk in addition to tremor of limbs.
Video is available

I-06

Decoding neural signals from multielectrode arrays in the primate supplementary eye fields

AJ Sachs (Ottawa), F Pieper (Montreal), JC Martinez-Trujillo (Montreal)*

Background: Efforts to interface the primate brain with external prosthetic devices have largely focused on the primary motor area because of its well tuned motor signals, and established somatotopic organisation. However, this area is limited by the musculocentric reference frame, and its apparent lack of cognitive signals such as reward, learning, and conflict between motor plans. Other brain areas, such as the supplementary eye fields (SEF), in the prefrontal cortex, carry most of these signals and may be better candidates for interfacing with prosthetic devices. *Methods:* We surgically implanted two microelectrode arrays (8x8 electrodes each) in the SEF of an adult *Macacca fascicularis* using anatomical landmarks. We recorded neuronal activity during two tasks, a) when the monkey made delayed saccades to concentric targets (visually guided saccades), and b) when the monkey associated an arbitrary visual cue to a saccade direction (rule-guided saccades). *Results:* Spiking activity appeared two weeks after the implant in ~50% of the electrodes. We have obtained stable signals over a four month period since implantation, with day to day variations in channel activity. In a preliminary analysis we found poor tuning for the direction or amplitude of visually guided saccades. However, some SEF cells exhibited tuning during error trials in the rule-guided saccades task. *Conclusion:* Our surgical implant technique allows obtaining clear and robust neural signals from the SEF over periods of months. Such signals carry complex information about conflicting motor plans and errors. They could be potentially used to augment the performance of neural prosthetic devices.

I-07

Behavioural Analysis of Peripheral Nerve Regeneration Through Nerve Growth Factor (NGF) Loaded T-tube Chambers

SW Kemp (Calgary), AA Webb (Calgary), R Midha (Calgary)

Background: Behavioural recovery is the most important outcome measure following peripheral nerve transection and repair. Various behavioural measurements have traditionally been used to assess recovery following peripheral nerve transection, however, direct measures that objectively and sensitively assess the return of sensorimotor function in peripheral nerve injured animals is currently lacking. *Methods:* Animals were randomly assigned to one of six treatment groups: nerve crush (Group 1); direct repair (Group 2); transection and T-tube repair with 1 week saline administration (Group 3); transection and T-tube repair with 1 week NGF administration (Group 4); transection and T-tube repair with 3 weeks NGF administration (Group 5), and; sham-operated controls (Group 6). Locomotor measurements consisted of: (1) ladder rung; (2) tapered beam with crutch: (3) quantitative kinematics, and; (4) ground reaction force determination. *Results:* Animals administered NGF for a 3 week period committed less errors in skilled locomotor tasks compared to other surgical groups. In addition, these animals recovered their fore-aft ground reaction forces after a 2 month period, providing a more sensitive assessment of behavioural recovery. Sensory testing did not differ at any time point in peripheral nerve injured animals. Endpoint functional analysis corroborated the behavioural data, with animals administered NGF for 3 weeks having both faster conduction velocities and greater muscle weight as compared to all other surgical groups. *Conclusions:* These results suggest that animals administered NGF within a T-tube chamber for a three week period display improved sensorimotor behavioural recovery following peripheral nerve injury as compared to all other transection injury groups.

I-08

Syptomatic dystrophinopathies in pediatric females

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Background: Although manifesting female carriers of dystrophinopathies have been documented in adults, there are few reports of females presenting with symptomatic dystrophinopathies during childhood. *Method:* The Canadian Pediatric Neuromuscular Group identified and characterized cases of female children, 16 years or younger, with a confirmed genotypic or histologic dystrophinopathy. *Results:* Eight patients have thus far been identified, with an age range of 2-10 years (mean 6.5) at presentation. Presenting symptoms include proximal muscle weakness (6/8), calf pseudohypertrophy (6/8), abnormal gait (4/8) and myalgias (3/8). Four patients had significant behavioural and/or learning issues, while only one had cardiomyopathy. Alternative diagnoses were initially considered, including metabolic, hepatic, endocrine, and rheumatologic conditions. Skewed X inactivation was noted in 5/8 patients with three others awaiting results. Two of the patients were found to have an X/autosomal translocation, one of whom also had skewed X-inactivation. Six patients had muscle biopsy in addition to genetic testing confirming dystrophinopathy, with one recently diagnosed child awaiting biopsy. Two patients were treated with daily

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corticosteroids, but one discontinued them after two years due to side effects. *Conclusions:* Increased awareness of manifesting females with dystrophinopathies will allow for earlier diagnosis and give parents information regarding prognosis so they can make informed management decisions for these patients.

I-09

Functional and anatomical analysis of selective tibial nerve branch neurotization to the deep peroneal nerve in the rat.

JD Alant (Calgary), SW Kemp (Calgary), AA Webb (Calgary), R Midha (Calgary)*

Background: The central plastic processes that enable nerves originally innervating antagonistic muscle groups to function in synchrony after neurotization procedures remain an enigma. This study examined hind limb distal nerve transfers to investigate this issue. *Methods:* 37 Adult rats were assigned to one of four groups: Sham-operated controls; direct neurotization of the lateral gastrocnemius branch (LG) to deep peroneal nerve (DP) (Transfer Group); LG and DP transected (Negative Control); and LG and DP transected with direct repair of DP (Direct Repair). Locomotor measurements, serially obtained over 2 months, consisted of ladder rung, tapered beam, quantitative kinematics, and ground reaction force determination. Tibialis anterior CMAP recordings preceded the following measurements: tibialis anterior muscle weights; distal deep peroneal nerve histomorphometry; muscle fiber surface area and fiber counts. Retrograde labeling of relevant motoneuron pools was conducted in a subset of animals. *Results:* Both tibialis anterior CMAP amplitudes and muscle weights showed no statistical difference between Transfer and Direct Repair groups, but were statistically different from Sham and Negative Control groups. Nerve histomorphometrical, myological and behavioral measures as well as motor neuron pool data are pending. *Conclusions:* The rodent model used is a viable model for the study of distal hind limb transfers, with successful reinnervation of the anterior tibial muscle comparable to direct repair of the deep peroneal nerve.

I-10

Chronic inflammatory demyelinating polyneuropathy (CIDP): the correlation between treatment outcomes and nerve conduction study findings

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Background: Data regarding correlations between treatment response and nerve conduction study (NCS) findings in CIDP are inadequate. This prompted the examination of potential correlations between NCS results and clinical outcomes using data from the ICE trial, in which immune globulin intravenous, 10% caprylate/chromatography purified (IGIV-C; Gamunex®) significantly improved clinical disability measures in CIDP (Lancet Neurol. 2008;7(2):136-144). *Methods:* Patients received IGIV-C (n=59) or placebo (n=58) as a 2-g/kg loading dose and then as 1-g/kg maintenance infusions every 3 weeks for up to 24 weeks. INCAT score, MRC score, grip strength, and NCS were assessed at baseline and endpoint/week 24. Statistical analyses included calculation of Pearson's correlation coefficient. *Results:* Baseline averaged compound muscle action potential (CMAP) amplitude correlated with INCAT (P=0.014) and MRC (P=0.017) scores and grip strength (P=0.032). Improvements from baseline showed significant correlations between CMAP amplitude and adjusted INCAT scores (r=-0.53; P<0.001), MRC scores (r=0.38; P<0.001), and grip strength (r=0.44; P<0.001) and between change in conduction block and INCAT scores (r=0.29; P=0.001), MRC scores (r=-0.35; P<0.001), and grip strength (r=-0.37; P<0.001). *Conclusions:* These results indicate that clinical measures of disability and muscle strength in response to treatment in patients with CIDP are supported by correlative improvement in NCS.

General Neurosurgery II

J-01

Early experience with pediatric gamma knife radiosurgery in Canada

MJ Ellis (Toronto), L Normand (Toronto), N Elaine (Toronto), S Gary (Winnipeg), S Michael (Toronto), W Michael (Winnipeg), AV Kulkarni (Toronto), MJ Patrick (Winnipeg)*

Background: Stereotactic radiosurgery (SRS) has recently emerged as an effective treatment option for pediatric arteriovenous malformations (AVMs) and brain tumors. Treating the pediatric population, however, presents unique challenges. *Methods:* The objective was to review the clinical features, treatment plans and outcomes for all children treated with SRS at the University of Manitoba and University of Toronto. *Results:* Thirty-two children were treated with Gamma Knife radiosurgery at the two institutions (15 males, 17 females). Median age at treatment was 12.2 years (range 4-17). Twenty-seven of 32 children were treated while under general anesthesia. Eighteen children were treated for AVMs and 14 for tumors. Average marginal dose was 20.8Gy for AVMs and 14.8Gy for tumors. Average follow-up duration was 16.1 months. Complications included transient peri-lesional edema (4 asymptomatic, 1 symptomatic), hypopituitarism (1 patient), and vascular line complication (1 patient). Despite a short duration of follow-up, preliminary results indicate an AVM obliteration rate of 42% (as confirmed by MRA) and a tumor control rate of 82%. *Conclusions:* Stereotactic radiosurgery is a safe treatment modality for children with small, well-defined AVMs and tumors. Although preliminary results are promising, long-term follow-up is necessary to evaluate treatment efficacy in this population.

J-02

Single Neurons in the Human Subgenual Cingulate Differentiate Emotion Categories

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Background: Emotional information can be classified according to valence (or pleasantness) and arousal. We now provide the first direct measure of single subgenual cingulate [Brodmann area (BA) 25] neuron responses to emotionally evocative scenes, showing that specific BA 25 neurons differentiate complex emotion categories rather than emotional valence or arousal alone. *Methods:* During

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microelectrode recording of BA 25 neurons, participants sequentially viewed random series of 50 emotionally evocative images (separated by fixation screens) subdivided into 5 emotion categories based on valence and arousal. Single neuron activity was analyzed using Spike 2. *Results:* One hundred thirty six neurons were recorded in 15 patients with major depressive disorder. Fifty-five neurons (40.4 %) responded to the IAPS images. Four neurons (7.3%) responded to a specific emotion valence, 3 neurons (5.5%) responded to a specific arousal level, and 33 neurons (60%) were responsive to a specific emotion category. Thus, BA 25 neurons were more likely to respond specifically to complex emotion categories than to valence or arousal alone (Chi = 41, $p < 0.001$). Furthermore, neurons in BA 25 were preferentially responsive to negative emotion categories (disturbing and sad combined = 18) over neutral (6) or positive emotion categories (happy and exhilarating combined = 9) (Chi = 7.1, $p < 0.05$). *Conclusions:* BA 25 neurons respond to positive and negative emotion categories, but more negative emotion processing neurons are present than positive emotion processing neurons. Therapies that alter activity in this region may work by down-regulating an overactive and preferentially negative emotional processing bias.

J-03

Spontaneous Third Ventriculostomy Identified in Five Patients with Previously 'Arrested' Obstructive Hydrocephalus

MG Hamilton (Calgary), A Mitha (Calgary), K Bullivant (Calgary), C Gallagher (Calgary)*

Background: 'Arrested' obstructive hydrocephalus is not uncommonly identified in the older child or adult patient. It is presumed that a process to reestablish cerebrospinal fluid (CSF) dynamics must have occurred for a patient to become 'stable' and therefore defined as having 'arrested hydrocephalus'. However, the mechanism of 'compensation' is not typically evident. *Methods and Results:* We identified 5 patients with obstructive hydrocephalus who had an MRI CSF flow study demonstrating robust CSF flow through the floor of the anterior third ventricle. None had previously undergone an endoscopic procedure. Two patients (one child and one adult) experienced delayed clinical progression of hydrocephalus symptoms and underwent endoscopic expansion of what was branded a 'spontaneous third ventriculostomy'. These 2 surgical patients improved after the endoscopic expansion of the third ventriculostomy site. The three other patients remain stable, all continuing with clinical and MRI follow up. *Conclusion:* The mechanism by which CSF dynamics are re-established to produce 'arrested obstructive hydrocephalus' is usually not obvious. These 5 patients all had MRI evidence of spontaneous third ventriculostomy. In these 5 patients it is hypothesized that the spontaneous third ventriculostomy was responsible for correcting the abnormal CSF dynamics that were initially present. However, while the spontaneous third ventriculosotomy remains sufficient in 3 patients, it required expansion in 2 patients for delayed clinical deterioration. This suggests that the mere presence of a spontaneous third ventriculostomy should not be considered a 'cure' for obstructive hydrocephalus. Patients should be observed long term for evidence of clinical deterioration.

J-04

Is decompressive craniectomy an independent risk factor for communicating hydrocephalus?

R Rahme (Montreal), M Sabbagh (Montreal), MW Bojanowski (Montreal)*

Introduction: It has been recently suggested that communicating hydrocephalus is an almost universal finding after hemicraniectomy and that early cranioplasty may prevent the need for permanent cerebrospinal fluid (CSF) diversion in these patients. We conducted this study in an attempt to confirm these findings. *Methods:* Between 2001 and 2007, 10 patients underwent decompressive craniectomy for cerebrovascular accident-related refractory elevated intracranial pressure. Medical records were retrospectively reviewed. Hydrocephalus was defined as clinically significant dilatation of the ventricular system or enlarging extraaxial CSF collection requiring CSF diversion. *Results:* The patient population consisted of 3 males and 7 females with a mean age of 44 years (31 - 53 years). Diagnoses included malignant middle cerebral artery territory infarction in 5 patients, infarction of other territories in 3 patients, basal ganglia hemorrhage in 1 patient, and transverse sinus thrombosis in 1 patient. Extent of craniectomy ranged from midsize bone flaps in 4 patients to large hemicraniectomies in 6 patients. One patient died during the acute phase and was excluded from the analysis. The remaining 9 patients underwent cranioplasty after a mean interval of 27 days (3 - 84 days). None of these patients developed clinically significant hydrocephalus necessitating CSF diversion. In one patient, there was radiological evidence of external hydrocephalus but the patient's neurological condition remained stable and the collection resolved spontaneously following cranioplasty. *Conclusion:* Our results suggest that, contrary to some beliefs, hydrocephalus does not frequently occur after decompressive craniectomy.

J-05

Compensated Hydrocephalus In Familial Colloid Cyst Of The Third Ventricle

JA Radic (Halifax), IG Fleetwood (Halifax)*

Background: Colloid cysts (CC) are rare intracranial lesions and when symptomatic can be a neurosurgical emergency. Presenting symptoms range from non-specific headache and nausea and vomiting, to sudden death from obstructive hydrocephalus. Natural history studies recommend resection for asymptomatic patients with growing cysts or if ventriculomegaly develops. There have been few familial cases reported. *Methods:* We discuss non-twin sisters with strikingly different presentations of CC. *Results:* One sister had specialist consultation for visual changes but was found dead in 1997 prior to investigations. Autopsy confirmed obstructive hydrocephalus secondary to CC. The other sister was found to have an incidental CC on CT head in 2003 but refused treatment, despite marked ventriculomegaly. Remarkably, she remained asymptomatic for more than five years. In 2009 she presented with syncope, muteness, and cognitive/behavioral changes. She underwent urgent endoscopic CC resection. *Conclusions:* 1) We could find no prior reports of compensated hydrocephalus in asymptomatic patients with CC. There are no reports of sudden death in patients with small CC. Given this potential for compensated hydrocephalus, the guideline of resection for asymptomatic patients with growing cysts

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but without hydrocephalus may be reconsidered. 2) There is insufficient evidence for screening first degree relatives of CC patients.

J-06

Fully endoscopic surgery of lesions in the skull base and craniovertebral junction

CB Agbi (Ottawa), A Lamothe (Ottawa), S Kilty (Ottawa)*

Background: Endoscopic techniques have been utilized as an adjunct to traditional open techniques in the treatment of skull base lesions for some time, but the treatment of these lesions utilizing fully endoscopic techniques is relatively new. We present our initial experience using the expanded endonasal technique in the surgical treatment of a variety of skull base and craniovertebral junction lesions at the Ottawa Hospital. *Methods:* From April 2006 to December 2008, a total of 78 procedures for lesions in the skull base and craniovertebral junction were carried out using the expanded endonasal approach. The majority of cases were pituitary tumours. The other cases include meningioma (3), craniopharyngioma (3), sinonasal lesions (2), frontonasal encephalocele (1), clival chordoma (1) and odontoid/craniovertebral lesions (4). *Results:* The procedure was successfully employed in all the cases. The goals of treatment were achieved in the majority of cases. Four cases required a second endoscopic procedure to complete resection and 2 cases required conversion to traditional open techniques. There was one case of post-operative mortality. Morbidity included CSF rhinorrhea (6), and intrasellar hematoma (2 cases). *Conclusion:* Fully endoscopic treatment of selected lesions in the skull base and craniovertebral junction can be achieved safely and efficaciously using the expanded endonasal technique.

J-07

"Sources and Patterns of Pain in Lumbar Disc Disease"; Revisiting of Francis Murphey's theory

S Alemo (Philadelphia), A Sayadipour (Philadelphia)*

Background: To revisit the mechanical theory of discogenic Low Back Pain (LBP) and determine whether or not it is a logical one. *Methods:* The literature pertinent to sources of pain in lumbar disc disease was reviewed and analyzed logically emphasizing mechanical theory of discogenic LBP. Deductive versus Inductive logic has been discussed to evaluate the Murphey's theory. *Results:* The innervation of the intervertebral lumbar disc discovered in 1947. Francis Murphey had unprecedented experience of testing the annulus and Posterior Longitudinal Ligament (PLL) under local anesthesia and he concluded that lumbar disc disease is a source of LBP: "It is found that the PLL and the remaining annulus fibrosus over the herniated discs are also exquisitely tender, even the slightest pressure on them produces pain. In other cases, compression of the posterior longitudinal ligament and annulus does not produce pain. Strangely, while cutting these structures is not painful, compression or stretching is, as stated above, extremely painful." However there was short coming in his conclusion relating the sensory innervation of the annulus and PLL to LBP based on Deductive logic Inductive logic system. *Conclusions:* Mechanical theory of Francis Murphey is weak Inductive logic. Evidenced-based studies are needed to justify discectomy in patients suffering from LBP.

J-08

Information needs of patients undergoing craniotomy for benign but life-threatening intracranial lesions: A qualitative study

KO Khu (Toronto), L Rozmovits (Toronto), M Bernstein (Toronto)*

Object: Doctor-patient communication in the setting of a life-threatening neurosurgical illness poses considerable challenges. This study aimed to determine the information needs of neurosurgical patients. *Methods:* Qualitative case study methodology was used. Twenty-five semi-structured interviews were conducted with ambulatory adult patients who had undergone surgery for a benign brain tumor, arteriovenous malformation, or cold aneurysm. Interviews were digitally audio recorded and transcribed, and the data subjected to thematic analysis. *Results:* Six overarching themes emerged from the data: (1) the amount of information patients want varies; (2) the type of information needed is not limited to information about treatment options and risks; (3) patients engage in independent information seeking for a variety of reasons; (4) patients consider compassion from their surgeon as important; (5) direct communication with the surgeon post-operatively is very important; and (6) patients' information needs are greatest post-operatively. *Conclusions:* Many patients felt that the amount and quality of information they received were not sufficient, particularly regarding recovery and long-term life issues, leading many to do their own research. The findings from this study emphasize the need for improved communication with neurosurgical patients so they can participate meaningfully in choices about their treatment, give a truly informed consent, and effectively participate in their own recovery.

J-09

Do subspecialized neurosurgeons experience higher complication rates for non-subspecialty emergency surgery? A systematic review

A Fallah (Toronto), S Ebrahim (Toronto), M Englesakis (Toronto), M Bernstein (Toronto)*

Objective: Subspecialized neurosurgeons with a narrow focus of elective practice inevitably have decreased exposure to surgical procedures outside the scope of their practice. It is unknown whether this leads to higher complication rates for emergency surgical procedures during call. The objective of this study was to evaluate the scientific literature for complication rates of subspecialized neurosurgeons when performing non-subspecialty neurosurgery. *Methods:* A comprehensive search of OVID/Medline, EMBASE, Cochrane and SCOPUS was performed. Two authors independently reviewed articles using a standardized inclusion and exclusion criteria. References and key word terms of independently included articles were assessed to yield additional related articles. *Results:* A total of 560 articles were retrieved using these databases. Two articles met our inclusion criteria. Both articles were commentaries that suggested subspecialized neurosurgeons may experience higher complications and decreased versatility for non-subspecialty neurosurgery. *Conclusion:* There is a lack of objective evidence that subspecialized neurosurgeons [with a limited scope of practice] are more prone to complications for non-subspecialty neurosurgery. Newly designed trials [particularly qualitative or observational studies] are warranted to further investigate this topic. Potential implications of these studies could include the restructuring of call schedules and/or training.

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J-10

The association between intracranial tumours and multiple dyschondroplasia (Ollier's disease or Maffucci's syndrome): Do children and adults differ?

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Background: In Ollier's disease (OD) and Maffucci's syndrome (MS), there is dysplasia of cartilage, primarily involving long bones, which can lead to sarcomatous degeneration. There is an association with other neoplasms, including intracranial tumours. We have compared children with OD or MS and an intracranial malignancy with their adult counterparts. *Methods:* Cases were identified through PubMed, SciSearch, Scientific Commons, Springer Link, and Google. Children and adults were compared with respect to gender, geographic distribution, histology, site of lesion, and underlying enchondromatosis syndrome. *Results:* Forty-six patients with 47 intracranial malignancies were identified; nine were younger than 18 years. The incidence of intracranial chondrosarcomas peaked in the 4th decade, in parallel with the peak number of MS cases; conversely, both non-sarcomas and OD peaked in the 3rd decade of life. Six of 9 youths (67%) versus 17 of 36 adults (47%) were female ($p = 0.30$). There was no difference in geographic distribution ($p = 0.82$). Four children (44%) versus 16 adults (43%) had a chondrosarcoma ($p = 0.95$). There was no significant difference by tumour site ($p = 0.42$). However, 7 (77%) of children had Ollier's disease as their underlying syndrome, versus just 17 (46%) of the adults, a difference approaching statistical significance ($p = 0.086$). *Conclusions:* The association between enchondromatosis and intracranial malignancy is roughly the same in children versus adults, though Ollier's disease predominates among youths.

Spine II

K-01

Development of a Provincial Spine Pathway for Saskatchewan

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Objective: In Canada, the wait time to see the spine surgeon is often longer than the wait for spine surgery. An effective triage strategy is essential to ensure that patients who require surgery are seen earlier and appropriate non-surgical therapies can be initiated for the majority. Based on the success of hip and knee pathways, we developed a provincial spine care pathway to improve the delivery of timely, appropriate, evidence-based therapy for patients with lower back or leg pain. *Methods:* Over two years, regular meetings were held between Saskatchewan spine surgeons and other stakeholders to develop a provincial spine care pathway. The pathway is based on a systematic review of the assessment and treatment of spinal disorders. *Results:* The Saskatchewan Spine Pathway (SSP) has three major components: (1) Education of primary care physicians to identify and treat major patterns of back pain and leg pain using evidence-based techniques. Patients who fail to show signs of improvement are referred to SSP clinics in Saskatoon and Regina. (2) These specialized clinics, staffed by primary care providers with extra training in the SSP, assess and triage patients to receive further non-surgical therapy, imaging and/or referral to a spine surgeon. (3) The success or failure of the pathway is assessed by monitoring wait times, cost-effectiveness and patient-reported outcomes. *Conclusions:* The provision of timely, evidence-based spine care is difficult to deliver on a provincial basis. The implementation and success of this pathway may hopefully form the basis of similar programs in other provinces

K-02

The use of the National Trauma Registry (NTR) of the Canadian Institute for Health Information as a database of spinal cord injury (SCI): A validation study using an institutional clinical database

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

Background: Selecting cases of SCI using the 10th Revision of the International Classification of Diseases (ICD-10) coding system may result in error due to miscoding or methodological limitations. This validation study compares the data based on ICD-10 codes sent from our spine center to the NTR with our clinical database. *Methods:* All patients with acute spine trauma who were admitted to our institution from May/2003 to April/2007 were included. Accuracy, sensitivity and specificity were estimated having chart data abstraction as the gold standard. *Results:* There were 92 patients with spine trauma (50M, 42F; ages: 16-102 years, mean of 51.4). The use of the NTR as SCI database has an accuracy of 32.6%, sensitivity of 81.3% and specificity of only 6.7%. If the same database is considered as a spine trauma database, there will be an increase in the precision with an accuracy of 87%, sensitivity of 89.8% and specificity of 25%. *Conclusions:* Our results indicate that the NTR may be relatively more precise when used as a database of spine trauma in comparison with its use as a database of SCI. However, the low specificity suggests that the NTR should be comprehensively validated using data from the other institutions that contribute to the NTR.

K-03

The influence of age at the time of spine trauma on the length of stay and hospital costs in a university-based Canadian acute care center

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

Background: This retrospective cohort study examines the potential influence of age on length of stay (LOS) and total hospital costs (THC) of patients with spine trauma who were managed in a spine trauma centre. *Methods:* We included consecutive patients with acute spine trauma who were admitted from 2002-2007. Costs were adjusted to 2008 Canadian dollars (CAN$) based on inflation rates. Data were analysed using unadjusted regressions and after controlling for potential confounders (gender, pre-existing co-morbidities, level and severity of injury). *Results:* There were 55 women and 91 men (ages 16 to 92 years, mean of 50) who had a mean LOS of 13.4 days (1-230 days). THC varied from CAN$396.13 to CAN$410,426.35 (mean of CAN$24,073.23). Longer LOS was significantly associated with older age in the unadjusted model ($R^2=0.041$; $p=0.014$) and after controlling for confounders ($p=0.04$). THC was not significantly correlated with age in the unadjusted ($p=0.14$) and adjusted regression analyses ($p=0.59$). However, longer LOS was more costly ($R^2=0.785$; $p<0.0001$). *Conclusions:* Our results indicate that older age is

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weakly associated with longer LOS in the acute care unit, but older age is not correlated with THC. Therefore, age appears to be an unreliable proxy to estimate healthcare costs related to acute spine trauma care.

K-04

MRI as a tool to predict outcome in spinal cord injury - a systematic review of the literature.

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

Background: Traumatic spinal cord injury is a devastating problem both at the level of individual patients and at the level of society. MRI has played a pivotal role in both diagnosis and careful selection of treatment paradigms but has had limited role in predicting prognosis. *Methods:* A search of the literature for articles published from 1950 through present was performed using the U.S. National Library of Medicine. Both human and animal studies were included in the search strategy. All languages were included. 3005 results were returned. 255 publications were chosen by the authors that provided information on either traumatic or degenerative spinal cord lesions and provided data that linked MRI characteristics to prognosis. *Results:* We provide a systematic review of how MRI has been used to predict prognosis in spinal cord injury to date. 53 human studies are analyzed by the criteria of Downs and Black and conclusions are drawn with regard as to how this information is useful for assessing spinal cord injury and predicting prognosis. 7 animal studies are also reviewed. Spinal cord hemorrhage is consistently associated with poor neurological recovery. Spinal cord edema is associated with a more favourable neurological recovery. *Conclusions:* Conventional MRI has limited ability to predict prognosis. One of the most important aspects of spinal cord injury that has not been studied is the objective assessment of neuronal function after spinal cord injury. We propose a translational project in order to obtain and utilize fMRI data in a comprehensive assessment of spinal cord injury.

K-05

A novel construct for atlantoaxial stabilisation demonstrated in a case series

KH Au (Edmonton), R Fox (Edmonton)*

Background: Instability at the atlantoaxial junction may arise due to trauma, inflammation, degeneration, neoplasm, or congenital malformation. Rigid internal fixation techniques, including transarticular screws and C1-C2 screw and rod constructs, offer immediate stabilisation and high fusion rates, but may present technical challenges due to body habitus or to anatomic variations of vertebrae and vertebral arteries. *Methods:* Eleven patients underwent atlantoaxial stabilisation with a construct composed of C2 pars screws and a U-shaped rod contoured and secured to the C1 posterior arch. The age of the patients ranged from 4 to 68 years, and pathology included trauma (n=3), rheumatoid arthritis (n=4), degenerative arthritis (n=1), and os odontoideum (n=3). The procedure was well-tolerated, based on intra-operative electrophysiological monitoring and post-operative clinical assessments. *Results:* A follow-up period of 13 to 22 months has demonstrated bony fusion and operative segment stability on dynamic radiography. *Conclusions:* This case series demonstrates that a C2 pars screw - C1 contoured rod construct is a safe and simple method of atlantoaxial fixation.

K-06

Minimally Invasive Surgery for lumbar spondylolisthesis

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

Introduction: Minimally Invasive Surgery (MIS) is becoming an increasingly popular alternative to conventional open spine surgical procedures. Increasingly complex pathologies can now be managed by MIS techniques. We describe our experience with MIS techniques (transforaminal lumbar interbody fusion (TLIF) and percutaneous pedicle screw fixation for lumbar degenerative spondylolisthesis. *Methods:* Patients undergoing MIS decompression and fusion for degenerative lumbar spondylolisthesis and stenosis were prospectively entered into a data base. Demographic, intraoperative, and pre- and post-operative outcomes were collected (SF36, VAS, and Oswestry Disability Scores). *Results:* Thirty four patients underwent a planned MIS procedure. Mean age was 51.9 years. The most common diagnosis was Grade I spondylolisthesis/stenosis. In 4 patients the procedure was modified due to technical difficulties, resulting in a hybrid MIS/open procedure. Mean surgical blood loss was 115cc, total OR time 3.5h, postoperative VAS scores 4.2, and hospital stay 2.3 days; all significantly less compared to a historical cohort of patients undergoing conventional open surgery. There was a trend towards reduced postoperative narcotic requirement in the MIS group. One patient had persistent sciatica after surgery. There were no instrumentation-related complications. *Conclusions:* MIS decompression and fusion for degenerative lumbar spondylolisthesis and stenosis is an attractive alternative to conventional open surgery with the advantages of reduced OR time, blood loss, postoperative morbidity.

K-07

The Effect of Body Habitus on Perioperative Complications during Lumbar Spine Fusion

MF Shamji (Ottawa), S Parker (Durham), C Cook (Durham), R Pietrobon (Durham), C Brown (Durham), RE Isaacs (Durham)*

Introduction: Lumbar spine fusion is a common procedure performed across a broad range of patients. Current North American population trends are toward obese body habitus, but no large-scale study has determined the effect of body habitus on the perioperative course of lumbar spine fusion patients. The value of such information is to guide patient selection and to confirm operative safety. *Methods:* Data for 244,170 patients undergoing lumbar spine fusion between 1988 and 2004 was collected from the Nationwide Inpatient Sample database. Multivariate logistic regression tested the incidences of postoperative complications, duration of hospitalization, resource utilization, and discharge disposition for subjects grouped by surgical approach (anterior, lateral, posterior) and body habitus (normal, obese, morbidly obese). *Results:* Perioperative morbidity sustained by lumbar spine fusion patients was observed to depend on body habitus. Substantial demographic heterogeneity was seen between body habitus levels, though multivariate regression revealed higher BMI to associate with more transfusions and greater likelihood of requiring assisted living after operation ($\alpha = 0.05$). Furthermore, morbidly obese patients undergoing posterior surgery sustained more frequent wound complications and postoperative infections ($p < 0.001$). Body habitus groups had equivalent mortality, length of stay, and other perioperative complications. *Conclusions:* Greater BMI was found

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to expose patients to risks of more frequent transfusions and also higher likelihood of requiring assistance at discharge. This may help guide patient selection and surgical strategy, but the equivalent mortality, length of stay, and other complication rates suggests the obese patient to remain a safe surgical candidate.

K-08

Evaluation of cervical spine surgery information available on the internet for English speaking patients

AG Weil (Montréal), MW Bojanowski (Montréal), T Gustin (Yvoir), J Jamart (Yvoir), M Lévêque (Marseille)*

Background: The internet has become an important resource for patients and provides information that often leads them to make decisions concerning disease management. Little is known about the type and quality of medical information. The purpose of this study was to evaluate the quality of these sites based on their accessibility, comprehensibility and accuracy. *Methods:* Six keywords, representing the array of cervical procedures, were entered into 2 different search engines. For each keyword, the first 50 websites were reviewed using the DISCERN tool. *Results:* Of a total of 5,098,500 evaluable websites, 553 were visited. Of these websites, 97 (18%) were evaluated for quality and comprehensiveness by two independent neurosurgeons. Websites were destined to the general public (93%) and medical professionals (7%). Websites were authored by a variety of affiliations: 44% private clinic, 19% academic centers, 1% professional associations, 8% commercial sites, and 7% goods company. According to our scoring system, 34% of websites were found to be above average, 15% were average, and 48% were poor or worse. Websites were more likely to be of higher quality if they had higher ranks on Yahoo ($p<0.043$), had a higher number of entering links ($p< 0.01$), were recently updated ($p <0.001$), or were affiliated with a professional association ($p<0.001$). *Conclusion:* Searching for medical information on the internet is time consuming and often disappointing. Neurosurgeons must be aware of the content on the internet available to patients and efforts must be made, particularly by professional societies, to address this issue.

K-09

In-Vivo Kinematic Comparison of ProDisc-C, Prestige LP and Bryan Cervical Disc

*I Kowalczyk (London), D Rabin (London), N Duggal (London)**

Introduction: This retrospective, in-vivo study examines the kinematic parameters following cervical arthroplasty with three differing cervical disc replacements. *Methods:* Patients underwent disc replacement with the ProDisc-C, Prestige LP or Bryan cervical disc (n=15 per group). Kinematic parameters examined included range of motion (ROM), anterior disc height (ADH), posterior disc height (PDH), center of rotation in the X and Y directions (COR X and COR Y, respectively) and functional spinal unit (FSU) angle. *Results:* Post-operatively the ROM increased in ProDisc-C group by 4.7 degrees ($p=0.0002$) and the Prestige LP by 3.2 degrees ($p=0.03$). There was no significant change in ROM for the Bryan group. The ADH and PDH increased in the Prodisc-C group (3.0 to 6.1 mm, $p<0.0001$ and 2.9 to 4.8 mm, $p<0.0001$, respectively) and Prestige LP group (3.69 to 4.59 mm, $p=0.01$ and 3.09 to 3.74 mm, $p=0.002$, respectively). The Bryan group demonstrated a 0.82 mm ($p=0.003$) decrease in ADH and a 1.27 mm ($p=0.03$) decrease in PDH. The ProDisc-C and Bryan groups had a small, but significant shift in COR X values, whereas there was no significant change in the Prestige group. All groups demonstrated a small decrease in COR Y values. The FSU angle significantly increased from -2.68 to 1.81 degrees ($p<0.0001$) in the ProDisc-C group and decreased from 1.78 to -3.10 degrees ($p=0.05$) in the Bryan group. *Conclusion:* Different cervical disc replacements designs have varying degrees of impact on postoperative kinematics. This is the first comparative study highlighting the in-vivo kinematic differences.

K-10

Effect of a Novel Chinese Formula XGS-1 on 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 condition that leaves patients with a lifelong burden of debilitating disease. Currently, there are no widely accepted pharmacological interventions for the treatment of acute TSCI. XGS-1 is a novel Chinese herbal formula that has been used anecdotally in the treatment of TSCI. In this pilot study, we undertook the first systematic scientific evaluation of this compound. *Method:* Spinal cord injury was performed using the rat spinal cord coverslip forcep compression model (n=12). Daily gatrogavage of XGS-1 were given 24 hours after injury. Locomotor behaviour was assessed using the Open Field Walking Test (OFWT) scored on the Bass-Beattie-Bresnahan Scale (BBB). At the end of the observation period, spinal cord tissue was submitted for gross histology to assess lesion volume. Additional tissues were sent for immunohistochemical analysis and microarray analysis. *Results:* Animals treated with XGS-1 demonstrates smaller lesion volumes and reduced caspase 3-positive apoptotic cell deaths. Targeted staining demonstrates reduced fibrinogen and RhoA expression in the treatment group. Behaviour testing shows greater open field walking test (OFWT) scores in XGS-1 treatment animals (17.5) compared to vehicle treated controls (14.1). *Discussion:* Our results suggest that XGS-1 can be effective in improving functional recovery in rats after TSCI, by reducing the amount of injured tissue and by attenuating apoptosis. Furthermore, preliminary microarray analysis suggests that XGS-1 modulates multiple pathways in the inflammatory, excitotoxic and neuroregenerative cascades. XGS-1 may hold promise as treatment for patients with TSCI.

Stroke/Cerebrovascular Surgery II

L-01

Clinical Presentation and Management of Temporal Lobe Arteriovenous Malformations

M Labib (London), D Pelz (London), SP Lownie (London)*

Background: The authors investigate the clinical presentation and management strategies of temporal lobe AVMs with attention to seizure outcome and visual field defects. *Methods:* Between 1992 and 2008, twenty-eight patients with temporal lobe AVMs were treated at our Centre. Data were retrospectively reviewed. *Results:* The mean age was 34 years. The mean follow-up period was 28.4 months (range, 0.25-168). Sixteen patients presented with

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intracranial hemorrhage, 9 with seizures and 3 with headaches. Preoperatively, 17 patients had excellent, 4 had good, and 7 had poor clinical grades. There were 3 large, 9 medium, and 16 small AVMs. Successful preoperative embolization was achieved in 9 patients after one session, in 3 patients after 2 sessions, and in 2 patients after 3 sessions. All patients were treated surgically; 5 patients received "staged" procedures. In one patient, microsurgery was preceded by radiosurgery. Complete AVM excision was achieved in all patients. Sixteen patients had excellent and 12 had good outcomes. All patients who presented with seizures had good seizure control on weaning doses of antiepileptic drugs postoperatively. Thirteen patients had full visual fields pre-and postoperatively, 4 patients developed new field deficits, 1 patient had complete resolution of her preoperative deficit, and 3 patients had persistent deficits. *Conclusions:* AVMs of the temporal lobe can be completely excised with acceptable visual field outcomes. In patients with unruptured AVMs who present with seizures, surgical and endovascular management will eliminate the risk of hemorrhage. Treatment may not completely eradicate the seizure disorder but did provide better control of seizures.

L-02

tPA effect: does gender matter?

N Shobha (Calgary), MD Hill (Calgary), J Fang (Toronto)*

Introduction: Stroke thrombolysis is known to have a differential effect by sex. We sought to examine the relationship between gender and outcome after thrombolysis. *Methods:* This is a retrospective cohort study of stroke patients from the Registry of Canadian Stroke Network phase 1 (June 2001-February 2002) and phase 2 (June 2002-December 2002). Variables including demographics, history, clinical data, process measures, and outcome were analyzed. The primary outcomes were the Stroke Impact Scale-16 score (SIS-16) and mortality at 6 months. We compared the outcomes of the thrombolysed and non-thrombolysed cohorts and examined the data for a tPA-by-sex interaction on the two primary outcomes. *Results:* The overall proportion of patients who achieved an excellent outcome (SIS16 > 75) was not different by gender. However, the proportion of patients achieving an excellent outcome in the non-tPA cohort was much greater in males with an absolute risk difference of 11.8%. A multiplicative treatment by sex interaction was evident (p=0.054). Significant differences were found in tPA treated patients between the two genders (Female vs Male) with regards to - hyperlipidemia (27.1%, 41.2%), hematocrit (129.10 ± 13.40 , 141.22 ± 16.34) and blood glucose levels (6.90 ± 2.16, 7.79 ± 3.45). *Conclusions:* Women fared poorly compared to men in the placebo groups but this negative prognostic sex effect was neutralized by tPA.

L-03

Small intracerebral hemorrhages are are unlikely to expand and do not seem appropriate for ICH hemostatic treatment trials.

D Dowlatshahi (Calgary), EE Smith (Calgary), ML Flaherty (Cincinnati), M Ali (Glasgow), P Lyden (San Diego), AM Demchuk (Calgary)*

Hematoma expansion following intracerebral hemorrhage (ICH) is an important target for therapeutic intervention. Recent studies suggest that smaller baseline ICH volumes are associated with less hematoma expansion and better clinical outcomes. We hypothesized that hematomas with baseline volumes <10ml are less likely to expand, or be associated with early clinical deterioration. Data from patients with acute ICH were obtained from the Virtual International Stroke Trials Archive; subjects were imaged within 6 hours. Primary outcome was significant hematoma expansion over 72 hours, based upon three common definitions (6ml or 12.5ml growth, and 33% growth). Secondary outcomes were early neurological worsening (ENW: NIHSS change ≥4 points at 24 hours), 90-day survival, and good outcome (90-day mRS<3). Logistic regression was used to assess the effect of small baseline hematoma volume, defined a priori as <10ml. Our cohort comprised 496 patients; 36% had small baseline hematomas. Small hematomas showed less absolute expansion, defined by either 6ml growth (OR 0.2, p<0.001), or 12.5ml growth (OR 0.1, p=0.005). Using these definitions, no hematoma under 5.5ml expanded, and only 2.6% had ENW. By contrast, small hematomas had a similar risk of expanding by ≥33% (OR 0.7, p=0.32). Patients with small hematomas were more likely to survive at 90-days (OR 3.4, p=0.02) with good clinical outcome (OR 2.6, p<0.001) and a trend towards less ENW (OR 0.4, p=0.06). Patients with baseline ICH volumes<10ml are less likely to experience significant hematoma growth. Hematomas under 5.5ml may represent a particularly benign population with minimal risk of ICH growth and ENW.

L-04

Clinical and angiographic outcomes following surgical or endovascular therapy of very large and giant intracranial aneurysms

TE Darsaut (Palo Alto), NM Darsaut (Palo Alto), MP Marks (Stanford), GK Steinberg (Stanford)*

Background: The optimal management of very large (>20 mm) and giant (>25 mm) intracranial aneurysms remains unknown. *Methods:* The authors retrospectively identified 205 aneurysms measuring 20 mm or greater treated at Stanford Hospital between 1983 and 2008. Clinical data including patient age, presentation, and baseline modified Rankin Score (mRS) were recorded, along with aneurysm size, location and morphology. Type of treatment and treatment method were recorded, and clinical outcomes were measured using mRS at discharge and final follow-up. Angiographic outcomes were recorded. *Results:* 121 aneurysms were treated surgically, and 61 were treated by endovascular methods alone. Eleven aneurysms were treated with combination therapy, while 12 were followed conservatively. The mean mRS score at final follow-up (mean 5.2 years) was 2.23 for surgically treated aneurysms, compared to 2.98 for endovascularly treated aneurysms. Univariate and multivariate statistical analyses are pending. *Conclusions:* Preliminary results suggest that patients with very large and giant aneurysms treated with endovascular methods fared worse at final follow-up compared to surgically treated patients. Factors related to these outcomes will be better defined following statistical analysis.

L-05

Conventional Neurophysiologic Monitoring Is Unnecessary For Carotid Endarterectomy Under General Anesthesia.

*IG Fleetwood (Halifax)**

Background: The GALA trial showed outcome following carotid endarterectomy (CEA) under general anesthesia (GA) or locoregional anesthesia (LA) was the same. Conventional neurophysiologic monitoring (including EEG, SSEP, TCD and

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cerebral oximetry) are often used to make decisions regarding shunting for CEA under GA. Clinical examination is used when CEA is performed under LA. *Methods:* A series of 226 consecutive CEA's performed over seven years in the absence of conventional monitoring was reviewed for shunting criteria and clinical outcome. *Results:* All but one procedure were performed under GA. All GA patients were given neural suppressants prior to clamping to induce burst suppression on an anesthesia bispectral index monitor. A shunt was used in four patients (1.8%). Decision to shunt in GA patients was based on pre-operative anatomic review or intra-operative challenge testing as well as qualitative assessment of collateral flow. Mean clamp time was 41.6 minutes. Five patients had strokes (2.2%) and all appeared thrombo-embolic on DWI MRI (not secondary to hemispheric hypoperfusion). *Conclusions:* Routine use of conventional neurophysiologic monitoring and routine shunting are unnecessary during CEA under GA. Patient-specific anatomic factors best predict the need to shunt. Cerebral infarction during CEA is likely related to thrombo-embolism rather than cerebral hypoperfusion.

L-06

Red blood cell transfusion increases cerebral oxygen delivery in anemic patients after subarachnoid hemorrhage

R Dhar (St. Louis), AR Zazulia (St. Louis), TO Videen (St. Louis), CP Derdeyn (St. Louis), MN Diringer (St. Louis)*

Background: Anemia is common after subarachnoid hemorrhage (SAH) and may exacerbate the reduction in cerebral blood flow (CBF) and oxygen delivery (DO2) that underlies delayed cerebral ischemia. The association between lower Hb and worse outcome , including an increased rate of cerebral infarction, suggests a role for transfusion in anemic patients. However, there remains uncertainty regarding the net cerebral response to transfusion, as higher Hb may increase viscosity and impair CBF. *Methods:* Eight patients with aneurysmal SAH and anemia (Hb<10g/dl) were studied with PET before and after transfusion of a single unit of RBCs. We measured global and regional CBF, oxygen extraction fraction (OEF), and oxidative metabolism (CMRO2), and calculated DO2 from CBF and arterial oxygen content (CaO2). *Results:* Transfusion resulted in the expected rise in Hb (8.7±0.8 to 9.9±0.9 g/dl) and CaO2 (11.8±1.0 to 13.6±1.1 ml/dL, p<0.001). Global CBF remained unchanged (40.4±8 to 41.6±10), resulting in a 20% rise in DO2 from 4.8±1.1 to 5.7±1.4 (p=0.005). This increase in DO2 was associated with a drop in OEF from 0.49±0.11 to 0.41±0.11 (p=0.06), with a stable CMRO2 (2.23±0.6 to 2.19±0.4). Rise in DO2 was greater in regions with oligemia (low DO2 & high OEF) but was attenuated within territories exhibiting angiographic vasospasm. *Conclusions:* Transfusion of RBCs to anemic patients with SAH resulted in stable CBF and a significant rise in cerebral oxygen delivery. Although no increase in oxygen utilization was detected, increased DO2 led to reduced OEF, which may translate into improved tolerance to further impairments of CBF within vulnerable brain regions.

L-07

Prediction of re-canalization risk after endovascular treatment of intracranial aneurysms using real-time, intra-operative determination of initial volume occlusion percentages

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Background: Real-time, intra-operative tools for minimizing future aneurysm re-canalization may prove useful during endovascular treatment of intracranial aneurysms. This study aims to identify a volume occlusion percentage threshold above which aneurysm re-canalization is significantly reduced. *Methods:* A retrospective analysis of 207 aneurysms treated by endovascular coiling in 191 patients between 2002 and 2008 was conducted. Initial volume occlusion percentages were calculated using an online calculator (Angiocalc©, Hanley et al.) that incorporates aneurysm size, shape, and coil characteristics. Re-canalization was defined as any angiographic increased filling from baseline and stratified into minor or major re-canalization. *Results:* 146(70.5%) ruptured and 61(29.5%) unruptured aneurysms were reviewed with a mean (± standard deviation) follow up of 18±13 months, size of 7.7±3.9mm, age of 53±11, and initial occlusion percentage of 27±10% (median 25%). Re-canalization occurred in 49(23.7%) of 207 coiled aneurysms. Initial volume occlusion less than 25% was a significant predictor of any re-canalization in univariate analysis odds ratio (OR) 2.73 [95% confidence interval (CI) 1.39,6.89], p = 0.003 and of major re-canalization in univariate analysis OR 4.10 [95% CI 1.30,12.92], p = 0.01. Similarly, adjusted multivariate analysis was significant for initial occlusion less than 25% predicting any re-canalization OR 2.35 [95% CI 1.15,4.81]. *Conclusion:* This study suggests an initial volume occlusion threshold of <25% to be significantly associated with aneurysm re-canalization. Using real-time, intra-operative tools such as Angiocalc© for calculating this volume occlusion percentage, clinicians may be able to reduce the risk of aneurysm re-canalization following endovascular treatment by striving for >25% volume occlusion at the time of treatment.

L-08

A Novel Tissue Engineering Approach Using Endothelial Progenitor Cell-Seeded Biopolymer to Treat Intracranial Saccular Aneurysms

AP Mitha (Calgary), JP Aronson (Boston), CS Ogilvy (Boston)*

Background: Recurrence after coiling of intracranial aneurysms is reported in up to 42% of small aneurysms. Studies suggest the problem underlying aneurysm recanalization is lack of endothelialization across the ostium. This project uses a novel tissue engineering approach to promote endothelialization by seeding endothelial progenitor cells (EPCs) within a fibrin polymer injected endovascularly into the aneurysm. *Materials and Methods:* Aneurysms were created in New Zealand White rabbits using the modified elastase method. Following angiographic confirmation of aneurysm formation, rabbits were left untreated (N=3), or microcatheterization was performed and aneurysms treated with platinum coils (N=3), fibrin biopolymer alone (N=3), or fibrin combined with autologous cultured EPCs (N=4). Efficacy of aneurysm occlusion was assessed angiographically and histologically at 2, 6, 12, and 16-week time points. *Results:* No coil- or EPC-treated aneurysm recurred or recanalized angiographically.

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At the longest time points used in these studies, coiled aneurysms had loose connective tissue at the neck with only partial neointima formation, while EPC-treated aneurysms had thick neointima with an endothelial cell monolayer across the ostium. *Conclusions:* Endovascular treatment of intracranial aneurysms using a tissue engineered autologous EPC-seeded fibrin biopolymer promotes early endothelialization and neointima formation at the aneurysm neck. This novel treatment method may address reasons for the limited durability of standard coil embolization and provides further avenues for the development of improved devices for the care of patients with aneurysms.

L-09

Angiographic Vasospasm is Associated with Cerebral Infarction

*R Macdonald (Toronto)**

Background: It has long been accepted that angiographic vasospasm causes cerebral infarction afer subarachnoid hemorrhage (SAH). On the other hand, recent clinical trials cast doubt on this relationship because preventing vasospasm did not improve clinical outcome. *Methods:* We tested the hypothesis that angiographic vasospasm is associated with cerebral infarction using 413 patients randomized into the CONSCIOUS-1 trial. Patients were treated with placebo or clazosentan in one of 3 doses, which decreased vasospasm overall. Angiographic vasospasm was assessed by central, blinded adjudicated, quantitative assessment (2 reviewers) of catheter angiography at baseline and 7-11 days after SAH. Cerebral infarction was assessed by blinded, central review (2 reviewers, not adjudicated) and categorized as secondary to vasospasm, other causes or unknown. *Results:* Angiographic vasospasm was classified as none/mild in 204 (56%), moderate in 111 (30%) and severe in 51 (14%) of 366 patients with evaluable images. According to one reviewer, infarction due to vasospasm or unknown causes was present in 43 (12%) patients. Infarction was significantly associated with vasospasm ($p < 0.001$). Infarction due to vasospasm or unknown cause was present in 7 of 204 (3%) patients with no/mild, 11 of 111 (10%) with moderate and 25 of 51 (49%) with severe vasospasm. Results from the other reviewer were similar. *Conclusions:* These results show a substantial relationship between cerebral infarction and vasospasm. It seems likely that vasospasm contributes to poor outcome unless one assumes infarction is not detrimental or there is another process highly correlated with angiographic vasospasm but not amenable to treatments that decrease angiographic vasospasm.

L-10

Combination antithrombotic therapy limits MES (Microembolic Signals) in acute stroke patients with symptomatic carotid disease

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Backround: CARESS trial showed double antiplatelet therapy with aspirin and clopidogrel more effective than aspirin alone reducing asymptomatic embolization in patients with symptomatic carotid disease within 1 month of symptoms. However, knowledge about effects of different acute antithrombotic treatments in this population is limited. We evaluate heparin and antiplatelets reducing MES count in the ER. *Methods:* 87 TIA/stroke patients with symptomatic carotid disease received treatment according to attending physician decision and prospectively enrolled into the TASC study within 48 h after symptoms onset. TCD MES count was performed at baseline, and those with positive results were screened 24 hours later. Clinical outcome at 90 days was collected. *Results:* 25 patients (28.7%) had MES. Total count was 243 (mean 10.1±13.2). Only 13.1% had persistent MES on follow up. The heparin+antiplatelet group had a baseline count of 12.8±15.1, reduced at follow-up to 0.6±1.3. The dual ASA+clopidogrel group had 16±18.7, that disappeared at follow-up. The ASA alone group had 4.2 ±5.2 with a follow-up of 3.7±3.8. Reduction in the MES count at follow-up was significantly higher with heparin+antiplatelet(s) compared to ASA alone ($p=0.008$), but there were no difference between the groups with two or more antithrombotics used. Recurrent events rate was 8.6% at 90 days, higher in the MES positive than in the MES negative group (22% to 0% $p=0.015$). *Conclusion:* Combinated antithrombotic therapy, heparin+antiplatelet(s), is more effective than aspirin alone reducing MES count in this population.

NEURO-ONCOLOGY

M-01

MRI Volumetric Extent of Contrast Enhancement and Resection in Oligodendroglial Tumors

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Introduction: MRI enhancement in oligodendrogliomas portends poorer prognosis, but the impact of the initial volume-and subsequent surgical removal-of enhancing tissue is unknown. We assessed the prognostic significance of preoperative and residual postoperative enhancing tumor volume in oligodendrogliomas. We also assessed the relationship between enhancement and loss of heterozygosity (LOH) of chromosomes 1p/19q, known to confer chemo- and radio-sensitivity to these tumors. *Material and Methods:* We analyzed the pre-operative and initial post-operative T1-contrast-MRIs of 100 consecutive oligodendroglioma patients. Sixty-three had enhancing tumors. Preoperative enhancement and residual post-surgical enhancement volumes were measured by a single blinded observer. Multivariate analysis was used to assess influence of contrast enhancement at diagnosis, and volume of pre- and post-operative contrast enhancing tumor tissue, on time-to-relapse (TTR) and overall survival (OS), while controlling for confounding clinical/treatment factors. *Results:* Presence of contrast enhancement at diagnosis was not correlated with TTR, OS, or LOH 1p19q. In enhancing tumors, greater initial enhancing tissue volume correlated with shortened TTR ($p=0.0002$). Reduced post-operative residual enhancing volume and greater resection of enhancing tissue correlated with longer OS ($p=0.0002$ and 0.0076 respectively). In a subgroup analysis, patients in whom 100% of enhancing tumor was resected had dramatically longer TTR (174 vs. 64 weeks) and OS (392 vs. 135 weeks) than those with incomplete resection. Interestingly, 90-99% or even 95-99% resection of enhancing tissue did not improve prognosis. *Conclusions:* Among oligo-dendrogliomas enhancing on MRI, completely resecting enhancing

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tissue independently improves outcome. This finding may impact the goals of surgical planning in these tumors.

M-02

Purely Endoscopic versus Endoscopic Assisted Approaches to Sellar Tumours: A Cost Analysis

J Khetani (Hamilton), SM Banglawala (Hamilton), D Sommer (Hamilton), K Reddy (Hamilton)*

Objective: Advancing technology and expertise in the purely endoscopic management of sellar tumours has demonstrated improvements in morbidity and effectiveness when compared to traditional endoscopic-assisted approaches. However, in a health care system with limited resources, an economic analysis is warranted to help integrate any novel surgical approach. This study will attempt to demonstrate the direct cost comparison between these two surgical strategies. *Methods:* Retrospective case series of 40 consecutive transphenoidal surgeries; the first 20 patients undergoing an endoscopic-assisted approach and the next 20 using a purely endoscopic approach at a tertiary care center. *Results:* The demographics were similar between both cohorts. Patients in the purely endoscopic group had a shorter mean operative time and fewer cases of residual tumor compared to patients in the endoscopic assisted cohort. Length of hospital stay in the purely endoscopic category was significantly shorter than in the endoscopic assisted group. Direct costs were slightly less in the purely endoscopic group. *Conclusions:* Purely endoscopic surgery for sellar tumors have been demonstrated to decrease operative time, reduce complications, improve tumor resection and decrease hospital stay when compared to traditional endoscopic-assisted approaches. This study now provides evidence that purely endoscopic surgery also has a reduced direct cost.

M-03

Glioblastome multiforme (GBM) sensitivity to temozolomide (TMZ) in an ex vivo invasion assay correlates to an increase in patient survival time

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Background: GBM tumour progression is dependent on the tumour's ability to invade and grow into surrounding tissue. GBM surgical samples were assessed while exposed to a panel of clinically relevant chemotherapies including TMZ using an ex vivo invasion and growth model. The invasion and growth of representative tumour tissue fragments are hypothesized to be reflective of clinical response to therapy. GBM patients in this study went on to receive TMZ post-operatively. *Methods:* Tissue specimens placed into a collagen matrix were monitored for invasion in the presence of chemotherapies for 5 days post-surgery. All samples were preserved for further examination of tumour growth, invasion and viability. Patient outcomes were measured form the OR / assay date onward. *Results:* 128 CNS patient tumours were assessed, of which 58 were GBMs. Each patient's tumour displayed a unique invasion and response profile. Here we report a significant correlation between a TMZ invasion inhibition of 20% or greater to GBM patient outcome. Mean survival time for GBM patient's whose tumours were not significantly sensitive to TMZ in the invasion assay was 181.7 ± 43 days. GBM patients mean survival for invasion assay responders to TMZ was 290 ± 33 days. Results will continue to be compared to patient response, time to recurrence and survival up to 2 years. *Conclusions:* Individual response to chemotherapy is highly variable both clinically and in our ex vivo assessment. Pre-screening responsiveness to chemotherapies could lead to more individualized and more effective treatment of brain tumours.

M-04

Proliferation of Human Glioblastoma Stem Cells Occurs Independently of Exogenous Mitogens

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Glioblastoma multiforme (GBM) is an aggressive, primary tumor of the central nervous system with a dismal prognosis. Despite identification and isolation of human brain tumor stem cells (BTSCs), characteristics that distinguish BTSCs from neural stem cells remain to be elucidated. We employed a neural stem cell culture technique, the neurosphere assay, to culture cells isolated from GBMs in order to understand their growth requirements. Both CD133+ and CD133- adult GBM BTSCs proliferated in the absence of exogenous mitogenic stimulation and gave rise to multipotent GBM spheres. GBM spheres were capable of self-renewal with retention of multipotency. Epidermal growth factor (EGF) and fibroblast growth factor-2 enhanced GBM BTSC survival, proliferation and subsequent sphere size. Exogenous mitogen independent GBM sphere growth was reduced by blockade of EGF receptor (EGFR) signalling. Intracranial implantation, of as few as 10 exogenous mitogen independent GBM BTSCs, into immunocompromised mice led to the formation of highly invasive intraaxial tumors which closely resembled human GBMs. These results demonstrate that exogenous mitogen independent growth of GBM BTSCs, mediated in part through EGFR signaling, is one characteristic that distinguishes both CD133+ and CD133- GBM BTSCs from neural stem cells. This novel experimental system will permit the elucidation of additional constitutively activated mechanisms that promote GBM BTSC survival, self-renewal and proliferation.

M-05

Binasal Endoscopic Transphenoidal Resection of Giant Pituitary Tumors: Surgical Outcomes and Comparison with Craniotomy and Microscopic Transphenoidal Cases

P Kan (Toronto), M Cusimano (Toronto)**

Background: Giant pituitary tumors (GPT) are formidable lesions and surgical resection is often performed via a craniotomy. Since 1993, we began treating pituitary tumors through a purely binasal endoscopic transphenoidal (BETS) approach. The goals of our study were to evaluate the outcomes of patients with GPT who underwent a purely binasal endoscopic transphenoidal resection and compare with outcomes achieved through craniotomy and microscopic transphenoidal approaches with tumours of comparable size. *Methods:* Sixty-six consecutive patients with GPT (all greater than 10 cm^3 in volume; mean maximal diameter was 4.0 cm) who were treated surgically at a single institution (26 BETS, 29 craniotomy, 11 microscopic transphenoidal) were reviewed for clinical outcomes, degree of tumor resection, recurrence rates, and surgical

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complications. The results between the 3 approaches were compared using chi-square and ANOVA analyses. *Results:* The BETS group had significantly better mean tumor volume reduction (90%) than craniotomy (65%) and the microscopic group (70%), p=0.000. Gross total resection rates were also best in the BETS patients. Eighty-five percent of patients with BETS were recurrence free at last follow-up as compared to 69% in the craniotomy group and 82% in the microscopic group. The median length-of-stay (4 days) for BETS was shorter, and surgical complications were rare compared to the craniotomy group (p=0.02) and similar to those for the microscopic group. *Conclusions:* BETS for GPT offers excellent oncologic and clinical outcomes and can frequently obviate the need for craniotomy in these patients.

M-06

Chordoid Glioma: Diagnosis by Imaging

AD Tu (Vancouver), T Yeo (Edmonton), L Resch (Edmonton), D Steinke (Edmonton), V Mehta (Edmonton)*

Background: Chordoid Gliomas are a recently described clinicopathologic entity. These tumors are generally benign with complete cure possible by gross total resection. Its location in the third ventricle however, portends to difficult surgical approaches with considerable risks for post-operative morbidity. Tissue biopsies for diagnosis are similarly challenging, making determination of appropriate treatment difficult. This lesion however, has demonstrated consistent pathognomonic features that allow for a confident diagnosis by imaging. *Method:* Case report and literature review. *Results:* Here we describe a case of asymptomatic chordoid glioma that was diagnosed by imaging and confirmed later surgically. We also review the clinical, pathologic, and radiographic features of this case. *Conclusion:* The stereotypic topography and imaging characteristics of this tumor allow for the potential diagnosis of this lesion solely by radiography. By forgoing traditional analytic methods requiring tissue biopsy, the patient is spared substantial potential morbidity. Given the promising response to radiation based treatments, this lesion may one day become a primarily non-surgically managed condition.

M-07

Trends in survival of patients with glioblastoma multiforme(GBM): Surveillance, Epidemiology, and End Results (SEER) Program 1973-2005

CD Harraher (Halifax), A Norden (Boston), E Claus (Boston)*

Background: Previous studies suggest White and married patients with GBM have increased survival. This study analyzes survival by race and sex in patients with GBM using recent population-based data. *Methods:* The Surveillance, Epidemiology, and End Results (SEER) Registry, 1973-2005 was used and 17663 patients with GBM (ICD-O 9440) were analyzed. Chi-square tests determined statistical significance of prognostic factors by race and sex. Kaplan-Meier methodology estimated crude survival by race and by sex. Differences in survival by each prognostic variables were calculated using Cox proportional hazards models. *Results:* Crude survival of patients with GBM is 13.80 months with 50% of patients alive at 7 months. Survival in male patients(log rank p=0.0006) and Black patients(log rank p=0.0351)was increased. Univariate models demonstrate female patients had 5% increased hazard of death(HR: 1.05) compared to men. Single patients had 9% increased hazard of death compared to married patients(HR:1.09). A GBM diagnosis in 1974(HR: 1.25) had an increased hazard of death compared to 2004(HR: 0.94). The multivariate model demonstrated that every year increase in age of diagnosis increased the hazard of death by 3%(HR: 1.03). Radiation treatment(HR: 0.48), any surgical treatment(HR: 0.74), being married(HR: 0.95) and undergoing total surgical resection(HR: 0.79) significantly decreased the hazard of death from GBM. Race, tumor location, partial surgical resection and year of diagnosis were not significant predictors of survival. *Conclusions:* Race does not appear to affect survival in patients with GBM after adjusting for prognostic variables. Married patients who undergo total surgical resection and radiation have significantly increased survival.

M-08

Diagnostic Tractography Features of Intradural, Intramedullary Spinal Tumors

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Diagnosis of intramedullary spinal cord tumors is limited with conventional magnetic resonance imaging (MRI) sequences. Tractography is an MRI technique that utilizes diffusion weighted images to delineate white matter tracts. We assessed tractography features in pathologically confirmed spinal cord tumors to determine if there were features that could improve diagnosis and management. Clinical status and image files of patients that underwent MRI tractography from December 2006 to January 2009 were obtained from the tractography database. Imaging was performed on a 1.5T Siemens MR Imager and the tractography protocol involved axial diffusion-weighted single-shot echo planar imaging sequence using Grappa and 12 noncollinear gradient directions. MEDINRIA version 1.7.0 and DTIStudio Version 2.02 software were used to generate the fiber tracking images. Imaging features were then correlated with pathological diagnosis. Nine patients with intramedullary spinal cord tumors were identified. In all patients, tractography images were able to be obtained and processed. We found tractography allowed improved visualization of white matter tracts within the spinal cord in relation to intramedullary tumors, compared to routine MRI. Patients with astrocytomas had fibers that were located within the region of the tumor whereas with the other tumor types, fibers were displaced by the tumor. Although larger numbers are required, MR tractography holds promise in allowing improved identification of how white matter tracts are affected by spinal cord tumors, and holds promise with respect to differentiation of astrocytomas from other intramedullary cord tumors.

M-09

Stereotactic Radiosurgery Induced Malignant Transformation of a Jugular Foramen Schwannoma

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

Background: The jugular foramen is one aperture of the basal skull that transmits nervous and vascular structures. Tumors of this vicinity comprise less than 1% of all CNS oncology. Symptoms are often related to compression of cranial nerves or brainstem structures. Malignant lesions are rare. Radiosurgery is commonly used in this area owing to the challenging surgical approach and importance of adjacent anatomy. The effectiveness of this treatment with minimal side effects has been well documented. *Method:* Case

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report and literature review. *Results:* Here we describe a case of stereotactic radiosurgery for benign jugular foramen schwannoma that developed malignant recurrence 8.5 years later. We also review the clinical, pathologic and radiographic features of this case. *Conclusion:* This report is the first description of a jugular foramen schwannoma undergoing malignant degeneration after radiation therapy, as well as one of the few cases of malignant recurrence post radiosurgery. Given the rarity of subsequent malignancy, the actual risk to patients appears to remain low. Regardless, this case raises questions including whether radiosurgery is as universally safe and effective for all cranial nerve schwannomas as was traditionally felt, or whether some characteristic predisposes to treatment failure and even malignant degeneration.

M-10

Adjuvant Stereotactic Radiotherapy for Craniopharyngiomas: British Columbia Cancer Agency (BCCA) preliminary experience

RR Janicki (Vancouver), B Toyota (Vancouver), M Mackenzie (Vancouver)*

Background: The optimal management of craniopharyngiomas is yet to be elucidated. Maximal gross total resection (GTR) at all cost risks serious injury to the patient. Conventional fractionated radiotherapy following subtotal resection improves progression free survival. However, late radiation risks to the pituitary, visual apparatus and surrounding structures are a significant concern. Stereotactic radiotherapy (SRT) is an alternative. *Methods:* The prospectively collected database at the BCCA was interrogated to identify all patients with craniopharyngiomas treated with SRT between May 1999 and October 2007. The electronic medical record was used to obtain patient characteristics, clinical course, SRT regimen and outcomes. *Results:* 26 patients (12 males and 14 females) with a mean age of 37.6 years (9.7-78.3 years) received SRT. 73% (19/26) of the patients were ≥ 16 years. Half had undergone more that one surgical intervention. 46% suffered surgical morbidity; pituitary dysfunction occurred in 39%. A LINAC system was used to deliver 45-54 Gy over 25-30 fractions over 6 to 6.5 weeks. Clinical status at initiation of therapy varied. Mean follow-up was 47 months (7-157 months). Progression after SRT was documented in 1 patient. 12% suffered pituitary dysfunction. Transient hypersomnolence syndrome, memory impairment, seizure disorders and cystic enlargement were documented. No deaths occurred. *Conclusions:* BCCA's early experience is favorable. Tumor response/control is the norm. The rates of late toxicity are yet to be fully appreciated. Seizure and memory impairment related to SRT do occur. There has been a move to 'conservative' surgery followed by SRT in patients referred to the BCCA.

TRAUMA

N-01

Does blood alcohol concentration influence mortality, impairment and disability after acute traumatic spinal cord injury (SCI)?

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

Background: We examined whether blood alcohol concentration (BAC) affects survival, neurological and functional recovery after acute traumatic SCI. *Methods:* All patients who were enrolled in the Third National Acute SCI Study (NASCIS-3) were included. The study population was divided into: "no-alcohol", "legal" (0< BAC ≤0.08%) and "illegal" (BAC>0.08%). Outcome measures included survival, NASCIS motor and sensory scores, NASCIS pain scores, and Functional Independence Measure (FIM) at baseline and at 6 weeks, 6 months and 1 year post-SCI. Analyses were adjusted for major potential confounders: age, gender, ethnicity, trial protocol, Glasgow coma score, cause, level and extent of SCI. *Results:* There were 499 patients (423M, 76F; ages: 14-92 years, mean=35.7) who were received 24-hour methypredinosolone, 48-hour methypredisolone or 48-hour tirilazad mesylate. The mean BAC was 0.054±0.006% (range: 0-1%). The survival at 1 year (94.4%) was not associated with the BAC (p=0.374). BAC was not significantly correlated with motor recovery (p>0.166), sensory recovery (p>0.323), change in pain score (p>0.312), and functional recovery (p>0.133) at all three time points post-SCI. *Conclusions:* Despite preclinical animal work suggestion a potential deleterious effect of alcohol on neurological outcomes post-SCI, BAC at time of injury did not have a detrimental effect on the patients' mortality, impairment or disability within the first year post-SCI.

N-02

Neural Precursor Cell Transplantation Increases Trophic Factor Expression and Preserves Oligodendrocytes after Spinal Cord Injury

GW Hawryluk (Toronto), D Chew (Toronto), S Spano (Toronto), E Eftekharpour (Toronto), S Karimi (Toronto), MG Fehlings (Toronto)*

Background: To date, there is limited understanding of the interaction between transplanted cells and the host CNS. This knowledge is essential to optimize cellular therapies for spinal cord injury (SCI). *Methods:* Female Wistar rats subjected to T7 clip-compression SCI underwent transplantation of neural precursor cells (NPCs) or control 2w post-SCI. Histological analysis was conducted with H&E and LFB stains. Oligodendrocytes were stained with anti-CC1 and axons crossing the injury were labeled with fluorogold. Cell quantitation was conducted with StereoInvestigator. qPCR for trophic factor expression was performed with SYBR Green chemistry. *Results:* NPCs upregulate expression of many trophic factors following in vitro differentiation and lead to increased expression in the spinal cord 1w following transplantation (for all neurotrophins, GDNF, LIF, and FGF p<0.05). 2w following transplantation there were no differences in volume of cyst, scar, grey matter, white matter, or preserved axons in cord tissue. Preservation of endogenous oligodendrocytes near transplanted NPCs was noted relative to control sections (avg. 2464 vs.1746 cells, p=0.0096). *Conclusion:* We provide evidence that preservation

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of oligodendrocytes complements remyelination in our protocol. Upregulation of trophic factors is a possible mechanism for this.

N-03

Demographics, injury characteristics and in-hospital mortality after acute spine trauma: Experience from a specialized university-based unit in comparison with the Canadian national registry.

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

Background: This study examines demographics, injury characteristics and clinical outcomes of patients with spine trauma who have been treated in a spine trauma center. *Methods:* All patients with acute spine trauma who were admitted from 1996-2007 were included. In addition to comparisons among the 4 triennia, our 2001/2002 SCI data were compared to the National Trauma Registry (NTR) dataset. *Results:* There were 569 patients (394M, 175F; ages: 15-102 years, mean of 50). While demographic profile has been steady over the last 4 triennia, the frequency of more severe spine trauma at the lumbosacral levels due to falls has increased over time. The mean length of stay and in-hospital mortality rates has not changed over the last 12 years. Our in-hospital mortality rate (4%) was significantly lower than the provincial rate (7.5%; p=0.005). Comparisons between our SCI data and the NTR dataset showed significant differences regarding age groups. *Conclusions:* Our results indicate that changes in the injury characteristics but not demographics have occurred overtime in our institution. There were differences between our database and the NTR regarding age distribution. Our reduced in-hospital mortality rates in comparison with the provincial data reinforce the recommendations for early management of those patients in a spine trauma center.

N-04

A Cluster of Seizures after Cardiac Surgery

GB Young (London), J Granton (London), JM Murkin (London), M Chu (London)*

Background: We have observed clinically apparent seizures in our post-op cardiac surgery population at a rate of 0-1 per month over the past 5 years. However, 13 seizures occurred in a three month period in early 2008, with 7 occurring in a single month. *Methods:* We reviewed clinical records, EEGs and neuro-imaging on patients with seizures after cardiac surgery from January 1 - July 31, 2008. *Results:* The increase in seizures paralleled an increase in tranexamic acid (TA) dose from 100-259 mg/kg in place of high dose aprotinin. After a reduction in dose of TA to 30 mg/kg load and 15 mg/hour infusion, the incidence of seizures fell to 0-2 per month. Seizures occurred with a mean of 4.7 hours from the end of surgery, with one occurring intraoperatively and 1 at 24 hours. Of the 13 clustered patients EEGs showed multifocal or generalized spikes in all but 1 patient. Three patients had embolic strokes on MRI scans. Patients without strokes did well and had no further seizures. *Conclusions:* An increase in seizure frequency in post-cardiac surgery patients was associated with high dose tranexamic acid administration. Seizures were usually generalized or multifocal in nature and those without strokes did well.

N-05

Intraventricular thrombolysis and coiled aneurysms: a case-control study

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Introduction: Intraventricular hemorrhage is associated with poorer outcome in patients with aneurysmal rupture. Intraventricular thrombolysis with alteplase (rt-PA) may be effective in preventing mortality and morbidity in that population. Few reports and no published study exist about the safety of intraventricular thrombolysis in patients treated by aneurysmal coiling, since this therapy may potentially cause rebleeding. *Materials and Methods:* Between 1999 and 2008, 20 patients with coiled aneurysms and intraventricular hemorrhage had undergone intraventricular thrombolysis via an external ventricular drain (EVD). We also identified 20 control patients who had undergone EVD positioning without intraventricular thrombolysis, who were individually matched for sex, age and Hunt-Hess score. These two groups were studied for rebleeding, infection and death. Duration of external ventricular drainage, ICU length of stay and permanent ventricular shunting were also studied. *Results:* The two groups were similar for sex, age and Hunt-Hess score distributions. All aneurysms were treated by endovascular coiling. There was no significant difference in death (15% vs 10%) or infection (20% vs 15%) between the thrombolysed and non-thrombolysed groups. We identified one bleeding secondary to EVD positioning in the control group, but no rebleeding. There was no significant difference in mean EVD duration (9.30 vs 9.45 days), ICU length of stay (13.5 vs 13.1 days) or the need for permanent shunt (50% vs 45%). *Conclusion:* Intraventricular thrombolysis with rt-PA is safe in patients with coiled aneurysms. These patients should be included in prospective randomized studies powered to assess outcome impact of this therapy.

N-06

Rotational Acceleration Measurements - Evaluating Helmet Protection

M Kis (Halifax), F Saunders (Kingston), MW Ten Hove (Kingston), JR Leslie (Kingston)*

Purpose: Current helmet testing standards do not address the rotational components of an impact to the head. We describe a new testing paradigm used to measure the rotational acceleration of a headform and a protective helmet following an impact to the head in the horizontal plane. This impact simulation allows for the testing of currently available head protection devices in conditions thought to be important for the generation of cerebral concussion. The degree to which a particular helmet dampens rotational acceleration, and thus protects against concussion, can be assessed. *Methods:* Our testing device consists of a pneumatic piston that provides a measured impact to a standard headform. Four different helmets were tested using the described paradigm. *Results:* Acceleration curves for each helmet and the corresponding headform are presented. *Conclusions:* Clear differences in rotational acceleration were demonstrated. Possible avenues of further investigation are discussed.

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N-07

Hockey Helmet Rotational Acceleration Protection in Concussive Injury

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Objective: Rotational acceleration protection is not addressed in current helmet safety testing standards. Using a previously described paradigm, we test low and high cost hockey helmets from four well known manufacturers for their ability to attenuate rotational acceleration. *Methods:* Our testing apparatus consists of a pneumatic piston that delivers measured impacts to a standard headform fitted with a helmet. A total of eight helmets were tested using the described paradigm. *Results:* Percent reduction of headform acceleration comparing helmeted headform to unhelmeted baseline are presented. *Conclusion:* There was no correlation between price of hockey helmet and degree of rotational acceleration protection. We aim to assist consumers in making educated choices in purchasing hockey helmets as well as illustrate the need for revised safety standard testing.

N-08

Long-term functional outcomes following major traumatic brain injury

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Background: Patients who suffer brain trauma can have significant and long-lasting cognitive, psychosocial, physical and functional sequelae. We have prospectively enrolled patients with major head injury and report on their outcome. *Methods:* 51 patients with major head injury (GCS 3-12) were recruited. These patients were evaluated at 6, 12 and 24 months after injury, and were subjected to a clinical assessment, imaging studies and a battery of testing that included a Glasgow Outcome Scale score. *Results:* 25 follow-up visits are complete to date. 20 patients have withdrawn prior to their 24 month follow-up; 6 follow-ups are pending. 76% (19/25) of patients had a GOS of 5 at 24 months. 16% (4/25) had a GOS of 4, and 8% (2/25) had a GOS of 3. Among those patients whose GOS was less than 5 at the 6-month follow-up, 21% (3/14) showed further improvement at 1 year. Among those patients whose GOS was less than 5 at the 12-month follow-up, 45% (5/11) showed improvement at 24 months. *Conclusions:* A significant segment of this population remains unable to return to work or school, or unable to live independently in the long-term. However, important gains in functional independence can be achieved during the first two years following a major brain injury.

N-09

Lumbar subarachnoid pressure following spinal cord injury

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Background: Patients with spinal cord injury (SCI) may benefit from elevated spinal cord perfusion pressure (SCPP). *Methods:* As part of a 2X2 factorial randomized controlled trial investigating the utility of blood pressure management and matrix metalloproteinase inhibition, the present analysis describes lumbar subarachnoid pressure (LSP) in controls. Hourly values were recorded for seven days via lumbar drain. Transducers were leveled at site of injury. *Results:* 2722 hourly observations were collected on 18 patients. Mean age was 37 (range 16-69). 61% were male. Injury etiology included: MVC (72%), recreational (17%), and occupational (11%). 61% of patients suffered cervical cord injuries and 39% suffered thoracic injuries. Six patients had incomplete injuries and 12 had complete injuries. Median daily maximum lumbar subarachnoid pressure (LSP) ranged from 14 mmHg (day8) to 29 mmHg (day4). LSP was not significantly different among those with complete compared to incomplete injuries. Median daily maximum LSP was slightly higher in patients with complete injuries for the first 5 days after injury but only reached significance on day 3 (P=0.05). LSP was significantly lower in those with cervical injuries only on day 3 (-4.7 mm Hg; 95%CI: -9.1, -0.3, p=0.04). *Conclusions:* LSP is elevated following SCI. These data have implications for post-injury SCPP management.

N-10

Perioperative factors associated with prolonged unconsciousness after cardiac surgery

R Rodriguez (Ottawa), M Bussiere (Ottawa)*, HJ Nathan (Ottawa), M Bourke (Ottawa), T Mesana (Ottawa)*

Background: Delayed awakening after cardiac surgery may be the manifestation of permanent brain damage or the reversible effects caused by metabolic derangements, seizures or medications. We aimed to determine the patient characteristics and peri-operative factors associated with prolonged unconsciousness after cardiac surgery. *Methods:* Retrospective analysis of patients that remained unconscious >24 hours after cardiac surgery. *Results:* 112 of 3940 patients admitted for surgery in the last 3 years met entry criteria (only 77 patients are reported here). Stroke was diagnosed in 23, encephalopathy in 31, stroke and encephalopathy in 18 and seizures in 5 patients. Eight patients never regained consciousness (time to death: 11±10 days). Eighteen of the 69 patients that recovered consciousness (time from surgery: 6±5 days) had a second period of unconsciousness and 15 died. Factors associated with prolonged unconsciousness were elevated creatinine (p=0.001), low hemoglobin (p=0.021) and platelet count (p=0.042). In patients without brain infarcts, creatinine (p=0.013) and hemoglobin (p=0.003) remained significantly correlated with time to regain consciousness. In patients with new infarcts, only low hematocrit (p=0.004) was a prognostic factor. *Conclusion:* High pre-operative creatinine and low post-operative hemoglobin are associated with prolonged unconsciousness after cardiac surgery. This was particularly evident in patients without new brain infarcts.

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POSTER PRESENTATIONS

GENERAL NEUROLOGY

P-001

Transient global amnesia associated with discontinuation of tadalafil after chronic daily use

G Pfeffer (Vancouver), A Penn (Victoria)*

Background: Transient global amnesia (TGA) is characterised by temporary anterograde memory loss of unknown aetiology. It is occasionally associated with the use of phosphodiesterase-5 (PDE-5) inhibitors such as tadalafil. We report a case of TGA that developed coincident with discontinuation of chronic tadalafil use. *Methods:* Case report. *Results:* This 43 year old man had an episode of TGA of two hours' duration following weight training. His sister had TGA at a similar age. He had taken tadalafil 5 mg daily for one year as part of a study for benign prostatic hypertrophy, and discontinued the agent two days prior to presentation. *Conclusion:* PDE-5 inhibitors are vasoactive agents and have been reported with TGA, stroke and EEG abnormalities. A rebound vasoconstrictive effect from withdrawal of long term daily tadalafil may have increased this patient's susceptibility to TGA relating to any or all of the above effects. A vascular mechanism is postulated. Clinical suspicion should be present for this association as PDE-5 inhibitors are increasingly prescribed for long-term use.

P-002

Neurocysticercosis in a 27 year old male with right alien hand episodes and a single generalized seizure.

Z Poonja (Saskatoon), J Tellez-Zenteno (Saskatoon), F Moien (Saskatoon)*

Background: Neurocysticercosis is the leading cause of seizures worldwide and is of increasing importance in Canada. It is caused by exposure to *Taenia soleum*, a tapeworm. Exposure must occur from human feces, which carry the T.solium eggs, and commonly occurs when human fecal matter contaminates food. *Methods:* We report a case of a 27-year-old man who had presented to the ER with dizziness and worsening sensory symptoms on the right side of the body which started 4 months previously. The patient described intermittent right alien hand syndrome, which is characterized by absence of volition in the performance of complex and seemingly purposeful movements of the right arm. The patient progressed to experience numbness in his right arm and face that spread to his legs and culminated in a generalized seizure preceded by tonic-clonic activity in the right side of the body. The patient was from India and was attending the University of Saskatchewan. *Results:* CT scan performed in the ER showed two small calcified lesions in the left frontal and right parietal subcortical areas as well as a 1cm round ring enhancing mass in the superior aspect of the left central sulcus. These lesions led to the diagnosis of neurocysticercosis. Treatment was initiated with Dilantin, Albendazole and a short one-week course of Prednisone. *Conclusions:* Over the next few months the patient's response to treatment was excellent with complete resolution of symptoms as well as improvements in imaging findings. Dilantin was used for 6 months and then discontinued. Epidemiological aspects are discussed.

P-003

Intravascular Lymphoma Involving the Brain Following Renal Cell Carcinoma

*MA Badawi (Vancouver)**

We report a 72- year- old man with intravascular lymphoma which presented as abnormal gait with cognitive impairment. Brain MRI revealed muliple infarct-like lesions. Open brain biopsy was performed, showing the features of intravascular lymphoma (B-lymphocytes). He was treated with with R-CHOP , which lead to symptomatic improvement and decrease in the size of brain lesions. After one year from diagnosis, the patient is still doing well with no complications or new symptoms. Interestingly, he had renal cell carcinoma 7 years ago which is known to be related to IVL. *Introduction:* Intravascular lymphoma was first described in 1959 by Pfleger and Tappenier as an endothelial neoplasia with vascular dissemination. Since that date, about 300 cases have been reported. It is an extremely rare form of Non-Hodgkin lymphoma, aggressive and usually disseminated. It is also known as angiotropic large cell lymphoma, and malignant angioendotheliomatosis. It is characterized by almost exclusive proliferation of lymphoma cells inside blood vessels lumina. Tumor cells can occlude the small vessels of various organs.While the brain and skin are the most commonly involved sites, nodal involvement is rare.

P-004

Gammaknife procedure for treatement of hypothalamic hamartoma

C Pinard (Sherbrooke), C Deacon (Sherbrooke), D Mathieu (Sherbrooke), B Kenny (Sherbrooke), J Duval (Sherbrooke)*

Drug resistant epilepsy associated with hypothalamic hamartoma (HH) can be treated by surgery. Morbidity and mortality risks of surgery are significant. Gamma knife surgery is a non invasive procedure that can be used to treat HH. We conducted a non randomised prospective study to evaluate the efficacy and safety of gamma knife to treat epilepsy associated with HH. Three patients have been treated until now and one patient completed two years follow-up. We present the data of this patient. The pre surgical work-up included seizure semiology and frequency, neuropsychological performance, electroencephalogram abnormalities, MR imaging and quality of life testing. After radiosurgery, patients were followed every 6 months for two years. Seizure frequency was recorded. Electroencephalogram was done at 6 months. MR imaging were performed every 6 months. Neuropsychological performance and quality of life testing were repeated at 12 months. The first patient treated is a 39 years old male with severe partial epilepsy despite being treated with 3 antiepileptic drugs. His EEG showed bi-frontal spikes. On MRI a small type I HH was seen. The lesion was treated on November 2006. He experienced a cessation of all types of

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seizures immediately after treatment. We noted a normalisation of the EEG and a reduction of the size of the HH on MRI. Neuropsychological performance showed improvement in verbal memory and attention. Drug resistant epilepsy associated with HH can be treated with gamma knife. Rapid improvement was observed in our first patient. More data on the other patients will be available in June.

P-005

Sleep Disorder due to Viral Encephalitis

NA Parekh (Ottawa), CR Skinner (Ottawa)*

Background: Orexin, a peptide produced in the posterior and lateral hypothalamus, stabilizes sleep-wake cycling and prevents unwanted transitions into REM sleep. *Methods:* A 23 year old woman developed cough, fatigue, and nausea followed shortly by diminished appetite, intermittent headache and olfactory hallucinations. Five days later she developed nightmares, visual hallucinations, insomnia, and periods of decreased alertness. The next day she fell asleep during an appointment with her family doctor. She went to bed that night and awoke 15 hours later with gait difficulties, tremulousness/shivering, drooling, and a head drop. Upon arrival to our hospital, a neurological exam was non-localizing. CSF analysis was compatible with viral encephalitis, though the causative agent was never identified. Neuroimaging and neurophysiological testing was unremarkable. The patient subsequently underwent polysomnography. *Results:* The polysomnogram demonstrated a total sleep time of 400min with 232 stage shifts. Sleep onset latency was 1.5min and REM latency was 2min. The sleep architecture was highly fragmented with no evidence of sleep disordered breathing or abnormal movements in sleep. Further examination of the raw data demonstrated sleep spindles superimposed on K complexes as well as REM intrusions on NREM sleep. *Conclusion:* The viral encephalitis likely affected the posterior hypothalamus resulting in impairment in thermoregulation and diminished orexin levels. The diminished orexin levels would explain the sleep state instability and possibly the REM intrusions into wakefulness and NREM sleep. Sleep disturbance due to the involvement of the posterior hypothalamus by viral infection raises the possibility that this represents a case of modern-day encephalitis lethargica.

P-006

Opsoclonus-myoclonus syndrome associated with cytomegalovirus mononucleosis

MR Keezer (Montreal), M Thibeault-Eybalin (Montreal), E Fon (Montreal)*

Background: Opsoclonus is characterized by involuntary, rapid, arrhythmic, conjugate saccades occurring in all directions of gaze. Opsoclonus is associated with myoclonus, postural tremor, ataxia and behavioural disturbances. *Method:* We report a case of opsoclonus myoclonus syndrome (OMS) associated with a cytomegalovirus (CMV) mononucleosis. *Results:* A 26-year-old woman presented with subacute headache, nausea and 1 day of confusion. In hospital she was found to have significant behavioural disturbances punctuated by periods of agitation and emotional lability. Neurological exam revealed opsoclonus that persisted during eye closure and sleep, multifocal myoclonus as well as a vocal and postural tremor. Extensive investigations, including a thorough neoplastic work-up, were negative except for mild splenomegaly on abdominal ultrasound, elevated hepatic enzymes, positive serum CMV IgM and a serum CMV polymerase chain reaction quantitative viral load of 1.37 x 10^3 copies/ml confirming an acute CMV infection. Cerebral spinal fluid examinations were normal. The patient was treated with methylprednisolone, intravenous immunoglobulin, clonazepam, levetiracetam and thiamine. She improved remarkably and was discharged to a rehabilitation centre 3 months after her initial presentation. *Conclusions:* We present the first reported case of OMS associated with confirmed CMV monocleosis.

P-007

HaNDL - a diagnostic challenge: The Halifax Experience

L Shimon (Halifax), V Bhan (Halifax), C Maxner (Halifax)*

Background: The syndrome of headache with neurological deficit and CSF lymphocytosis (HaNDL) is under recognized and under reported. Less than 100 cases are reported in the literature. *Methods:* Review of the Registry of patients admitted to the neurology service at QEII Health Sciences Center in Halifax, Nova Scotia between July 2006 and August 2008 yielded 6 patients with presumptive diagnosis of HaNDL. A thorough chart review of these six cases was conducted. *Results:* Six patients (5 males, 1 female; mean age 39 years) had non-diagnostic headaches and fluctuating neurological symptoms/signs including confusion, focal motor and sensory symptoms, and expressive dysphasia. The varied fluctuating clinical course lasted several weeks to 3 months. This led to multiple clinical assessments, hospital admissions and investigations. Five of the six patients had elevated CSF opening pressure over 25-cm H_2O without optic disc edema. Aside from lymphocytic pleocytosis, extensive CSF studies were normal. Neuroimaging, often repeated, was normal. EEG was normal or showed non-specific changes. All recovered completely by three months. *Conclusions:* HaNDL is under recognized and is often associated with elevated intracranial pressure (ICP), numerous fluctuating signs and symptoms with prolonged course resulting in diagnostic uncertainty. Early recognition may help avoid over investigating such patients.

P-008

Hairy Cells and Hyphae: A Case and Review of Rhinocerebral Aspergillosis

*A Shoamanesh (Vancouver)**

Background: Rhinocerebral aspergillosis (RA) is a highly aggressive, invasive infection that is increasing in incidence due to the higher prevalence of immunocompromised patients. *Methods:* Case report and literature review on a patient with RA. *Results:* 67 year old man presented with a subacute history of headache, left sided CN VI and VII palsy, left sided hemiparesis, dysarthria and dysphasia in the setting of newly diagnosed hairy cell leukemia. CT/CTA showed an aggressive infiltrating mass involving the left ethmoidal and sphenoidal sinus, infiltrating into the brain via bony destruction of sphenoidal walls and encroaching upon the left cavernous sinus, causing critical stenosis of the left internal carotid artery. MRI demonstrated acute infarction of the right ventral pons and watershed infarcts . Pathology obtained from biopsy of the sphenoid sinus confirmed the diagnosis of RA. *Conclusions:* RA should be highly suspected in immunocompromised patients with neurological symptoms. Empirical treatment with amphotericin B

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should be initiated immediately in the immunocompromised patient who exhibits neuroimaging suggestive of rhinocerebral mycosis. Once aspergillosis is confirmed, therapy should be changed to voriconazole. Surgery serves as an important adjunct in the management of the disease. Mortality rates remain high, ranging from 60-95%, emphasizing the need for quicker diagnostic modalities and further randomized clinical trials.

P-009

Selenium-Induced Optic Neuropathy

WA Fletcher (Calgary), VE Hill (Calgary), SF Wilson (Calgary), KD Busche (Calgary)*

We report two unrelated women who simultaneously suffered severe bilateral optic neuropathy due to iatrogenic selenium toxicity. Visual loss and positive visual phenomena progressed to no light perception in both eyes within 5 days of starting daily methylselenocysteine capsules. Analysis of similar capsules showed that the selenium content was as high as 94 mg daily, roughly 18-times the intended dosage. One patient had mild optic disc swelling and arteriolar narrowing and the other had normal fundi and normal fluorescein angiographic findings. Both patients had normal full-field ERGs and normal MR scans of orbits and brain. CSF studies in one patient were normal. Both patients lost their hair. Within 6 weeks, visual acuity improved to count fingers but then gradually deteriorated over several months to light perception in one patient and no light perception in the other. Both developed profound optic atrophy and narrowing of retinal arterioles. A condition in ungulates called "blind staggers" is caused by feeding on seleniferous plants. The pathology and pathogenesis of selenium-induced optic neuropathy is unknown. Chronic exposure to high levels of organic selenium leads to decreased availability of intracellular glutathione, an important antioxidant. Decreased capacity to handle oxidative stress may bring about damage of retinal ganglion cells.

P-010

Mycobacterium bovis vertebral osteomyelitis, epidural abscess, and possible cerebral tuberculoma following intravesical BCG therapy

CB Josephson (Halifax), S Al-Azri (Halifax), BL Johnston (Halifax), D Haase (Halifax)*

Background: Bacille Calmette-Guérin (BCG) strain of *Mycobacterium bovis* is an efficacious therapy for transitional cell carcinoma (TCC) of the bladder. Pott's disease (tuberculous vertebral osteomyelitis) is a rare complication of therapy. *Methods:* Chart review and case report. *Results:* A 75-year-old male with grade 3 TCC of the bladder underwent transurethral resection and a 6 week course of intravesical BCG therapy followed by 6 weeks of combined intravesical BCG and interferon α treatment. Over the next 6 months he experienced a decline in motor function associated with back pain. Spinal CT and MRI revealed a lytic process involving the L1-2 disc and adjacent vertebrae with associated epidural and psoas abscesses. Gadolinium-enhanced MRI of the brain was normal. CT-guided biopsy revealed Mycobacterium tuberculosis complex on culture. DNA probe and major polymorphic tandem repeat sequencing analysis confirmed *M. bovis* BCG. Subsequent MRI of the head revealed a new enhancing nodular lesion in the right temporal cortex suggestive of a tuberculoma. *Conclusions:* BCG-related Pott's disease is rare. To our knowledge, no other case has been associated with an epidural abscess and possible cerebral tuberculoma. A high index of suspicion for active infection is required in all patients treated with intravesical BCG.

P-011

Can a cognitive screening test predict quality of life in rural and remote patients with memory complaints?

PH Wong (Saskatoon), A Kirk (Saskatoon), DG Morgan (Saskatoon), M Crossley (Saskatoon), M Heggie (Saskatoon), C Karunanayake (Saskatoon)*

Background: Few objective measurements have been found to be useful predictors of quality of life (QoL) in dementia. We examined whether the Modified Mini Mental State Examination (3MS), or subcategories of the 3MS predict QoL of patients in a Rural and Remote Memory Clinic. *Methods:* The first 133 patients seen in our Rural and Remote Memory Clinic were included. Pearson correlation coefficients of 3MS scores with self-rated patient QoL and caregiver-rated patient QoL were determined. Best subset regression analysis was performed to determine the variation in caregiver-rated patient QoL that 3MS scores account for. *Results:* 3MS Total Score, Memory Score, Speeded Executive Function, and MMSE Total Score all correlated significantly with caregiver-rated patient QoL. 3MS and MMSE scores did not correlate with self-rated patient QoL. In regression analysis, 3MS Speeded Executive Function accounted for an additional 2.5% of the variation in QoL. *Conclusion:* Measures of cognitive function significantly correlate with caregiver-ratings, but not self-ratings of QoL. Speeded Executive Function as a predictor of caregiver-rated patient QoL allows for the explanation of more variation in a predictor model than does 3MS Total Score.

P-012

Case Report: Multiple Intracranial Inflammatory Pseudotumors

CC Gillis (Vancouver), CS Haw (Vancouver)*

Objective and Importance: To raise awareness of the possibility of multiple plasma cell granulomas and their similarity to meningiomas, especially intraoperatively. *Clinical Presentation:* A 68 year old woman presented with a history of multiple falls, dragging of the left foot and progressive gait instability. On exam she exhibited mild left hemiparesis, left pronator drift and left sensory neglect. CT contrast scan revealed two homogeneously enhancing lesions near the right Rolandic area. *Intervention:* Surgical resection of the lesions was performed. The larger of the two lesions was successfully removed. Intraoperatively the lesion resembled meningioma and the overlying dura looked abnormal, however, there was no hyperostosis and there was a reddish membrane surrounded the lesion which was also resected. *Conclusion:* The differential for extra-axial lesions should include plasma cell granuloma. Surgical resection alone is a viable treatment option. It is important to rule out other possible infectious causes before this diagnosis can be confirmed. Inflammatory Pseudotumor should be on the differential for meningioma.

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P-013

Botulinum toxin in the treatment of chronic pain syndromes.

SS Nijjar (Toronto), AS Gordon (Toronto)*

Background: Botulinum toxin (botox) is emerging as a treatment of chronic pain. However, the evidence is incomplete with respect to which patients benefit most and the mechanism of improved symptoms. This study aimed to compare the benefits of botox in different pain syndromes by assessing outcomes with respect to function and pain. *Methods:* A prospective study was performed on forty patients that were admitted to our pain centre and treated with botox for chronic pain. All admitted patients completed the Short-Form Health (SF-36) and Pain Intensity questionnaires. Patients who were treated with botox and consented to the study repeated the questionnaires within one to two months following treatment. Data analyzed was scored in categories including: physical functioning, role limitations, energy/fatigue, emotional well being, social functioning, pain, and general health. *Results:* Patients treated with botox had improvements in all categories with the most significant improvements in physical functioning and role limitations. In particular, patients with migraines, chronic daily headache, and neuropathic pain appeared to benefit the most. *Conclusions:* Preliminary data suggests that botox may be beneficial in improving the level of functioning and pain intensity in patients with various chronic pain syndromes. Further randomized control studies will be instrumental in furthering our understanding of this benefit.

P-014

Léger de main: the thalamus and the automatic limb.

DB Newman (Rochester), RM Elias (Rochester)*

Background: Alien hand syndrome (AHS) is a rare condition associated with involuntary limb movement. Characterization of AHS subtypes may facilitate diagnosis and minimize morbidity. *Case:* A 56 year-old male farmer with a history of hypercholesterolemia presented with a one day history of numbness and involuntary movement of the left arm. He was in his usual state of health when he noted the sudden difficulty manipulating objects with his left hand. He further described his arm as “”floating uncontrollably.” Minutes later he noted tingling of the left hand that progressed cephalad along the left arm and transient numbness of the left leg and left side of the face. Emergency respondents administered 325 mg aspirin, and he was transferred to the hospital where examination revealed mild, proximal left arm weakness with numbness to pinprick. An electrocardiogram, head CT, cardiac enzymes, and carotid artery ultrasound were all normal. On hospital day two, he reported two more episodes of tingling and uncontrolled “”floating”“ movements of the left arm. An EEG failed to demonstrate epileptogenic activity. An MRI revealed increased T2 signal and positive diffusion image involving the right thalamus suggestive of a subacute lacunar infarct. *Conclusion:* Prior studies have attempted to show correlation between the site of lesion and the clinical manifestation of AHS. To our knowledge, this is the first presentation of AHS presenting with positive sensory phenomena due to a thalamic lacunar infarction. Recognition of “”positive”“ phenomena as rare presentations of ischemic stroke may help expedite therapy and minimize morbidity.

P-015

Xeomin® is stable without refrigeration: complexing proteins are not required for stability of botulinum neurotoxin type a preparations

S Manara (Toronto), S Grein (Frankfurt am Main)*, GJ Mander (Frankfurt am Main), HV Taylor (Frankfurt am Main)*

Native botulinum toxin type A (BTX-A) is a high molecular weight complex of about 900 kD, com-posed of the biologically active 150 kD neurotoxin, several hemagglutinins, and other nontoxic proteins. Although these complexing proteins do not have any therapeutic effect, it has been speculated that they might be required for stability of botulinum neurotoxin type A preparations. Xeomin® is a botulinum neurotoxin type A preparation, which, unlike other marketed BTX-A products, contains only the pure 150 kD neurotoxin without complexing proteins. The stability of Xeomin® was assessed in comprehensive real-time and accelerated stability studies according to ICH guidelines. The study results showed no detrimental effects on the quality of Xeomin® after storage of up to 40 °C, and have accounted for its shelf-life of three years without the need for refrigeration. In a further temperature stress study, samples of Xeomin® were stored above 40 °C. As in the ICH-conform stability studies, the samples were tested with fully validated or standardized pharmacopoeia analytical methods also used for release testing of Xeomin®. The results demonstrate that Xeomin® is not negatively affected by storage at temperatures between 40°C and 60 °C for up to one month. Altogether, these findings provide clear evidence that the complexing proteins in pharmaceutical preparations of botulinum neurotoxin A are not required for stability.

Muscular Sclerosis

P-016

Atypical ADEM with evolving necrosis

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Background: Acute disseminated encephalomyelitis (ADEM) is a predominantly monophasic, often post-infectious, encephalopathic, demyelinating disease of the central nervous system. *Method:* We report a case of ADEM characterized by multiple necrotizing lesions. *Results:* A 40 year old man, previously healthy, presented with acute confusion and hemibody paresthesias. He was intubated 36 hours after hospital admission for rapid deterioration in his level of consciousness. Magnetic resonance imaging (MRI) of the brain was highly suggestive of ADEM; multiple large, poorly marginated areas of hyperintense FLAIR signal in the subcortical white matter of both cerebral hemispheres and corpus callosum and the right basal ganglia, most showing modest enhancement after Gadolinium. There were no periventricular or thalamic abnormalities. Serum Epstein Barr Virus (EBV) IgM antibodies and EBV CSF polymerase chain reaction were positive. He was treated with intravenous immunoglobulin, ganciclovir and plasma exchange. He was extubated 5 days later and was ambulating within 1 month. No evidence of hemorrhage was found on initial or repeat imaging, lumbar puncture or brain pathology. However, an MRI 4 weeks after disease onset revealed cystic necrosis of his prior brain lesions as well as several new but similar lesions. *Conclusions:* We present the first reported case of necrotizing ADEM.

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P-017

An Evaluation of Practice Audit in Multiple Sclerosis

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Background: Practice audit is essential for continuing professional education. We evaluated a novel accredited practice audit program (RCSPC Section 5) for neurologists, utilizing hand-held device (PDA) to assess specific aspects of their multiple sclerosis practice and compare with national aggregate results. *Methods:* Between June and September of 2008 participating neurologists entered data using pre-programmed PDA including: 1) Physician Profile: demographics and physician's perception of practice; 2) Patient Assessment: practice data on 20 MS patients 3) Patient Survey: collects their knowledge, decision making, and evaluation of communication with their physician. This data was downloaded to a central server allowing participants to review results at a secure website. *Results:* Twenty seven neurologists entered 481 Patient Assessments. 240 (50%) patients returned anonymous surveys. Data analysis compared community (n=15) versus academic (n=12) neurologists. For diagnosing MS, 60% of community and 85% of academic neurologists used McDonald Criteria. Average wait for elective MRI, was 1-2 months in community and 5-6 months in academic institutions. Only 17% of CIS patients were treated with disease modifying drugs. Physicians' perception of practice was also compared to the patient survey results. and educational needs for both were analyzed. *Conclusions:* The Practice Audit in Multiple Sclerosis is convenient and enables neurologists to compare their practice with peers.

P-018

Diffusion tensor imaging abnormalities in cognitively impaired multiple sclerosis patients with mild disability

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Background: Cognitive impairment (CI) affects 40-60% of patients with multiple sclerosis (MS). Lesions and atrophy, however, cannot fully explain the presence of CI in these patients. The aim of this study is to assess the contribution of normal appearing white matter (NAWM) and gray matter (NAGM) to CI in MS patients using diffusion tensor imaging (DTI). *Methods:* 62 MS patients (51 female, mean age= 40(SD=9.6) years, median EDSS=2.5, mean time since diagnosis=94.6(SD=70.1) months) meeting McDonald criteria underwent neuropsychological testing using the Neuropsychological Screening Battery for MS (NPSBMS) before undergoing magnetic resonance imaging (MRI) (1.5T GE) that included DTI sequences. Total T1 hypointense and T2/Pd hyperintense lesion volumes were measured using semi-automated software. Lesion volumes were subtracted from whole-brain parenchyma to obtain NAWM and NAGM. Fractional anisotropy (FA) of NAWM and mean diffusivity (MD) of NAGM were obtained. T-tests were used to compare patients with and without CI on imaging data. *Results:* 11 patients (17.7%) showed CI. Patients with CI had higher T1 hypointense (p=0.011) and T2/Pd hyperintense (p=0.003) lesion volumes, greater NAWM atrophy (p=0.007), lower FA of NAWM (p=0.003), and higher MD of NAGM (p=0.015). Significant lesion and atrophy measures could explain 39.8% of the CI variance. DTI measures raised the amount of variance explained to 53%. *Conclusion:* DTI measures of NAWM and NAGM were able to add to lesions and atrophy in explaining the presence of CI in MS patients with minimal disability. This study underlies the important role of normal-appearing brain tissue in the pathogenesis of MS-related CI.

P-019

Prevalence of other autoimmune diseases in patients with multiple sclerosis.

S Kirby (Halifax), MG Brown (Halifax), TJ Murray (Halifax), P Andreou (Halifax), JD Fisk (Halifax), D MacKinnon-Cameron (Halifax), V Bhan (Halifax)*

Background: To determine the prevalence of other autoimmune diseases (AiD) in patients with clinically definite multiple sclerosis (MS). *Methods:* The Dalhousie Multiple Sclerosis Research Unit maintains clinical records and a database on all patients seen since 1979. This has been merged with health services utilization data for the Nova Scotia Department of Health. Of 1758 MS patients, 1695 (96.4%) charts were available for review. Diagnoses of AiD from all sources were recorded. Service utilization data were searched for ICD diagnostic codes for AiD and codes recorded at least twice were accepted. *Results:* 329 MS patients (19.4%) had at least one AiD. AiD were diagnosed in 57/442 males (12.9%) and 272/1253 females (21.7%); 167/864 (19.3%) relapsing-remitting, 105/545 (19.3%) secondary progressive and 57/278 (20.5%) primary progressive patients. Class of MS was uncertain in 8 and none had AiD. 263 patients had one, 52 had 2, 8 had 3, 4 had 4 and 2 had 5 AiD. *Conclusions:* The findings indicate a high prevalence of other AiD in patients with MS. AiD were more prevalent among females. The prevalence of AiD did not differ between classes of MS.

P-020

Stop and switch data in disease modifying drugs in multiple sclerosis: Nova Scotia experience

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Background: Conventional disease modifying drugs (DMDs) in multiple sclerosis (MS) are partially effective and have adverse events, resulting in switching or stopping in some patients. We studied the DMD stop/switch experience in Nova Scotia MS patients. *Methods:* The Dalhousie Multiple Sclerosis Research Unit (DMSRU) administers the Nova Scotia DOH funded DMD Program. Patients are assessed by a neurologist, attend a DMD education program and have mandatory annual follow-up. MS patients on DMDs were identified using the DMSRU database. Chart review was conducted. *Results:* Of the identified 974 DMD treated patients (mean follow-up of 51 months), 545 (56%) remained on first DMD. 189 (19%) switched DMDs: 151 switching once, 33 twice and 5 thrice or more. Switches were Rebif 22 to 44 (24%, n=73), interferon to Copaxone (30%, n= 91), Copaxone to interferon (13%, n=40) and conventional DMDs to natalizumab/ mitoxantrone/azathioprine (11%, n= 33). Reasons for switching: adverse events alone (20%, n=62), DMD failure alone (39%, n=120). 240 (25%) stopped DMDs (185 after one drug, 40 after 2 drugs and 15 after 3 or more drugs). Reasons for stopping: DMD failure alone (22%, n=53), adverse events alone (13%, n=30). *Conclusion:* DMD stops/switches are common with therapy failure and adverse events as major causes.

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General Neurosurgery

P-021

Hair clipping in Sikh patients undergoing craniotomy - An ethical analysis

*S Ebrahim (Toronto), S Bance (Toronto), A Fallah (Toronto)**

Introduction: Hair-clipping prior to craniotomy is considered routine neurosurgical practice as it allows for increased accuracy in surface landmarking and a presumed decrease of surgical site infection (SSI). Suggestion of hair removal raises anxiety and concern in many Sikh patients as a result of their religious beliefs. *Objective:* To examine the ethical issues relating to hair clipping in Sikh patients undergoing a craniotomy. *Methods:* A narrative review was performed to retrieve articles related to SSI and the importance of hair in Sikhism. *Results:* Although hair-clipping permits better orientation, freedom in placement of incision and secure bandaging, there is insufficient evidence that it minimizes SSI in cranial neurosurgery. In actuality, hair-clipping may alter the normal scalp bacterial flora and may increase SSI rates. An alternative technique of hair parting along the proposed site of incision is described in literature. "Kesh" (hair) is an extremely important symbol for Sikhs. Hair-clipping is forbidden except in emergency surgical procedures where minimal amounts of hair should be cut. Informing patients of alternative options [in a respectful and informative manner] prior to elective neurosurgery is important. *Conclusion:* Although it is customary to clip hair prior to cranial neurosurgery, there is a lack of evidence that this practice decreases SSI. Avoiding hair clipping when feasible becomes of profound importance with devout Sikh patients. Increased global immigration/migration necessitates the need to practice medicine in a culturally sensitive manner and mere acknowledgement of differences usually lead to improved communication between surgeon and patient. This issue needs to be addressed systematically using an ethnographic qualitative methodology.

P-022

Competitiveness of gaining admission to a neurosurgical residency program: the discrepancy between Canada and USA

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Objective: To examine competitiveness to gain admission into a neurosurgical residency program between Canada and the USA and to discuss factors that may explain the discrepancy. *Methods:* Data was obtained from the SF Match and CARMS website regarding American and Canadian medical students applying to neurosurgery. Extracted data [from 1997-2008] included: total number of positions, total number of students ranking neurosurgery as their primary choice and total number of students matched. From 1997-2008, the mean match rate for the USA was 83% while the rate for Canada was 90%. Epoch analysis revealed that the discrepancy was largely due to the increased competitiveness to gain admission to the USA neurosurgical programs from 1997 to 2002 ($p<0.05$). From 2003-2008, no statistically significant difference was observed in competitiveness between the two countries ($p=0.620$). From 1997-2008, no statistically significant difference was observed in the level of competition within Canada ($p=0.215$) whereas there was a decrease within the USA over the latter 6 years ($p<0.05$). *Discussion:* Neurosurgery was a competitive field to gain admission for residency about a decade ago, but is now considered to be non-competitive in both countries. The literature identifies three trends that may lead to a decline in interest: [1] Emphasis to increase the output of medical students interested in primary care. [2] A decline in obligatory rotations of surgical specialities in medical school studies. [3] An increase in women in medical schools and their preference for non-surgical careers. Failure of neurosurgical educators to emphasize emotional and financial rewards of neurosurgery aggravates these trends.

P-023

The posterior septotomy of the Binasal Endoscopic Tans-sphenoidal Approach: An anatomical analysis of surgical access to the skull base

*MD Cusimano (Toronto), AA Elashaal (Toronto)**

Background: Our group was the first to describe the binasal endoscopic transphenoidal (BET) approach using the posterior septotomy (PS) that allows the surgeon to work through both nostrils. The approach is challenging for novice surgeons to master. In this study we measured anatomical access using critical anatomic landmarks that guide the surgeon during the approach to the skull base. *Method:* Measurements of 50 patients' CT and MRI scans pre and post BET undertaken by the senior author. Photographs and 24 measurements were performed to describe the available access to the skull base including aspects of the characteristics of the PS to the pathology. These measurements were compared to actual intraoperative measurements in a subset of patients. Result: The medial-lateral space for surgical access to the skull base without performing a medial maxillectomy was 23.4mm (range 15 - 33mm) at the level of the septum, and 22.5 mm (14 - 32) at the level of the optic nerves. The PS measured 33 (10 - 49) by 22.3 (12 - 34). Surgical issues related to these measurements and anatomical-surgical correlations are discussed in the paper. *Conclusion:* This is the first paper to accurately measure surgical anatomical landmarks and relate these to surgical access and pathology. The characteristics of the PS are critical to the success of the procedure and the PS should be tailored to the patient's local anatomy and extent of pathology.

P-024

Cerebrospinal fluid shunts insertion: a technique of peritoneal catheter insertion and abdominal wall closure

AA Elashaal (Toronto), MD Cusimano (Toronto)*

Background: Good abdominal wall closure is a one of the basic surgical skills and is a common feature of almost all modern day ventriculoperitoneal (VP) shunt operations. That some patients require multiple abdominal operations highlights the need for a simple and effective technique of abdominal closure. In this report, we describe a simple technique for passing the peritoneal catheter of a VP-shunt through the abdominal wall such that closure minimizes the risk of abdominal wall related complications. The technique: We use two steps to tunnel the peritoneal end of the catheter. In the first step the abdominal catheter of the CSF shunt is tunneled from the scalp incision to the abdominal incision, or in the alternate direction through the subcutaneous tissue using a tubular passer. The second step involves passing the peritoneal catheter through the abdominal fascia into the peritoneal cavity. To do this second step, we have two methods. In the first, the tip of the disposable passer is gently bent

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into a J-shape and passed through the abdominal wall from the peritoneum to the subcutaneous tissue. The catheter passed through the empty passer to end in the peritoneum. The second method we use is to use a Dandy forceps passed up through the abdominal fascia to grab the peritoneal catheter in the subcutaneous tissues to the peritoneal cavity. *Conclusion:* This technique will give the advantage of anatomical closure of the layers of the abdominal wall. This closure minimizes the risk of both incisional hernia and distal shunt malfunction.

P-025

Patient with an unrepaired lumbosacral myelomeningocele presenting with a new 'head nod'

A Szymczak (London), A Ranger (London)*

Background: Reports of primary brain tumors and spinal dysraphism in children are extremely rare. Those few cases we have identified usually involve tandem dermoid tumors of the cranial and spinal compartments. A 16 year old male returned for follow-up of his unrepaired lumbosacral myelomeningocele one year after diagnosis. Progression of symptoms included increasing problems with leg pain and gait. Furthermore, he had a new tendency to tilt his head to the right and an absent gag on physical examination. *Method:* Unexpectedly, MRI revealed a new mass at the craniovertebral junction extending out of the foramen magnum down to the level of C2 with associated obstructive hydrocephalus. In retrospect the mass was present on spine imaging from a year earlier. The patient underwent two operations to remove the posterior fossa mass and is currently receiving adjuvant cranial radiation. *Results:* The patient tolerated the surgeries well, with gross total excision. Surgical pathology revealed the mass to be an ependymoma. The lipomyelomeningocele remains symptomatic and requires surgical repair. *Conclusion:* Dual pathology of spinal dysraphism and a primary CNS tumor is rarely described. There are reports of tandem cranial and spinal dermoid cysts, but the two conditions manifest in this case have not previously been reported to occur together. Our conjecture is that these two conditions are not related embryologically and their co-occurrence is an extremely rare event.

P-026

Extended Endoscopic Endonasal Approach to Skull Base

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Background: Different approaches to the skull base have been developed through the sphenoidal sinus. Traditional boundaries of the trans-sphenoidal approach can be extended in antero-posterior and lateral planes. We review our experience with the extended endoscopic endonasal approach. *Methods:* We used the Extended Endoscopic Endonasal Approach in 30 patients with different lesions of the skull base. This study specifically focuses on types of lesions, surgical approach, outcome and surgical complications. *Results:* The extended endoscopic endonasal approach was used in 30 patients with following lesions: 11 invasive adenomas to cavernous sinus, 4 clival chordomas, 4 craniopharyngiomas, 1 hypothalamic astrocytoma and 10 pituitary adenomas extending unto the tuberculum sella. Gross total resection was achieved in 21 cases (70%) subtotal resection in 8 (26.7%) and biopsy only could be accomplished in the case with the astrocytoma. This patient developed meningo-encephalitis and died two weeks later. *Conclusions:* The extended endoscopic endonasal approach is a promising minimally invasive alternative for selected cases with sellar, parasellar or clivus lesions. As techniques and technology advance this approach should be considered an option by skull base surgeons and may become the procedure of choice in the management of the patients with these complex pathologies. Key words: Skull base, extended endoscopic endonasal approach, tumor

P-027

National Survey of Practice Patterns for Post-operative Anticoagulation in Patients Undergoing Intracranial Surgery

NK Jha (Hamilton), G Belovay (Hamilton), M O'Donnell (Hamilton), J Eikelboom (Hamilton)*

Study Design: A questionnaire survey. *Objectives:* To collate and analyze the views of Canadian adult neurosurgeons on the use of pharmacological thromboprophylaxis after neurosurgical procedures. *Background:* Data: There is no consensus regarding the optimal timing of pharmacological thromboprophylaxis after neurosurgical procedures to decrease the incidence of venous thromboembolism and simultaneously avoid the risks of intracerebral hemorrhage. We have conducted a national survey amongst adult neurosurgeons regarding practice patterns in this area. *Methodology:* A questionnaire was created that took into account the controversies that currently exist in the area of thromboprophylaxis and was sent to adult neurosurgeons across Canada. *Results & Conclusion:* Approximately 50% of the surveys were returned and the data has been recorded and analysed. Our national survey reports a variation in practice patterns which stresses the need for additional research in this area.

P-028

Carotid artery visualization during anterior skull base surgery: a novel neuronavigation protocol

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Background: Detailed knowledge of the vascular anatomy of the anterior skull base is critical to successful surgery in this area. Whereas conventional neuronavigational approaches combine MRI (± contrast) for tumor visualization and CT (± C) for bony and vascular anatomy, we describe a novel protocol integrating MR angiography (MRA) into surgical neuronavigation to provide superior visualization of the carotid artery. *Methods:* The pre-operative imaging protocol employs a T1-weighed, 3D fast spoiled gradient echo MRI (± C) for soft tissue anatomy, a plain CT for bony anatomy, and a 3D time-of-flight MR angiography for carotid anatomy. The series are imported into the Medtronic StealthStation® image-guided system; during intra-operative 3D neuronavigation, each series (MRI, CT, MRA) can be viewed individually, or layered and viewed as a composite image. *Results:* Our protocol has important advantages. First, it provides detailed tissue, tumor, vascular and bony anatomy. Second, a contrast CT is not necessary; this is important, as numerous reports have highlighted the nephrotoxic nature of radiographic contrast material. Third, visualization of the carotid system is superior than can be obtained from CT angiography. *Conclusions:* We use this unique imaging protocol for all of our endoscopic transsphenoidal surgeries to provide superior visualization of the carotid artery during anterior skull base surgery.

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P-029

Diffusion Tensor Imaging, A Novel Tool in Neurosurgery, from Planning to Prognostication

HM Al-Jehani (Montreal), R Saluja (Montreal), K Petrecca (Montreal)*

Diffusion tensor imaging-based fiber tracking is a new MRI technology that is being utiliazed to reveal the relationship between the principal white matter tracts and the intracerebral lesions. DTI-based fiber tracking may be helpful for surgical planning and intraoperative visualization of the eloquent white matter tracts to protect neurologic function. Fiber tract data can be reliably integrated into a standard neuronavigation system, allowing for intraoperative visualization and localization of major white matter tracts such as the pyramidal tract or optic radiation. The knowledge of the position of major white matter tracts during surgery may help to prevent too extensive resections, which could potentially damage major white matter tracts and result in postoperative neurological deficits.We will present a review on the state of DTI imaging in surgery of brain tumors and vascular lesions of the brain as well as its utilization in acute traumatic brain injuries.

P-030

Interdisciplinary, Multimodality Treatment of Orbital/Skull Base Tumors

HM Al-Jehani (Montreal), A Zeitouni (Montreal), F Codère (Montreal), R Leblanc (Montreal)*

The Skull Base Tumour Program at the Montreal Neurological Hospital-McGill University Health Center addresses the evaluation and treatment of patients with anterior and posterior skull base tumors. This interdisciplinary group is composed of two neurosurgeons, an endoscopic rhinologist, an orbital surgeon, an endocrinologist, two radiation-oncologists, and a clinical nurse specialist. The group meets on a regular basis for monthly Tumour Boards and bi-monthly clinics. Patients are treated with a combination of therapeutic modalities including endoscopy coupled to high-resolution video imaging, neuronavigation through image reconstruction, microscopy, ultrasonography, nerve integrity monitoring, conventional and stereotactically-focused radiotherapy. The interdisciplinary approach allows for the optimal management of a variety of pathologies that in the past may have been treated on a more ad hoc basis. In this context we illustrate our interdisciplinary approach by describing a series of patients with a variety of pathologies involving the nasal cavity and nasal sinuses, the orbits and its contents, and the anterior fossa. We will conclude that the interdisciplinary-multimodality approach permits optimal management of patients with very challenging lesions that are not restricted to one part of the head.

P-031

The ICE phenomenon: a challenge to existing theories on the pathophysiology of communicating hydrocephalus

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

Introduction: It is generally accepted that external (EH) and internal hydrocephalus (IH) represent different aspects of the same pathological process, the common denominator of which is impaired CSF absorption. The 2 entities are interchangeable and conversion from one form to another is well documented. However, intracerebral CSF entrapment (ICE) resulting in neurological deterioration has not been previously reported. *Methods:* Case report. *Results:* A 65-year old female patient suffered grade 4 subarachnoid hemorrhage with a large intracerebral hematoma secondary to rupture of a right MCA aneurysm. Pterional craniectomy, hematoma evacuation, and aneurysm clipping were performed. The patient had a favorable post-operative course and made a remarkable neurological recovery. Three weeks following her hemorrhage, the patient developed right-sided EH but remained asymptomatic. However, a few days later, she developed sudden neurological deterioration with extreme lethargy and left hemiplegia. CT demonstrated conversion into IH with a distended CSF-filled hematoma resorption cavity and severe overlying cerebral edema leading to herniation of the parenchyma through the craniectomy defect. The hypothesis of high-pressure ICE within the hematoma cavity and secondary CSF dissection into the cerebral parenchyma was proposed. Ventriculoperitoneal shunting was urgently performed. The patient exhibited immediate post-operative improvement and returned to her baseline neurological condition. *Conclusion:* The ICE phenomenon represents a challenge to the existing theories on communicating hydrocephalus. It is likely that the pattern of CSF accumulation in hydrocephalus is largely determined by the relative compliance of each of the intracranial structures. CSF diversion remains the common solution to all forms of hydrocephalus.

P-032

Spontaneous paradoxical herniation in the absence of CSF drainage following decompressive craniectomy

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

Introduction: Paradoxical transtentorial herniation is a rare but classic complication of CSF drainage in patients with large decompressive craniectomies. However, brain sagging in the absence of CSF hypovolemia has not been previously reported. *Methods:* Case Report. *Results:* A 30-year old female patient suffered massive intracerebral hemorrhage from a small residual left frontal AVM following endovascular embolization and stereotactic radiosurgery 2 years earlier. The patient initially presented in coma with left pupil dilation and decerebrate posturing and underwent emergent frontoparietal decompressive craniectomy, evacuation of the hematoma, and insertion of an intraparenchymal ICP monitor. Post-operatively, despite a depressed skin flap and low ICP readings, the patient remained in a poor neurological condition and CT revealed persistent midline shift with transtentorial herniation and brainstem compression. Although there was no history of CSF drainage or excessive CSF loss, the diagnosis of brain sag was suspected since herniation seemed to occur in the setting of intracranial hypotension. The patient was placed in a 15° Trendelenburg position and improved dramatically within hours. A few days later, she was fully awake and had purposeful movements with her left side, although she had persistent aphasia and right hemiplegia. *Conclusion:* Although rare, paradoxical herniation in the setting of a large craniectomy defect may occur in the absence of CSF drainage. This entity should be suspected whenever transtentorial herniation occurs in conjunction with direct or indirect signs of intracranial hypotension. Placing the patient in the

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Trendelenburg position should be attempted as this simple maneuver may turn out to be life-saving.

P-033

Late Onset Idiopathic Aqueductal Stenosis in Identical Twin Sisters: A Case Report and Review of the Literature

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Late onset idiopathic aqueductal stenosis (LIAS) accounts for about 10% of adult hydrocephalus. Younger patients typically present with chronic headache, and older patients tend to present with the classic NPH symptoms of gait difficulty, memory disturbance, and incontinence. For a diagnosis of LIAS to be made, intracerebral lesions must be ruled out, history of intracranial infection and hemorrhage must be absent, and aqueductal stenosis must not have been diagnosed in infancy. Endoscopic third ventriculostomy (ETV) is the initial treatment of choice, but other CSF diversion methods have also been shown to be effective. Congenital aqueductal stenosis is thought to be inherited in an X-linked recessive fashion in about 2% of cases, however, the genetics of LIAS are unknown. We present a case of monozygotic twin females who presented with LIAS in their mid twenties. One was treated with ETV with good results. The other was treated with VP shunting as well as ETV, and continues to have headaches. To the best of our knowledge, this is the first reported case of LIAS in monozygotic twins, and suggests a genetic component to the pathogenesis of this condition.

P-034

Augmenting Hippocampal Neurogenesis Using Targeted Brain Stimulation: Implications For Memory Networks

SS Stone (Toronto), AM Lozano (Toronto), PW Frankland (Toronto)*

Adult generated dentate gyrus granule cells are capable of incorporating into circuits supporting hippocampal-dependent memories. Furthermore, the rate of adult hippocampal neurogenesis can be influenced by several factors, including targeted electrical stimulation of limbic structures. However, it is not known if increasing neurogenesis in this way can increase the pool of functional new neurons capable of network integration. Here, using the expression of the immediate-early gene product Fos as a marker for neuronal activation, we evaluated the contribution and recruitment rates of a limbic stimulation-induced increased population of new neurons to networks supporting Morris water maze memory. A nearly 2-fold increase in the number of 5-bromo-2-deoxyuridine (BrdU)-labeled cells in the subgranular zone of 2 month-old C57/B6x129svev F1 male wild-type mice was observed following one hour of low current and high frequency focal stimulation of the entorhinal cortex/perforant pathway. This increase in proliferation occurred during post-operative days 3-5 and was limited to the ipsilateral hemisphere during unilateral stimulation. In animals probed in the Morris Water Maze that were 10 weeks post stimulation and 4 weeks post maze learning, the increased pool of new neurons had the same probability of recruitment (Fos+ given new) into, but a greater probability of contributing (new given Fos+) to, the Fos+ memory trace when compared to the non-stimulated hemisphere. Ultimately, these experiments suggest that electrically stimulating DG inputs can produce more new neurons which contribute to activated DG memory networks, supporting attempts to examine this technique in the context of cognitive impairment.

P-035

Title: Hearing preservation following microsurgical resection of large vestibular schwannomas

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

Objective: 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 a single center series of 6 patients with hearing preservation following microsurgical resection of large vestibular schwannomas. *Methods:* From April 2003 to present, 165 patients underwent surgical resection of a VS. These included 46 large (>3 cm) tumours, of which 17 had serviceable hearing pre-operatively (defined as a speech discrimination score ≥50% and speech reception threshold ≤50 dB). Of these, 6 patients (35%) had preservation of hearing post-operatively. *Results:* Mean maximum tumour diameter was 3.6 cm (range 3.1 - 4.4 cm) and mean tumour volume using an ellipsoid calculation was 10.9 cc (range 7.2 - 19.6 cc). 4/6 patients had serviceable hearing pre-op (1 patient did not have pre-operative audiometry but reported good hearing clinically, and the second patient had a SRT of 60 dB and SDS of 20% pre-operatively). All patients underwent retrosigmoid craniotomy and tumour removal using intra-operative monitoring. Total removal was confirmed in 5/6 cases (in one case, small enhancement corresponding to either tumour or scar precludes confirmation of total tumour removal). Immediate post-operative day 1 House-Brackmann facial function was 1-2 in all patients. Audiological follow-up revealed preservation of serviceable hearing in 5/6 patients, and improvement in SDS in one patient from 20% to 86%. *Conclusion:* Our series demonstrates that hearing preservation is possible for large VSs and should be attempted in all cases with reasonable pre-operative hearing.

P-036

Neurological manifestations of Osler-Weber-Rendu disease: an inter-generational profile

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Background: Osler-Weber-Rendu syndrome, or, hereditary hemorrhagic telangiectasia (HHT), is an autosomal dominant disorder characterized by spontaneous and recurrent epistaxis, multiple telangiectasias, positive family history, and presence of internal lesions (GI telangiectasias, pulmonary, hepatic, cranial, spinal AVMs). Neurologic manifestations of HHT include brain abscess, TIAs, CVAs, spinal and cerebral AVMs, seizures, ICH and migraines. *Case Profile:* We document the neurologic findings that manifested among generations of a family diagnosed with HHT. A 43 year-old man, with childhood epilepsy disorder, was diagnosed with a pulmonary AVM that was embolized. He and his sister carried mutations in the endoglin and activin A receptor type II-like 1 (ACRLV1) genes. His sister, without pulmonary AVMs, succumbed to fulminent meningoencephalitis with intraventricular abscess. Their mother, with multiple pulmonary AVMs, also experienced subdural empyemas and intracranial abscess. She succumbed to massive GI bleed from GI telangiectasias. Their maternal grandfather succumbed to a ruptured abdominal aortic aneurysm. *Discussion:* HHT patients with neurologic involvement may initially present with subtle symptomatology. Neurologic manifestations can

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result from paradoxical emboli, air emboli, secondary polycythemia, systemic hypoxia from right-to-left shunting, or sterile emboli that become secondarily infected.

P-037

Polymicrobial gram-negative ventriculitis post resection of quadrigeminal cistern epidermoid cyst

BW Lo (Hamilton), N Murty (Hamilton), P Huff (Hamilton), K Carlino (Hamilton), S El-Zuway (Hamilton)*

Background: Epidermoid cysts account for 0.5-1.5% of all intracranial tumours. They have capsules composed of stratified squamous epithelium and contain keratin, cellular debris and cholesterol. They originate with retained fragments of primitive ectodermal layers. *Case Report:* An 18 year-old right-handed female presented to the Hamilton General Hospital with intracranial hypertension, with headaches and bilateral papilledema. On investigation, she had a 5 cm lobulated mass located in the quadrigeminal cistern, with associated obstructive hydrocephalus. She underwent combined supracerebellar infratentorial and transtentorial approach to resection of this lesion. No fistulous tract was noted intraoperatively. Pathology revealed epidermoid cyst. Postoperatively, she developed polymicrobial gram negative ventriculitis in the ICU, growing *Escherichia coli, Enterobacter cloacae* and *Pseudomonas aeruginosa*. She was successfully treated with intraventricular amikacin and parenteral meropenem. Upon clearance of CSF, a ventriculoperitoneal shunt was placed. At 10 months post resection, she is independently mobile and has begun her university studies. *Discussion:* Rupture of epidermoid cyst contents into the subarachnoid space can result in aseptic, chemical (Mollaret's) meningitis. Recurrent bacterial meningitis may occur if an occult epithelialized portal of entry is present. Identification of polymicrobial meningitis should be promptly treated with combined parenteral and intrathecal antibiotics to avoid its associated high mortality rate.

P-038

Neuronavigation-guided endoscopic transnasal drainage of anterior cranial base epidural and subdural empyema in children

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Background: Cranial epidural and subdural empyema represent serious neurosurgical problems requiring immediate attention. Frontal and paranasal sinusitis is a major predisposing condition that favors empyema formation adjacent to the frontal sinus. Although antibiotic treatment alone may be successful in select cases, surgical evacuation is often required. Simultaneous drainage of infected paranasal sinuses is usually indicated. The standard operative approach for frontal empyema remains through a uni- or bifrontal craniotomy. However, there are a number of pitfalls associated with this operation, including: large scalp incision, inability to replace boneflap due to gross infection, risk of post-operative bone flap osteomyelitis (when replaced), necessity for sinus cranialisation, and the potential for CSF and/or parenchymal dissemination of infection. Most of these pitfalls can be avoided with drainage via endoscopic transnasal approach. Although the indications for endoscopic transnasal surgery have grown in recent years, its application in the pediatric population, specifically to treat intracranial infectious pathology, is limited. To our knowledge, this is the first report of endoscopic transnasal drainage for intracranial infectious collections. *Methods:* Case Report and review of the literature. *Results:* Two patients with bacterial pansinusitis complicated with anterior cranial base epidural and subdural empyema were treated with endoscopic transnasal approach. Microbiology revealed a polymicrobial flora in both cases. The patients were treated with intravenous antibiotics for 6 weeks and both had an excellent outcome with complete resolution of infection and no permanent neurological deficits. *Conclusion:* Endoscopic transnasal drainage should be included as a treatment alternative when considering surgical intervention of pansinusitis complicated with anterior skull base intracranial extension.

P-039

Ventriculoperitoneal Shunting Causing Severe Turricephaly Mimicking

HS Fageeh (Riyad), AJ Sabbagh (Riyad), M Ahmad (Riyad)*

Background: Shunting severe hydrocephalus may lead to cranial deformities. This is caused by significant post shunting cranio-cephalic disproportion. *Methods:* We report 2 children that gradually developed severe turricephaly after shunting severe hydrocephalus soon after birth. Sequential cranial examinations and CT scans were studied. Both childen's parents were instructed to do multipositonal stimulation with frequent head re-positioning. Adjustable helmets were prescribed. One of the children had a cranial reduction procedure. The other child is followed. *Results:* conservative measures and helmets were not effective. One child had surgery at 2 years of age with an acceptable result. Sequential imaging showed that Turricephaly occurred in these patients as they are developmentally delayed and have poor neck control leading to the head being in a dependant position, that leads both parietal bones to grow and migrate superiorly while the frontal and occipital bones migrate inwards beneath the parietal bones. This results in an elongated posterior slanted cranial shape similar to ""Nefertiti's Head"" *Conclusion:* Awareness that turricephaly can result from shunting severe hydrocephalus may help anticipate and try to prevent its occurrence. Cranial reconstruction is possible in severe cases for palliative reasons.

P-040

Bilateral Coronal Craniosynostosis in Myelomeningocele Patients: Report of Two Cases

PJ Magown (Halifax), DP McNeely (Halifax)*

Introduction: Simultaneous occurrence of myelomeningocele and craniosynostosis is rare and the literature from case series is scant. *Cases Descriptions:* We report two female patients born with a myelomeningocele who were noticed to have an abnormal shape at birth prior to cerebrospinal fluid (CSF) diversion. The infants were delivered via cesarean section, underwent closure of the myelomeningocele at birth and insertion of a ventriculoperitoneal shunt one week later. Computed tomography confirmed bilateral coronal craniosynostosis in both infants. The youngest patient underwent surgical repair of the craniosynostosis whereas the family of the other patient declined surgery. *Discussion:* The presence of bilateral coronal craniosynostosis in patients who were born with a myelomeningocele is an unusual occurrence. The link between these two entities is unclear. It is generally accepted that patients who have

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hydrocephalus can develop an acquired craniosynostosis after CSF diversion. We hypothesize that an open neural tube defect may cause an acquired craniosynostosis. A "lemon sign" is often seen on prenatal ultrasound in patients who have a myelomeningocele. This imaging finding is thought to represent scalloping of the frontal bones due to venting of CSF through the open neural tube defect. An alternative hypothesis is that a genetic mutation may predispose to both disorders. Genetic testing and research aimed at investigating the etiology of craniosynostosis may help us understand how these two conditions interact.

P-041

Recent MNI Experience with Idiopathic Normal Pressure Hydrocephalus (INPH)

F Al Subaie (Montreal), D Sirhan (Montreal)*

Introduction: Idiopathic normal pressure hydrocephalus (INPH) is not uncommon with an estimated prevalence of 0.5% in those above 65 years of age. Though its diagnosis remains difficult and its treatment challenging, outcome seems more predictable when associated with a good response to a lumbar tap. We review the recent Montreal Neurological Institute experience prior and post lumbar tapping and subsequent surgery. *Material and Methods:* A retrospective chart review of all patients admitted to our institute with a diagnosis of INPH from January 2005 to December 2007. Diagnosis was established on clinico-radiological grounds. Assessment was done prior and post lumbar tap (approximately 30 cc). We further reviewed potential predictors of surgical outcome. *Result:* A total of 20 patients were diagnosed with INPH. There was no gender predilection. Age at onset ranged between 51-82 years with an average of 67. A trend toward using adjustable valve systems accrued from 35% to 100% over the 3-year period. Rate of subdural hematoma (SDH) needing surgical intervention declined with conversion to the programmable valve systems (30 to 11%). Response to lumbar puncture was predictive of clinical post-shunt improvement in 100% of our patients. *Conclusion:* Our recent experience suggests that INPH can be safely treated with proper screening. Shunting harbors a risk of overdrainage and subsequent SDH which is minimized with the recent trend towards adjustable valve systems. Because of our limited sample size a future prospective study is suggested.

SPINE

P-042

Role of Intra-Operative Neurophysiological Monitoring (IONM) in Complex Spine Surgery (CSS): A retrospective study

S Alemo (Philadelphia), A Sayadipour (Philadelphia)*

Background: To determine the efficacy of IONM in reducing the prevalence of iatrogenic neural injury during CSS. *Methods:* Records of 82 patients, who had had 382 titanium pedicle screws inserted, were reviewed. A standardized multimodality technique under total intravenous anesthesia was utilized. A relevant neurophysiological change (surgical alert) was defined as a reduction in amplitude of at least 50% for somatosensory evoked potentials or at least 65% for transcranial electric motor evoked potentials compared with baseline. The stimulation threshold of 8mA or less was considered the screw is to close to the nerve root. *Results:* Immediate feedback via Evoked Electromyography (EMG) using stimulating pedicle probes in appropriate muscle groups was suggestive of pedicle cortical bone compromise in 24 screws (6.5%). 21 screws were removed and redirected. Three false-positive evoked EMG was detected by visual examination of the nerve roots and pedicles and the surgeon elected not to reposition the screws. None of those patients had postoperative neurological deficit and the post-operative Computerized Tomography (CT) confirmed the integrity of pedicles. Three false-negative EMG was detected postoperatively in three patients by new neurological deficits and abnormal CT (3.65%). *Conclusions:* IONM complements the surgical skill and intraoperative fluoroscopy to protect neural tissue during CSS. However, postoperative CT is the ultimate test to determine the accuracy of positioning of the titanium screws. We propose wake-up test in operating-room after extubation and urgent CT if the patient develops a new neurological deficit to determine whether or not to reposition the screws in the same setting.

P-043

Potential complications of Anterior Cervical Discectomy (ACD)

S Alemo (Philadelphia), A Sayadipour (Philadelphia)*

Background: ACD represents one of the most commonly performed spinal procedures. Its result is quite rewarding in the majority of cases. However, infrequent complications can become troublesome, and occasionally disastrous. Thorough knowledge of likely ACD-related complications is important in order to avoid them whenever possible, and to successfully treat them when they are unavoidable. *Methods:* This is a level 4 evidence -based study presenting complications of 160 consecutive patients who underwent ACD using Methylmethacrylate (MMA), complimented by a comprehensive review of the relevant English literature. Illustrative cases were collected from our series and the literature to demonstrate various scenarios of complications, optional managements of them and the potential outcomes. Mean follow-up time of our series was 2.8 years. *Results:* Our mortality rate was 0% and morbidity rate was 17%. Dysphagia was always minor and transient symptom. Postoperative hematoma occurred in 1.9%, symptomatic recurrent laryngeal nerve palsy (hoarseness) in 7.5%, dural tear in 1.2%, worsening of preexisting myelopathy in 0.6%, superficial wound infection in 1.3%, chronic osteomyelitis in 0.6%, asymptomatic anterior partial spacer slippage in 2.5%, swan neck deformity in two patients with previous decompressive laminectomy 1.2%, fracture of MMA in 0.6% and laryngeal injury in 0.6%. The result and discussion of other potential complication has been presented as illustrative cases without highlighting the frequency and severity of each complication. *Conclusions:* Detailed knowledge of the ACD associated complications permits a vigilant surgeon to prevent them and properly manage complications when it is unavoidable.

P-044

Minimally Invasive Anterior Approach to C2 Vertebral Body, Surgical Technique and Report of Two Cases

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Background: Traditional open approaches to the C2 vertebral body such as the transoral approach is associated with prolonged operative times, infections, prolonged recovery periods and

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tracheostomy related complications. A minimally invasive, anterior extraoral, retropharangeal approach to C2 may afford adequate surgical access through a smaller surgical corridor. *Methods:* Two patients, a 7 year-old boy with a C2 bony lesion and an 89 year-old woman with an unstable odontoid fracture, underwent minimally invasive anterior retropharangeal procedures using the Metrx tubular retractor system. *Result:* Following a standard anterior cervical retropharangeal dissection, the Metrx tubular retractor system with the Quadrant retractor blades were used to facilitate exposure of the C2 vertebrate under fluoroscopic guidance. The 7 year old boy underwent a biopsy of the C2 vertebral body lesion whilst the 89 year old patient underwent a C2 odontoid screw fixation. Neither of the patients experienced any surgery related complications. *Conclusion:* The minimally invasive anterior cervical approach can be used for the treatment of different pathologies involving the C2 vertebrate body with good outcomes and few postoperative complications.

P-045

Case Report: Osseus Union of Odontoid II Fracture without External or Internal Immobilization

DH Zhang (Hamilton), YA Blake (Hamilton), E Kachur (Hamilton)*

Background: Type II odontoid fractures are common injuries of the upper cervical spine, that are considered unstable and easily displaced. Although controversies exist regarding the appropriate management of these fractures, external immobilization in a halo brace or a collar, versus instrumented internal fixation and fusion are thought to be necessary to achieve stable, osseus union. We present the case of a 48 year old patient, who was involved in a minor motor vehicle accident and discharged home with an undetected, displaced, odontoid II fracture. She presented one-year later with ongoing suboccipital neck pain. Radiographic investigations demonstrate robust osseus union at C2 with no evidence of instability or canal compromise. Current strategies in the conservative management of odontoid fractures is also reviewed. *Conclusion:* In the setting of trauma, a low clinical threshold for the investigation of suspected odontoid fractures should be encouraged. Despite the unstable nature of these injuries, osseous union without internal or external immobilization is still possible in select patients. The predictors for failed versus successful arthrodesis in the setting of non-immobilization are unknown, and therefore cannot be endorsed.

P-046

Review: Donor Site Morbidity Associated with Autologous Iliac Crest Bone Grafting

DH Zhang (Hamilton), E Kachur (Hamilton)*

Background: Autologous iliac crest bone graft is considered the gold standard in spinal reconstructive surgery. Dispite its widespread use, the harvesting of graft can be associated with significant morbidity at the donor site that can affect patient outcome and clinical decision-making. *Purpose:* To review the literature on donor site morbidity associated with autologous iliac crest bone grafting in order to better understand its impact in an era where alternatives to autograft exist. *Study Design:* The authors performed a literature review from 1966 to 2007, using the MEDLINE /PubMED search headings; iliac crest, graft, morbidity and complication. The senior authors' personal series of 12 patients is also presented for comparison. *Result:* From 190 articles retrieved, 72 were directly relevant to the topic. Retrospective studies and case reports predominated, with 1 prospective, randomized study. The most commonly reported acute morbidities were graft site pain (55%) and sensory dysfunction (19%). Reports of incisional hernias (9%), fractures (9%), hematomas (6%) and infection (13%) were less common. Long-term morbidities include chronic pain (35%) and cosmesis (13%). Prolonged patient recovery and reduced function capacity are also attributed to autograft harvesting. *Conclusion:* Autologous iliac crest bone grafting is associated with significant acute and chronic morbidities, most commonly pain. The true prevalence and impact is unclear given the paucity of prospective data on the subject. With the availability of allografts and xenografts, as well as the rapid emergence of biosynthetic constructs with improved structural and biological properties, the decision to use autologous iliac crest bone graft deserves closer scrutiny

P-047

Removal of lumber spine foreign body using minimal access system with navigation

Ga Al-Zhrani (Riyadh), Kn Almudrea (Riyadh), L Alsoualmi (Riyadh), ay Alturky (Riyadh)*

The removal of a foreign body from the spine is often a surgical challenge due to its close proximity to the spinal cord. Recent developments in computer-assisted surgery (CAS) have brought major improvements into the operating rooms. Continuous and ever accelerating advancements in computer science have made possible frequent use of computers in specialized medical applications for image based diagnoses and treatment of diseases, including surgical interventions. Even medical procedures which were commonly performed in a traditional way, nowadays take advantage of the minimal invasiveness, precision, velocity and interactivity provided by the computer assisted systems. Minimally invasive techniques (MIT) like microscopy, stereotaxy, endoscopy and neuro-navigation facilitate the procedures, improve neurosurgical results and reduce operative complications. In this technical report we used minimal access system with navigation to remove a broken spinal needle at L4-L5 level from an asymptomatic lady post-cesarean section.

P-048

Multicentric Reticulohistiocytosis Presenting as Progressive Spine Deformity: Case report and review of the literature

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Background: Multicentric reticulohistiocytosis (MRH) is a rare, idiopathic proliferative disease of histiocytes characterized by severe cutaneous and deforming osteoarticular lesions. The small joints in the hands are the most commonly affected whereas spinal involvement occurs in only 1% of patients. We report on a 51 year old woman with a severe cervical deformity secondary to erosive arthritis resulting from her underlying MRH who presented with progressive deformity, neurologic deficit and neck pain. *Methods:* The patients clinical course, management and outcome is discussed in the context of spinal deformity resulting from erosive arthropathy. *Results:* Management consisted of slow in-line traction for five days prior to surgery consisting of a C3-4 transverse osteotomy followed by operative fixation with C1-2 transarticular screws and C7-T4 pedicle screws supplemented with sublaminar Atlas cables and bone morphogenic protein. The patient did well postoperatively with

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significant recovery of neurologic function and decreased pain. Review of the literature revealed no reported instances of cervical deformity in association with MRH, however it is a common finding in patients with other erosive arthropathies such as rheumatoid arthritis. *Conclusions:* This is the first report of severe cervical deformity secondary to MRH. The patient was treated successfully with closed reduction and traction followed by long segment posterior instrumented fixation. Although MRH does not typically involve the spine, the operative principles that apply to cervical deformity resulting from other forms of erosive arthropathy appear to have utility in this unique scenario.

P-049

Application of a novel anterior system for odontoid screw fixation

*Iu Haq (Thunder Bay)**

Background: Type II odontoid fractures are the most common trauma-related dens fracture. Contemporary posterior atlantoaxial arthrodesis techniques for Odontoid fracture produce high rates of fusion but limit cervical rotation by 50%. Odontoid screw fixation via an anterior approach was developed to provide immediate fracture stabilization while preserving cervical rotation. Contraindications to the technique include transverse ligament disruption and a body habitus. Short-necked obese patients with increased AP chest diameter as seen in those with chronic obstructive pulmonary disease and pulmonary emphysema (barrel chest) present a challenge to the anterior approach. The appropriate screw trajectory along the long axis of cervical spine for placement of screws can be hindered by a barrel chest, fixed thoracic kyphosis, short neck and fracture type that require a flexed position to obtain reduction. *Methods:* The authors present an application of new anterior system for anterior Odontoid screw fixation. They discuss various modifications and innovations of such systems and describe their own tubular system, in which a beveled end conformal to the ventral surface of the vertebral column at the C2-3 level is used. That facilitates appropriate drill trajectory and insertion of anterior odontoid screw in the above mentioned difficult or impossible cases. *Results:* Six cases have been performed successfully with this new system. *Conclusion:* A new system had been developed and successfully used for insertion of anterior odontoid screw in otherwise difficult or impossible cases.
Manufacturer: (sofamore danek)

P-050

Chiari I Decompression with and without scoliosis in paediatrics: a retrospective study

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Background: The association of Chiari I malformations with syrinx is greater in paediatric populations than adults. The natural course of Chiari I malformations left untreated is understood, but the mechanisms are less understood. The effects of decompression of a Chiari I malformation on changes to or the development of scoliosis or a syrinx on those who present at less than 18 years old were compared. *Method:* Fifteen patients underwent decompression surgery for a Chiari I malformation by the same surgeon. A retrospective study looked at pre and post-operative imaging to confirm the degree of scoliosis, syrinx and Chiari malformation and any post operative changes. Variables included age, signs and symptoms, gender, and duration of follow up. Outcomes included changes in degree of scoliosis, syrinx, symptoms and further need for surgery. *Results:* Range of age was 17 months to 17 years. Mean follow up was 60.7 and 46.8 months for scoliosis and non-scoliosis patients respectively. Differences and trends in variables and outcomes will be presented. *Conclusions:* This retrospective pilot study is limited, but will be used to design a prospective study to better understanding factors that affect the development of syrinx and scoliosis in patients with a Chiari I malformation.

Pediatric Neurology

P-051

Dysplasia of the cerebellum in Chiari type II malformation revised: new insights from eye movement research

MS Salman (Winnipeg), M Dennis (Toronto), JA Sharpe (Toronto)*

Introduction: Chiari type II malformation (CII) is a developmental deformity of the hindbrain. The underlying structural damage and ocular motor dysfunction have not been systematically measured. We have previously reported that the midsagittal cerebellar vermis is expanded in CII and that saccadic adaptation, a form of cerebellar motor learning, is preserved in patients with CII. Both were unexpected findings. In this study, we combined results from several eye movement studies in CII with neuroimaging findings in order to establish the extent of impairment in ocular motor systems and correlate function with structural changes. *Methods:* Several classes of eye movements were recorded in 21 participants with CII, aged 8-19 years using an infrared eye tracker. MR imaging was correlated in 19 participants. Thirty-nine age-matched healthy participants served as controls. *Results:* Nine patients with CII had abnormal eye movements. Smooth pursuit gain was subnormal in eight, saccadic accuracy abnormal in four, and vestibulo-ocular reflex gain abnormal in three patients. None had fixation instability. Patients with abnormal eye movements had a smaller (non-expanded) midsagittal vermis area and smaller medial cerebellar volumes than CII patients with normal eye movements. *Conclusions:* The deformity of CII does not affect the structures and functions of the cerebellum uniformly. Expansion of the midsagittal vermis with relative preservation of its volume is a feature of CII in patients with spared ocular motor functions, despite an overall small cerebellar size. Sparing of vermis function in many patients with CII may open new avenues for novel rehabilitation strategies for such patients.

P-052

Ocular motor apraxia: Disconnections and compensations

MS Salman (Winnipeg), KM Ikeda (Hamilton), J Wrogemann (Winnipeg)*

Background: Congenital ocular motor apraxia (COMA) is an uncommon condition characterized by difficulty in initiating horizontal volitional saccades. It typically presents with head thrusts in infancy. COMA may be associated with developmental delay. *Methods:* A case report of a boy with COMA and unique MRI findings. Detailed eye movement examination was videotaped. *Results:* A 3-year-old aboriginal boy presented with head thrusts

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since infancy. Examination revealed prolonged horizontal saccadic latency and horizontal head thrusts when attempting to make horizontal saccades on command. Smooth ocular pursuit and vertical saccades were normal. He had mild developmental delay. Brain MRI showed severe thinning of the intercollicular commissure. The superior and inferior colliculi were otherwise normal. Follow up examination at age six years was unchanged. Frame-by-frame videotape analysis showed horizontal head thrusts with or without eye blinks. Occasionally, the eyes moved synchronously and in the same direction as the head rather than contraversively as had been previously reported. *Conclusions:* The intercollicular commissure is important for initiating horizontal saccades. Since patients with ocular motor apraxia are reported to have abnormalities in the corpus callosum, brainstem, cerebellar vermis, or bifrontal and biparietal lobes, we suggest that impaired communication between saccadic ocular motor regions located across the two sides of the brain or bilateral involvement of these regions by any disease process is the common underlying problem in ocular motor apraxia. Possible mechanisms will be presented and the use of head thrusts and eye blinks to initiate saccades will be explained in light of recent fMRI data.

P-053

Acute necrotizing encephalopathy in an Aboriginal Canadian child

MS Salman (Winnipeg), E Howayyer (Winnipeg), J Wrogemann (Winnipeg)*

Background: Acute Necrotizing Encephalopathy of Childhood (ANEC) was originally reported in Far East in 1995. It is a rare disease that presents with sudden and rapid neurological deterioration following a febrile illness. Neuroimaging is characteristic. Prognosis was reported to be poor in the past. We present a case of ANEC in an Aboriginal boy with mild residual neurological impairments on follow up. *Methods:* Case report. *Results:* A previously healthy 34 months old aboriginal boy from northern Manitoba presented with acute-onset encephalopathy and rapid deterioration following a brief febrile illness. His brain MRI was characteristic of ANEC with multiple areas of symmetric non-enhancing increased T2 signal intensity with diffusion restriction involving the posterior thalami, extreme and external capsules, medial temporal lobes, hypothalamus, midbrain, pons, tail of the caudate nucleus. MRI of the spinal cord showed focal areas of increased T2 signal intensity at C6-7 region, with no enhancement or expansion of the spinal cord, and another area at T11-12 region associated with some expansion of the cord. No specific etiology was found on extensive investigations. He was given a single dose of intravenous immunoglobulin (1g/kg). He improved markedly within few days. On follow up one year later, he had mild language delay and mild spastic gait. Follow up MRI showed mild residual atrophy in some of the previously affected areas. *Conclusions:* ANEC may occur in aboriginal children. The spinal cord can be involved. Prognosis is not necessarily poor because the disease can result in mild neurological impairment. Immunoglobulin may be beneficial.

P-054

A Case Presentation of Anti-NMDA-receptor Paraneoplastic Encephalitis

CM Francu (Ottawa), N Cook (Ottawa), D Keene (Ottawa), A Doja (Ottawa)*

Background: Anti-NMDA-receptor encephalitis is a recently identified paraneoplastic disorder associated with antibodies against subunits of the NMDA receptor. It usually presents in young women with psychosis or memory problems, alterations in mental status, seizures, hypoventilation, autonomic instability and dyskinesias. It is often associated with an underlying tumor, commonly ovarian teratomas. *Methods:* We present case of a 12-year-old girl with anti-NMDA-receptor encephalitis with no detectable tumor. *Results:* Our patient developed psychiatric symptoms, with psychosis, acute mental status changes, agitation, disinhibition, and amnesia, after a non-specific viral-like prodrome. She subsequently developed autonomic instability, with hypertension and tachycardia, as well as dyskinesias and catatonia. All investigations including MRI, EEG and CSF analysis were negative. Anti-NMDA antibodies were found in the serum and CSF, although no underlying tumor was found. Clinical recovery was noted after corticosteroids and IVIG. Relapse occurred several months later with similar presentation and associated seizures, and rituximab was added to the initial therapy with gradual improvement. Repeat investigations did not detect any tumor. *Conclusion:* Anti-NMDA-receptor encephalitis represents a new immune-mediated disorder which can be diagnosed serologically and treated if recognized promptly, although the prognosis remains guarded in patients without associated tumors.

P-055

Spontaneous intracerebral hemorrhage in a child with angiotensin receptor blocker fetopathy: A case report

SP Barry (Halifax), P McNeely (Halifax)*

We report an unusual case of multiple intracerebral hemorrhages in a 3 year 6 month old boy with a history of multiple congenital anomalies atributed to fetal exposure to Angiotensin II Receptor Blockers (ARB). The teratogenicity of ARB's are well documented. The patient's complex medical problems included chronic renal failure, hypertension, anemia of chronic disease, developmental delay, hypothyroidism, gastroesophageal reflux, and hypocalvarium. He was transferred to our hospital by air ambulance for management of acute or chronic renal failure. On arrival, profound neurological deterioration was noted, representing a dramatic change from his condition on leaving the referring hospital. His Glasgow coma score was 6, and his pupils were not reactive to a light. Neuroimaging studies demonstrated multifocal bilateral parenchymal hemorrhages with a large right basal ganglia hematoma causing significant midline shift with obstructive hydrocephalus. He did not improve despite cerebrospinal fluid diversion and medical measures instituted to manage his raised intracranial pressure. A palliative approach was recommended to the family, and the patient died 4 days post-hemorrhage. It was postulated that platelet dysfunction secondary to chronic renal failure may have contributed to the hemorrhage, but abnormal fetal cerebrovascular development resulting from the ARB teratogenicity is suspected to have played a role. Autopsy results are still pending. To our knowledge, this is the first case of intracerebral hemorrhage in the pediatric population purported to be caused by maternal ingestion of ARBs.

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P-056

How Common is ADHD in Children with Medically Intractable Epilepsy?

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Objective: To determine the prevalence of ADHD and epilepsy correlates of this condition in a population of children with medically intractable epilepsy. *Methods:* Children aged 5-17 years with medically intractable epilepsy, defined as failure of more than two appropriate AEDs for lack of efficacy and seizure frequency of at least every three months over the past year were identified from the Refractory Epilepsy Clinic of the Alberta Children's Hospital. Mothers completed the ADHD-Rating Scale-IV and patient charts were reviewed for age at seizure onset, epilepsy type (generalized vs localization-related), etiology (idiopathic/cryptogenic vs symptomatic), seizure frequency, history of status epilepticus, current number of AEDs, prior number of AEDs failed for lack of efficacy, current phenobarbital/benzodiazepine/levetiracetam use, ambulatory status (independent ambulation vs not independent ambulation) and cognitive status (borderline/normal vs delayed). *Results:* Forty three children were included, representing 66% of all eligible families. Thirty two (74%) children had ADHD-RS-IV scores at or above the 85%ile, and 10 (23%) scored at or above the 98%ile. Most epilepsy variables showed no significant correlation with ADHD. However, both greater numbers of AEDs failed for lack of efficacy, and independent ambulation correlated with higher scores on the ADHD-RS-IV. *Conclusion:* Children with medically intractable epilepsy have high rates of ADHD, however epilepsy variables correlate poorly with this disorder.

P-057

Brain Injury Patterns on MRI in Cooled Neonates with Hypoxic-Ischemic Encephalopathy(HIE)

JH VanderPluym (Edmonton), SL Bonifacio (San Francisco), HC Glass (San Francisco), J Barkovich (San Francisco), DM Ferriero (San Francisco)*

Background: Past neuro-imaging studies suggest sparing of the basal ganglia in infants with HIE who are treated with hypothermia. We assessed the pattern of brain injury on MRI in infants with HIE treated with whole-body cooling. *Methods:* We included term, non-syndromic infants with HIE, who met eligibility for cooling according to UCSF criteria. MRI was performed at a median of 4 days of age. The injury patterns were defined based on the principal site of injury: watershed (WS), basal ganglia/thalamus (BG/T), and normal (N). *Results:* 14 cooled newborns were compared with 24 non-cooled matched historical controls. There was no overall difference in the pattern of injury (Fisher's exact p=0.24). The decreased odds of BG/T injury in cooled infants was not significant (OR 0.23, 95% CI 0.02-1.48, p=0.08). *Conclusion:* We found no definite difference in the pattern of brain injury between the two groups. There was a trend toward less BG/T injury in cooled newborns. The lower risk of BG/T injury may represent a true neuroprotective effect of hypothermia, or may be explained by chance or bias. Larger studies are needed to determine the significance of these findings and correlation with outcomes is necessary to fully determine the effects of cooling. (See Table)

Predominant Pattern of Injury on MRI	Cooled Infants n=14	Not Cooled Infants n=24
Normal	4 (29%)	4 (17%)
Watershed	8 (57%)	10 (42%)
Basal Ganglia	2 (14%)	10 (42%)

P-058

A population-based cross-sectional study to investigate depressive symptoms in children with post-concussive symptoms

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Background: The diagnosis of post concussion syndrome (PCS) is controversial. Some researchers believe PCS symptoms result from pre-morbid stressors rather than the mild traumatic brain injury (mTBI) itself. Depression may precede or follow mTBI and may mimic PCS in adult populations. The purpose of this study is to investigate whether depression and life stressors influenced outcome of children with mTBI. *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). Study sample and control group were representative of the population with respect to age and sex distribution. Outcome measures: Child Depression Inventory, Significant Life Events Score, Post-concussion Symptom Inventory. *Results:* Symptomatic children (12.40 ± 4.50 years) were significantly older than asymptomatic controls (9.37 ± 5.63 years), $p < .01$. The symptomatic cohort experienced more life stressors $p < .01$. There was no difference in depressive symptoms between groups, $p = .52$. Significant life events score was a predictor of being symptomatic post-injury after controlling for the effects of age (Wald (1) = 8.51, $p = .004$). *Conclusions:* Children who developed PCS symptoms following mTBI experienced more life stressors but did not report more depressive symptoms 1-3 years following the injury. It appears that depression is not associated with PCS; however, further investigations are needed to explore the role of life stressors.

P-059

Hypothermia is associated with Amplitude-Integrated Electroencephalogram (aEEG) Background Abnormalities in Neonates with Hypoxic-Ischemic Encephalopathy (HIE)

SL Bonifacio (San Francisco), JH VanderPluym (Edmonton), HC Glass (San Francisco), J Barkovich (San Francisco), DM Ferriero (San Francisco)*

Background: aEEG background changes are associated with neurodevelopmental outcome in term infants with HIE. We assessed whether aEEG background differs in infants treated with hypothermia and with similar magnetic resonance imaging (MRI) patterns of brain injury. *Methods:* We studied 14 hypothermic and 17 normothermic term, non-syndromic infants with HIE. aEEG was performed within 24 hours of MRI. Tracings were scored using pattern recognition: continuous normal voltage (CNV), discontinuous normal voltage, burst suppression, continuous low voltage, and flat trace. The predominant pattern was noted and patterns other than CNV were considered abnormal. MRI injury patterns were defined by the principal site of injury: watershed, basal

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ganglia/thalamus, or normal. Logistic regression was used to assess the relationship between hypothermia and aEEG background. *Results:* The rate of abnormal aEEG was higher in hypothermic infants for all patterns of brain injury. After adjusting for pattern of injury, the odds of abnomal aEEG in cooled infants was 11.8 (95%CI 1.4-102.6), p=0.03. *Conclusion:* Hypothermic infants had increased odds of abnormal aEEG background activity. This may be related to differences in recovery from encephalopathy, medications, or changes related to hypothermia.

	Hypothermic	**Normothermic**
Normal MRI	N=4	N=1
Abnormal aEEG	1 (25%)	0 (0%)
Watershed Pattern	N=8	N=9
Abnormal aEEG	6 (75%)	2 (22%)
Basal Ganglia/Thalamus Pattern	N=2	N=7
Abnormal aEEG	2 (100%)	5 (71%)

P-060

Psychogenic non-epileptic seizures (PNES) in children: psychological associations

MB Connolly (Vancouver), I Jokic (Vancouver), M Ransby (Vancouver), K Farrell (Vancouver), A Ho (Vancouver)*

Background: Misdiagnosis of PNES is common as they may mimic epileptic seizures and occur in patients with epilepsy. The objective of this study is to assess the prevalence of psychological disorders in children with PNES. *Methods:* Patients were identified from the EEG database at BC Children's Hospital over a 15.5 year period. PNES was diagnosed by video-EEG monitoring and a comprehensive psychological assessment. *Results:* 59 children with PNES were identified, 25 of whom had epilepsy. 78% were female and the mean age at onset was 11.7 years. Neurodevelopment was normal in 75%. Anxiety disorders occurred in 41%, mood disorders in 12% and psychosis in 3%. Suicidal ideation or attempts occurred in 10% and self-injurious behavior in 12%. Substance abuse was observed in 7%. Sexual abuse was reported in 10%, bullying and teasing in 49%. School difficulties occurred in 41%, peer and teacher difficulties in 37% and family difficulties in 63%. Family history of anxiety was observed in 20%, mood disorders in 27%, psychosis in 2% and suicide in 12%. *Conclusions:* Anxiety, life and school stressors, bullying and teasing are common in children with PNES. An understanding of factors associated with PNES in children may result in more appropriate management.

P-061

The critical role of β1-integrin and its interaction with the centrosome in astrocyte wound healing

M Thibeault-Eybalin (Montreal), S Carbonetto (Montreal), P Holland (Montreal), H Peng (Montreal)*

Background: In response to central nervous system (CNS) injury, astrocytes orient toward the wound and form a "scar" that delimits the damaged area but impedes neural regeneration. Studies in vivo and in vitro have emphasized the role of the extracellular matrix (ECM) but not integrins, the main transmembrane receptors to interact with the ECM, in scar formation. *Methods:* The scratch assay was the experimental model used, which consisted in scratching a confluent monolayer of primary rat astrocytes with a micro-pipette to induce their polarization, migration, and process extension perpendicularly to the scratch. Wild-type and β1-null rat astrocytes were grown in suspension or allowed to adhere to culture dishes coated with different ECM proteins under various conditions. Addition of peptides containing high-affinity recognition sequences and function-blocking antibodies against α1, α6, and β1 subunits served to assess the contribution of specific integrins. *Results:* Seven integrins, each composed of α and β subunits, exist in astrocytes. Those of the β1 family were found to be essential for astrocyte polarization induced by a scratch wound. β1-integrin activation triggered reorientation of the centrosome, a major microtubule-organizing center (MTOC) localized close to the nucleus, toward the wound side promoting microtubule polymerization and polarized astrocyte process extension in that direction. Interference with β1-integrin disrupted the MTOC integrity and reorientation process. *Conclusion:* β1-integrin regulates centrosome integrity and polarization in a simple in vitro assay of astrocyte wound healing. Drugs inhibiting β1-integrin-mediated pathways may alter astrocytic scar formation in response to CNS injury in vivo.

P-062

Extrapontine myelinolysis with malignant cerebellar edema occurring after DDAVP-induced hyponatremia in a child: a rare problem with a tragic outcome

A Szymczak (London), S Levin (London), D Fraser (London), A Ranger (London)*

Background: We present the case of a 13 year old boy who presented with a severely depressed level of consciousness. He experienced a severe and rapidly overcorrected hyponatremia, resulting in a severe osmotic myelinolysis syndrome. His previously repaired nasofrontal encephalocele at 3 months of age and subsequent panhypopituitarism necessitated long-term corticosteroid, deamino arginine vasopressin (DDAVP) and thyroid hormone replacement. Brain imaging demonstrated mulitple bilateral changes in the basal ganglia, thalamus, pons and cerebral white matter consistent with CPM and EPM and malignant cerebellar swelling which ulimately required surgical decompression. *Method:* Despite muliti-disciplinary input involving critical care, endocrinology and neurology, the cerebellar edema progressed. The child was taken to the operating room for a suboccipital decompression, with subsequent improvement in his level of consciousness and in his imaging postoperatively. *Results:* Despite making a good recovery from surgery, this boy went on to a sudden cardiorespiratory event 8 weeks into his admission and succumbed to this. *Conclusion:* The literature contains few reports of children with this unusual event, and none requiring surgical intervention. EPM has been reported fewer than 20 times in children. Despite this, clinicians need to be aware of the impact of electrolyte imbalances on the brain, particularly in the setting of an underlying endocrinological disturbance.

P-063

Is it a Concussion or a Minor Traumatic Brain Injury or a Mild Traumatic Brain Injury?

KE Gordon (Halifax), EA Fitzpatrick (Halifax), P Wren (Halifax), JM Dooley (Halifax), EP Wood (Halifax)*

Background: The terms: concussion, minor traumatic brain injury and mild traumatic brain injury (TBI) are used interchangeably. We

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explored whether parents view these terms as equivalent. *Methods:* A convenience sample of parents attending a regional pediatric Emergency Department completed a questionnaire (N=2304). The equivalence or non-equivalence of the diagnostic terms: concussion, minor TBI and mild TBI were assessed in a pair-wise fashion. An embedded experiment was used to improve generalizability, changing the order of presentation of the two diagnostic terms and use of the outcome as "better" or "worse". The described injury involved children either "11" or "15" years old through a mechanism of an "accidental fall" or "playing sports". There were 48 different questionnaire versions with each parent responding only once. *Results:* 1734 questionnaires were received from eligible respondents (response rate: 75.3%). Missing values for individual questions ranged from 0.1 to 2.1%. Concussion was seen as considerably "better" than minor TBI ($p<0.001$, chi-square). Concussion was also seen as considerably "better" than mild TBI ($p<0.001$). Minor TBI was seen as "better" than mild TBI ($p=0.009$). There was a moderate degree of variability in parent/guardian responses. No significant effect was seen for the order of presentation, the nature of the outcome, the age of the children, or the mechanism of injury. *Conclusions:* Our findings suggest that parents interpret these terms (from better to worse) as: Concussion >>> minor TBI > mild TBI. Clinicians need to be aware of this interpretation, and choose their language carefully, when discussing traumatic brain injury with parents.

P-064

Acute traumatic subdural hematoma with associated restricted diffusion of cerebral white matter

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Background: Traumatic brain injury is a major cause of morbidity and mortality in infants. Diffusion weighted imaging has been shown to detect early injury in infants with traumatic brain injury and the presence of early injury correlates with poor outcome. Objectives: To describe the diffusion weighted imaging abnormalities in a series of infants with unilateral traumatic subdural hematoma. *Results:* We report 4 cases of infants aged 6-19 months, with suspected abusive head trauma and unilateral subdural hematoma who had isolated early restricted diffusion of the cerebral white matter. Three of the four had unilateral restricted diffusion and one had bilateral restricted diffusion of the white matter. All four patients presented with multiple seizures and bilateral multilayered retinal hemorrhages. All four patients survived with significant motor and cognitive deficits and had significant cortical atrophy on long-term imaging. None of the patients had evidence of extracranial arterial dissection. *Conclusion:* Diffusion restriction of the white matter in the setting of subdural hematoma and traumatic brain injury is a marker of poor outcome in infants. The mechanism for this phenomenon is unclear however does not appear to be vascular in origin. We propose that selective white matter injury as a result of either reperfusion or axonal degeneration in response to the initial insult accounts for this novel pattern of infantile traumatic brain injury.

P-065

Parental and patient strategies for ensuring adequate sleep deprivation in children undergoing sleep-deprived EEG

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Rationale: Sleep-deprived EEGs (SDEEG) places a notable burden on both parents and children. *Objective:* To prospectively study the specific strategies used by parents and/or children to ensure sleep deprivation before undergoing a SDEEG. *Methods:* Inclusion Criteria: Children (1-17 years) referred from the neurology and general pediatrics outpatient clinics at McMaster Children's Hospital for a SDEEG during May 2008-ongoing. All participants were interviewed by either an EEG technologist or co-investigator and were administered a qualitative questionnaire. The data collected was analyzed for trends and main themes. *Results:* 30 patients (aged 3-17 yrs) were interviewed, to date. Main themes identified for the patients were: 1) Parents' reactions to SDEEG; "Will my child fall asleep during EEG?" (66.6%), 'how will I do this?" (53%), and "I do not want to keep myself awake"(13%); 2) Strategies used to keep child awake at night; 29/30 engaged in some sort of indoor activities (80% watched TV, 56% watched video, 50% played computer/video games). 15/30 engaged in outdoor activities (23% went shopping, 20% visited restaurants, 13% went for a walk; 3) Strategies used to keep child awake on trip to hospital; constantly talking to child (73%). *Conclusions:* Certain sleep-deprivation strategies were used across all seasonal and age groups (watching TV, playing computer/video games, constantly talking during driving). Similarly, parents, across all patient age groups, are primarily concerned with whether their child will fall asleep during the SDEEG. The data collected can be used to help parents and children better cope with sleep-deprivation before SDEEG and to lessen their anxiety regarding adequate sleep deprivation.

P-066

Pediatric exophytic brainstem gliomas and post-operative cerebral salt wasting syndrome

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Background: Hyponatremia, in patients with central nervous system disease, may be due to impaired free water retention (SiADH) or excessive sodium excretion (cerebral salt wasting; CSW). Although the exact pathophysiology of CSW is not well defined, it is likely that humoral and neural mechanisms are involved. Of the many natriuretic peptides studied, the Brain Natriuretic Peptide (BNP) is a key player. Its secretion may be from the hypothalamus or its sympathetic projections. Although CSW has been associated with multiple central nervous system afflictions, to our knowledge, it has not yet been correlated with brainstem tumor surgery. We present two such cases. *Method:* Case Report, review of the literature and hypothesis emission regarding pathophysiology. *Results:* Subtotal resection was performed for exophytic tumors of the medulla oblongata in two patients, a 7 month old girl and 19 month old boy, who presented with failure to thrive and intermittent vomiting. Histopathology revealed pilocytic astrocytoma (grade 1). In the first hours after surgery, severe and symptomatic hyponatremia occured in both patients as a result of CSW syndrome. The condition resolved in 24 to 36 hours under appropriate treatment. *Conclusion:* Hyponatremia and CSW syndrome may occur following surgery of

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brainstem lesions, such as brainstem gliomas in children. Possible explanations regarding the pathophysiology are: (1) transitory dysfunction of sympathetic medulla projections, (2) secretion of natriuretic peptide from a nondescribed region in the medulla, and (3) ANP secretion as a result of increased blood pressure from brainstem manipulation.

P-067

Neuroimaging Correlations of Frontal Intermittent Rhythmic Delta Activity in Children

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Objective: To determine the correlation between frontal intermittent delta activity (FIRDA) and the clinical and radiological correlates in children. *Methods:* Retrospective review of the EEG and imaging studies of 37 children with documented FIRDA. *Results:* FIRDA was associated with multiple neurological conditions and not necessarily with midline lesions. Patients with abnormal neurological exam had a longer FIRDA duration (average 9.5 seconds) compared to children with no reported abnormal examination (average of 6.5 seconds). FIRDA ranged from 2 to 2.5 Hz (n=15), 3 Hz (n=17) and from 1.5 to 3 Hz (n=5) and there was a significant association between the duration of FIRDA and the abnormal findings ($p. < 0.05$, Student's T test). *Conclusion:* FIRDA does not correlate with midline brain lesions in children. FIRDA appears to be a non specific EEG abnormality of an unhealthy pediatric brain with or without seizures.

P-068

Relationship between MEG spike sources and fMRI language patterns in children with epilepsy

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Background: Language processing is typically preformed in the left hemisphere. Atypical language patterns in children are more often found in left handed individuals, and those with structural lesions and/or epileptogenic foci in the left hemisphere. This study examines the relationship between the location of the epileptic focus, as determined by magnetoencephalography (MEG) and language patterns in children with epilepsy. *Methods:* Retrospective data collection from 20 children that underwent presurgical evaluation at the Hospital for Sick Children from 2005-2008 was performed. Lateralization of MEG spike sources were compared with Functional Magnetic Resonance Imaging (fMRI) language activation maps. *Results:* 12/20 children had MEG spike sources in the left hemisphere, 7 with atypical language representation and frontal or temporal lobe foci and 5 with typical language presentation and foci outside these lobes. 8/20 children had MEG spike source in the right hemisphere, 4 with typical and 4 with unexpectedly, atypical language representation. *Conclusions:* The hemispheric side of the MEG spike source does not appear to predict atypical language patterns in children with epilepsy. Atypical language patterns may be better predicted by more precise localization of MEG spike sources. We plan further analysis of more subjects to generalize these findings.

P-069

Myoclonus-dystonia syndrome: early onset, atypical presentation in a child

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Background: Myoclonus-dystonia syndrome (M-D) is an autosomal dominant movement disorder, characterized by a combination of myoclonus and dystonia. The myoclonic jerks typically affect the neck, trunk, and upper limbs with less common involvement of the legs. Association of psychiatric symptoms is common. Onset ranges from early child- to mid adulthood. *Case:* We describe a 6 year old boy, first child of non-consanguineous parents, assessed by Neurology at 3 ½ years of age for abnormal gait. Pregnancy and early motor development were normal. He started walking at 11 months with odd posturing and jerking of his left leg, with compensatory hopping on his right leg. He also has ADHD. Family history revealed depression, anxiety, and aggressiveness on maternal side. *Investigations:* Neurological examination was normal except for an abnormal gait. Cranial and spine MRI, and nerve conduction studies were normal. A known heterozygous mutation in the SGCE gene: c.304 C>T (p.Arg102Stop) was found, confirming the diagnosis of M-D. Molecular studies of extended family are pending. *Treatment:* He has responded to a low dose of Clonazepam. *Recommendation:* Patients with evidence of dystonia and myoclonus even if only occurring in the lower limbs should be screened for M-D, especially if there are associated behavioural concerns.

P-070

Electroretinogram and Developmental Outcome of Infantile Spasms

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Background: There are no useful predictive neurophysiological markers for developmental outcome after infantile spasms (IS). The electroretinogram 30 Hz flicker amplitude (ERG), is currently used to assess retinal adverse effects of vigabatrin (VGB). The objective of this study was to assess the relationship between ERG and developmental outcome in IS. *Methods:* We undertook a retrospective study of randomly selected patients with IS (n=52) who underwent ERG. Study parameters included ERG amplitude pre-vigabatrin, IS onset, treatment delay, presentation of hypsarrhythmia at diagnosis, resolution of hypsarrhythmia 2 weeks after initiation of VGB treatment, MRI of the brain, developmental and seizure outcome at 2 year. *Results:* 47/52 children had abnormal developmental outcome, 15/47 (32%) had abnormal ERG. 5/52 had a normal developmental outcome, all (100%) had abnormal ERG. All 5 children had a resolution of hypsarrhythmia within 2 weeks and cryptogenic IS. *Conclusions:* Abnormal ERG may be a possible marker for developmental outcome along with the resolution of hypsarrhythmia in cryptogenic cases if treatment is initiated within 2 weeks. Patients with reduced ERG amplitude had normal developmental outcome at 11 month and at 2 years follow up.

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P-071

Congenital Oculomotor Paresis with Prolonged Non-Cyclic Spasm

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A 3-month-old boy developed spontaneous 30 - 60 seconds episodes of downward-inward movement of the right eye with concomitant right pupillary constriction and right eyelid retraction. The episodes stopped after 4 - 6 weeks but the right eye continued to "shake" occasionally and did not track normally, especially downward. There was no significant perinatal history other than prolonged labour and a forceps delivery. CT and MR brain scans were normal. Neuro-ophthalmological examination at 6 months of age showed impaired depression, elevation and adduction of the right eye. Initially, there was a 15-minute period of irregular 1 - 3 Hz twitching of the right eyelid and synchronous pupillary constriction and jerks of right eye adduction. This was followed by a period of constant mild right ptosis, exotropia and fixed pupillary dilatation, which lasted at least 10 minutes. Re-examination at 2 years of age showed constant miosis, right eyelid retraction and twitching, and little change in the ophthalmoplegia. There were no periods of ptosis or mydriasis. Oculomotor paresis with cyclic spasms is a rare congenital condition characterized by alternating paresis and spasm of muscles supplied by the third nerve. Typically, the two phases alternate in cycles of 2 or 3 minutes duration. The present case of congenital oculomotor paresis showed prolonged periods of spontaneous third nerve hyperactivity which were not cyclical. Although not typical of oculomotor paresis with cyclic spasms, the underlying mechanism may be similar.

P-072

MRI and Neurophysiology in Amyoplasia

SH Kelly (London), C Campbell (London), M Fortier (London)*

Background: Amyloplasia is the congenital absence of groups of muscles felt to be due to a static, early embryonic insult to anterior horn cells, typically resulting in severe arthrogryposis multiplex congenita. Although the clinical characteristics are documented in the genetics literature there is limited information about muscle MRI and neurophysiology. *Methods:* Two severely affected patients presenting to a single centre had sensory and motor NCS and EMG in the neonatal period and one at age 5 years. In both, neonatal, full-body MRI was obtained. *Results:* Both children presented with arthrogryposis multiplex congenita with no other medical issues or anomalies. Cranial nerve function and trunk muscle bulk was normal. All neuromuscular investigations and central imaging were normal. In one neonate both motor and sensory amplitudes were severely reduced in the neonatal period, but at 5 years the sensory response had normalized, with ongoing severe reduction in all motor responses. In the other neonate sensory responses were normal with reduced or absent motor responses in all muscles except the abductor hallucis. In both children EMG of limb muscles was limited due to thin muscles but revealed no significant spontaneous activity with large and polyphasic motor units. Paraspinals were normal. MR Images in both showed preserved axial musculature with symmetric, bilateral replacement of appendicular muscles with fatty tissue. *Conclusions:* Amyoplasia shows a pattern of muscle replacement by adipose tissue in appendicular muscles with normal axial muscles. Neurophysiology is consistent with the hypothesized pathophysiology of amyoplasia as a static, anterior horn cell process affecting the limbs.

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

P-073

Epilepsy is associated with greater unmet health care needs compared to the general population despite higher health resource use - A large national population-based study

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Background: Epilepsy is one of the most common neurological disorders. The objectives of this study were to determine if health status and health care utilization patterns differ between those with epilepsy compared to those without or to those with other chronic conditions (diabetes, migraine or asthma), and whether they are associated with any socio-demographic variables. *Methods:* Data from the 2001-2005 Canadian Community Health Surveys were used. Weighted estimates of association were produced as adjusted odds ratio with 95% confidence intervals. Logistic regression was used to explore the impact of demographic variables on health status and health care utilization. *Results:* Those with chronic conditions were significantly more likely to have a regular medical doctor, be hospitalized overnight and have consulted a health professional than the general population. However, those with epilepsy had the highest rate of hospitalizations and number of consultations with physicians, were less likely to seek out complementary and alternative therapies, and had less visits to the dentist. Despite higher rates of health care utilization, people with epilepsy were significantly more likely to report that they had an unmet health care need than the general population, specifically in the area of mental health. *Conclusions:* While individuals with epilepsy use more health care services than the general population, they are also more likely to feel that they have additional unmet health care needs, especially in regards to mental health care. This indicates a need for future studies to address the content of care in addition to the use of care.

P-074

Early treatment of Rasmussen's Syndrome with Ganciclovir

RS McLachlan (London), D Diosy (London)*

Background: Escalating focal sensorimotor seizures, progressive neurologic deficit and cognitive decline, usually in childhood constitute Rasmussen's syndrome. Three patients were treated with the anti-viral drug ganciclovir early in the course of their illness. *Methods:* Prior to planned epilepsy surgery for intractable Rolandic seizures with progressive neurologic deficit, 3 patients aged 5,7 and 20 years were given ganciclovir 10 mg/kg/day IV for 10 days. All were treated within 3 months of onset of the first seizure. *Results:* EEGs were abnormal in 3 and MRIs in 2 patients. CSF was normal in all three. A 20 yr old girl with >50 seizures/day and right

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hemiparesis became seizure free two days after ganciclovir was started. After two years she is neurologically normal and seizure free off medication. A 7 yr old girl with 30-40 seizures per day, left hemiparesis and cognitive impairment became seizure free 5 days after starting ganciclovir. At age 21 years she is neurologically intact, attends college but is still on medication for rare seizures. A 5 yr old girl with epilepsia partialis continua, language regression and right hemiparesis had no response to ganciclovir. After a left functional hemispherectomy pathology confirmed Rasmussen's encephalitis. At age 16 years she has right hemiplegia, is aphasic and has seizures weekly. *Conclusion:* The dramatic sustained improvement observed in two of these patients supports a viral etiology for the disease. Early recognition and treatment of Rasmussen's syndrome is important if antiviral therapy is to be of any benefit.

P-075

Prognostic value of ICA approach for EEG in prolonged unconscious states.

OE Gurskaya (St. Petersburg), VA Ponomarev (St. Petersburg)*

Background: Prognostic value of raw EEG is relatively low informative. *Methods:* The aim of this work is to assess the diagnostic value of independent component analysis (ICA) and low resolution electromagnetic tomography (LORETA) applied to raw electroencephalogram (EEG) of 16 patients in prolonged unconscious states on the 4 month after severe head injury. We compare the results to normative data of 800 healthy volunters. *Results:* All independent components, located in occipital, parietal and temporal lobes of brain in healthy volunteers, have dominant power in alfa band. But components with dominant power in delta band (1.5-4 Hz) were separated in patients in prolonged unconscious states and were located in anterior parts of brain (frontal, temporal lobes). The power of spectra in delta band of these components had a negative correlation link with Glasgo Outcome Scale after 4 months after trauma (r = - 0,66 ; p = 0,005). We found an increase of spectra power of indepedent component located in frontal lobes from mean value 3,9 uV2 in control group till 107 uV2 (median - 23 uV2) in group of patients in prolonged unconscious states. *Conclusions:* The application of ICA approach for EEG has a significant prognostic value for prolonged unconscious states.

P-077

Misdiagnosis of epileptic seizures as primary psychiatric illnesses

TE Gofton (London), SM Mirsattari (London), DJ Chong (New York)*

Introduction: Many epileptic presentations could meet DSM-IV-TR criteria for schizophrenia, brief psychotic disorder, anxiety disorder with panic attacks, and Alzheimer's dementia. Seizure mimicry can be so convincing that a seizure disorder may not be considered.
Methods: We describe the clinical profiles of six patients with epileptic seizures that manifested with prominent psychiatric symptoms and were initially treated as primary psychiatric disorders. We also discuss the scope and common characteristics of such presentations in epilepsy. *Results:* We present six patients (3 male, mean age 39 ± 12 years) with epilepsy initially diagnosed with panic attacks (3 patients), psychosis (2 patients) or schizophrenia (1 patient). Misdiagnosis led to early management of symptoms as psychiatric illness. *Conclusion:* Various psychiatric manifestations of epilepsy have been reported in the literature, but little attention has been paid to epileptic seizures presenting as psychiatric illness. The initial manifestations of epilepsy are diverse and misdiagnoses derive from a limited understanding of potential presentations and epilepsy and psychiatric disorders are also not mutually exclusive diagnoses. Clinicians must rely on their knowledge of varied presentations to consider epilepsy and whether investigations and consultation with an epileptologist are warranted. The authors have no financial interest in the therapies presented in this case series.

P-078

A Difficult Differentiation of Epilepsy from Sleep disorder and Movement disorder

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Objective: To present a case which poses diagnostic challenge between frontal lobe epilepsy, sleep disorder or movement disorder
Background: Patients with nocturnal neurological episodes may have frontal lobe epilepsy, parasomnia or movement disorder. Sometimes the investigations such as prolonged EEG monitoring, sleep study, or imaging may not be conclusive. However careful history taking may become a major tool of making a diagnosis. *Methods:* We report a case of 17 year old female who developed episodes of right leg jerking after she would fall sleep, these episodes started at age 6 months. She would wake up and will continue to have uncontrollable shaking of right leg for next 15-20 minutes. Her episodes were still continued at age 17 although were less intense but much more frequent. She has been on moderate dose of carbamazepine without any success. She had history of mild developmental delay. She was referred to movement disorders clinic and finally to epilepsy clinic. *Results:* MRI brain was normal. Ambulatory EEG was normal while she had spells. A differential diagnosis of frontal lobe epilepsy versus parasomnia such as PLMS was considered, frontal lobe epilepsy was favoured and EEG may have been negative because of deep seated focus. *Conclusion:* Patients with nocturnal seizures present a diagnostic dilemma between frontal lobe epilepsy, sleep disorder and movement disorder.

P-079

Development of Intractable Epilepsy Due to Mesial Temporal Sclerosis after Posterior Reversible Encephalopathy Syndrome (PRES)

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Background: PRES is an acute disorder characterized by seizures, alteration of mental status, decreased vision and headaches that has been associated with hypertension, transplant, and chemotherapeutic and immunosuppressant toxicity. While seizures may be problematic during the acute presentation, evolution to chronic epilepsy with mesial temporal sclerosis has not been reported. *Methods:* We report a case of a boy who developed intractable left temporal epilepsy due to mesial temporal sclerosis following PRES. *Results:* A 12 yo boy with no history of trauma, febrile seizures, CNS infection, and no family history of seizures presented with PRES and partial complex seizures eight days after initiation of intrathecal methotrexate for treatment of Burkitt lymphoma. His blood pressure ranged from

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140-180 systolic and on EEG, nearly continuous epileptiform discharges maximally in the mid and posterior left temporal region were seen. MRI showed extensive restriction of diffusion signal involving the entire left temporal lobe, insular cortex and posterior thalamus. Over a six year follow-up, he developed refractory temporal lobe epilepsy associated with MRI evidence of left mesial temporal sclerosis. He failed multiple antiepileptic medications and was evaluated for temporal lobectomy. *Conclusion:* We propose that the exceedingly frequent left temporal seizures and possible ischemic injury which occurred as a result of PRES resulted in cytotoxic injury to the left hippocampus, ultimately leading to mesial temporal sclerosis and intractable epilepsy. Seizures during PRES should be treated aggressively to prevent this rare complication.

P-080

Seizures Induced By Viewing Faces

*A Ogunyemi (St. John's)**

Background: Prosopagnosia denotes the loss of ability to recognize familiar faces. The brain localization of this deficit remains controversial. Although it is generally accepted that facial recognition involves complex visual processing, the underlying physiological mechanisms require further study. This communication describes a patient who had seizures triggered by viewing peoples' faces. Methods (Case report): This 24 year-old man presented to the emergency department of the Health Sciences Centre, St. John's NL because of a generalized tonic clonic seizure. Prior to this seizure, he had stereotype ""spells."" The spells were triggered only when he looked at peoples' faces. *Results:* The manifestations consisted of unusual abdominal sensation, nausea and a feeling of anxiety. There was no alteration in his level of consciousness. The symptoms lasted 30-45 seconds. MRI showed a non-enhancing mass lesion in the medial right temporal area. The pathological diagnosis was pilocystic astrocytoma. EEG showed focal epileptiform potentials in right posterior temporal region. *Conclusion:* The experience of our patient suggests that complex visual perception such as viewing faces can trigger epileptic seizures.

P-081

Ventricular asystole during implantation of vagus nerve stimulator

S Belkhair (halifax), D Clarke (Halifax), M Sadler (Halifax), S Rahey (Halifax)*

Background and Purpose: Randomized clinical trails have reported improvement in seizure frequency and severity with vagus nerve stimulation (VNS). Potential side effects of VNS are well known and include cardiac dysrhythmia; however, there have been few reports in the literature of ventricular asystole associated with VNS. *Methods and Results:* We report a case of a 49-year-old female patient known to have simple and complex partial seizures refractory to medical therapy for more than 20 years. She had no cardiac history. We present intra-operative ECG evidence showing ventricular asystole occurring at the time of lead testing. The ventricular asystole was successfully treated with atropine and the VNS device was explanted. The patient had no subsequent cardiac events. *Conclusion:* The findings in this case underscore the rare, but real, risk of ventricular asystole associated with VNS.

P-082

Predicting mesial temporal sclerosis using a newly identified white matter tract in 3T hippocampal images based on ex-vivo imaging and histopathological correlates

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Background: Magnetic resonance imaging (MRI) is an important diagnostic and prognostic tool in the assessment of temporal lobe epilepsy (TLE). 3T MRI reveals details not typically discernable on lower strength magnets which has been exploited to establish receiver operator characteristic (ROC) thresholds to infer mesial temporal sclerosis (MTS). This technique was utilized in 5 patients with MTS with subsequent examination of ex-vivo hippocampus sections using 3T MRI and histopathological examination to correlate ultrastructural features of MTS with pre-operative imaging measurements. *Methods:* 3T MRIs were obtained pre-operatively, and post-operatively en-bloc hippocampal resections were scanned ex-vivo and then prepared for histopathological analysis to assess thickness, myelin content, and glial fibrillary acidic protein staining in the stratum oriens, pyrimidale, radiatum, and lacunosum in the CA1 to CA3 regions. *Results:* Overlay analysis of ex-vivo tissue imaging and histological staining identified the hippocampal white matter tract as stratum lacunosum. Using this landmark, ROC analysis thresholds correctly identified hippocampal atrophy in 4 of 5 patients. Histopathological changes in various subfield of the hippocampus correlated well with pre-operative and ex-vivo imaging changes and the newly proposed measure for MTS. *Conclusions:* Using the ultrastructural details determined on 3T MRI may generate sensitive and practical pre-operative measurements to infer the presence of MTS.

P-083

Features of a subset of children with complex partial epilepsy requiring combination therapy for effective seizure control

*M Sloan (Montreal), E Simard-Tremblay (Montreal), M Shevell (Montreal)**

Objective: To identify children with CPE with increased risk for sub-optimal seizure control with one medication. *Methods:* A computerized database containing all patients seen in the context of a single pediatric neurology practice was reviewed for patients with complex partial seizures seen in the 15-year inclusive. The medical charts of the patients selected were then systematically retrospectively reviewed and EEG records were also examined. Subjects included in analysis were then divided into groups: a group in whom seizure control was attained with a single medication (Group 1) and a group for whom two or more medications were required for seizure control (Group 2). *Results:* Status epilepticus (SE) was found to be more common in Group 2 (22.2%; 6/27) than in Group 1 (4.2%; 3/72) (Chi-Square p=0.005. Patients requiring a combination of drugs for seizure control were more likely to have developmental disabilities. 55.5% of Group 2 (15/27) had developmental disabilities compared to 31.5% of Group 1 (23/73) (Chi-Square p=0.028. The presence of coexisting seizures was also significantly different with a higher predominance in Group 2 (6/27; 22.2%) than in group 1 (2/71; 2.8%) (Chi-Square p=0.001. Other dfferences between the two groups were not statistically significant.

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Conclusion: Patients with status epilepticus, with coexistent seizure types, and with developmental disabilities should be identified during neurological assessment. The treating physician should have a lower threshold for starting these children on a combination of AEDs since they are more likely to require such regimes for seizure control.

P-084

Differential Effects of Topiramate and SGS-742 in Succinic Semialdehyde Dehydrogenase (SSADH) Deficient Juvenile Mice: EEG and Behavior

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Background: Adlh5a1-/- mice is a model of human SSADH deficiency with elevated levels of GHB and GABA in urine, blood and CSF, and a phenotype with ataxia absence seizures and prolonged seizure activity with high mortality in the 4th week of life. Topiramate (TPM) enhances GABA-ergic neurotransmission, attenuates voltage-gated Na currents and inhibits excitatory neurotransmission through kainate & AMPA receptors. SGS-742 is a specific GABAB receptor antagonist currently used in clinical trials for Alzheimer disease. *Methods:* TPM (3, 4.5, 6 mg/kg) and SGS-742 (30, 100 mg/kg) were administered by i.p injections to Adlh5a1-/- mice from P12 to P20, for open-field test (TruScan) and behavioral analysis at P15 and P20. Epidural electrodes were implanted at P21 and EEG recordings were made daily from P22. Absence seizures were scored using Spike Wave Discharges (SWD) in SSADH and compared to age matched controls, over a 60 minute recordings. For comparison, Aldh5a1+/+ mice received GBL 100 mg/kg. *Results:* TPM exacerbated absence seizures in Adlh5a1-/-. SGS-742 protected against absence seizures and normalized the EEG recordings. Adlh5a1-/- mice were more active and displayed more anxiety as compared to controls on TPM more than SGS 742. TPM increased the lifespan of SSADH null mice more than SGS-742. SGS-742 significantly reduced SWD duration in Aldh5a1-/- compared to baseline and Aldh5a1+/+ on GBL ($n=4$ for all groups, $p<0.05$). *Conclusion:* Experiments with TPM versus SGS 742 may be useful tool for the investigation of the mechanisms responsible for seizure worsening and a shortened life span in SSADH null mice.

P-085

Utility of colour density spectral array and amplitude integrated electroencephalography for seizure identification in critically ill children

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Background: Colour density spectral array (CDSA) and amplitude integrated electroencephalography (aEEG) are techniques that transform EEG recordings into time-compressed displays. Our aim was to evaluate the utility of CDSA and aEEG for seizure identification among critically ill children undergoing continuous EEG monitoring. *Methods:* We transformed 17 continuous EEG recordings of at least 12 hours duration (a total of 306 hours of EEG containing 447 electrographic seizures) into separate 8-channel CDSA and aEEG displays. Six experts in electroencephalography, who were blinded to the raw EEG, were asked to review the CDSA and aEEG displays independently and mark suspected seizures. *Results:* The overall average sensitivity of CDSA for seizure identification was 73%, with a range of 61% to 82%. The overall average false-positive rate of CDSA was 0.31/hour, with a range of 0.05/hour to 0.94/hour. The overall average sensitivity of aEEG for seizure identification was 69%, with a range of 51% to 84%. The overall average false-positive rate of aEEG was 0.13/hour, with a range of 0.01/hour to 0.37/hour. However, among individual recordings, the sensitivity of CDSA and aEEG for seizure identification varied from 0% to 99%. Factors reducing the sensitivity included seizures that were focal and of low amplitude. Among individual recordings, the false-positive rate of CDSA and aEEG varied from 0/hour to 2.36/hour. Factors increasing the false-positive rate included movement and electrode artifacts, and non-ictal EEG waveforms. *Conclusions:* CDSA and aEEG appear to be promising tools for seizure identification in critically ill children when used by experts trained in electroencephalography.

P-086

Outcome in patients with psychogenic non-epileptic seizures: a prospective follow-up study

*W Truong (London), SM Mirsattari (London)**

Introduction: Lack of follow-up of PNES patients makes it difficult to assess the efficacy of early diagnosis and treatment. *Methods:* A prospective study of PNES patients admitted to the Epilepsy Monitoring Unit (EMU) at London Health Sciences Centre for video-EEG telemetry between May 2001 and May 2008. Patients with unknown outcome were identified and telephoned for an interview where a questionnaire regarding patients' outcome was administered. Several subgroups including those with PNES only, PNES plus epilepsy, early diagnosis (i.e. <two years), and late diagnosis (>two years) were studied. Gender, occupation, age at the onset of PNES, age at diagnosis, duration of PNES, number of AEDs taken before and after EMU admission, number of cranial MRIs, neurological assessments, hospitalizations/visits to the emergency departments (ED), and type of follow-up were documented. *Results:* One hundred forty three PNES patients were identified for follow-up. Fifty-seven patients (39.86%) were reached (38 females; 66.67%). Forty-six patients (80.70%) had PNES alone while eleven patients (19.30%) had PNES plus epilepsy. Mean duration of PNES was 6.71 years ± 8.43. *Conclusions:* Establishing the diagnosis of PNES resulted in improvement in outcome. Reasons for failure to return for follow-up treatment may be due to improvement or remission of PNES.

P-087

Sudden unexplained death in epilepsy (SUDEP): Report of two video-EEG monitored cases

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Background: Sudden unexplained death in epilepsy (SUDEP) is the most common cause of death in patients with epilepsy, with an incidence of 2.2-10 per 1000 patient years. Cardiorespiratory dysfunction and primary cessation of cerebral function have been proposed as causes of SUDEP. Four cases of monitored SUDEP and two cases of near-SUDEP have previously been reported. *Methods:* We report two cases of SUDEP in patients undergoing video-EEG telemetry at two centres. Patient 1 was a 42 year old woman with

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intractable partial seizures, treated with lamotrigine and phenytoin. Interictal EEG showed left temporal epileptiform discharges. MRI was normal. Patient 2 was a 62 year old man with intractable partial seizures, treated with phenytoin and carbamazepine. Interictal EEG showed left temporal epileptiform discharges. MRI results were unknown. *Results:* Both patients had terminal secondarily generalized convulsive seizures of left temporal origin, lasting 98 seconds and two minutes respectively, following which, both were prone. EEG was diffusely suppressed immediately following the seizures. In Patient 1, respiratory movements persisted for 12 minutes and EKG for 18 minutes, becoming slower and more erratic before ceasing. In Patient 2, EKG and respiratory artifacts continued for two minutes post-ictally. *Conclusions:* As in three other reported cases, diffuse EEG suppression following a terminal seizure preceded cardiac arrest. Although post-ictal respiratory effort was evident, it cannot be determined that the patients were adequately ventilating. We postulate that ictal and post-ictal hypoventilation may contribute to SUDEP with the resulting hypoxemia leading to failure of post-ictal recovery of cortical function.

P-088

A benign variant of Rasmussen's encephalitis

CS Cheung (London), SM Mirsattari (London), RS McLachlan (London), RR Hammond (London)*

Introduction: Rasmussen's encephalitis (RE), is a rare inflammatory brain disease manifesting with intractable focal epilepsy and a progressive neurologic course. A non-progressive variant of this syndrome has recently been reported in three cases. *Methods:* We describe the clinical profiles and serial investigations in four patients with pathologically confirmed RE who had relatively benign courses with no neurological progression and minimal deficits aside from that expected from the surgical interventions to diagnose and treat it. *Results:* Four patients (M:F=3:1; mean age 29.0±6.2 years) had seizure onset at mean age of 6.2±4.3 years. Their seizures remained focal and intractable with no change in semiology to indicate progressive disease. They had a stable neurological course with minimal deficits. Serial EEGs, MRIs, and neuropsychological testing showed no evidence of progression. Pathology of the resected tissue for the treatment of epilepsy unexpectedly showed chronic encephalitis consistent with RE. Surgical resection (frontal, occipital or temporal corticectomy or lobectomy) decreased, but did not stop seizures in any of the patients. *Conclusion:* We present four patients with childhood-onset RE whose long-term follow-up revealed a non-progressive form of the syndrome. These cases extend the spectrum of childhood-onset Rasmussen's to include mild, non-progressive variations. This comparatively benign variant of RE is likely under recognized.

P-089

Neuromodulation for Intractable Epilepsy

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The failure of available antiepileptic medications to adequately control seizures in a substantial number of patients underscores the need to develop novel epilepsy therapies. Electrical stimulation of deep brain structures is a promising new technology for the treatment of medically intractable seizures. Brain stimulation has been receiving increasing attention as an alternative therapy for epilepsy that cannot be treated by either antiepileptic medication or surgical resection of the epileptogenic focus. Over the last ten years there has been a progressively increasing interest in the research and clinical application of implantable electrical brain stimulation devices in the treatment of drug-resistant epilepsy. Preliminary results on humans are encouraging. However, such improvements emerge despite a lack of understanding of the precise mechanisms underlying electrical stimulation either delivered directly on the epileptogenic zone (direct control) or through an anatomical relay of cortico-subcortical networks (remote control). Although randomized controlled studies are still limited, deep brain stimulation is a promising treatment option for a subgroup of carefully selected patients with intractable epilepsy who are not candidates for resective surgery. The effectiveness, the optimal anatomic targets, the ideal stimulation parameters and devices, as well as patient selection criteria are still to be defined. We will reviews the progress made in this field. Special emphasis is given to the most important available evidence from animal and human studies, the neuroanatomical pathways and targets of stimulation. The stimulation methods and devices and the significance of correct programming of the stimulation parameters will be reviewed.

P-090

Prevalence of Temporal Lobe Epilepsy and Mesial Temporal Sclerosis in a tertiary care hospital in Pakistan

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Background: The study aims to determine the prevalence of Temporal Lobe Epilepsy (TLE) in a tertiary-care hospital in Pakistan. The study also highlights patient subset with Mesial Temporal Sclerosis (MTS) confirmed through MRI as future surgical candidates. *Method:* A retrospective study in a hospital-setting with an established specialized epilepsy clinic. A detailed questionnaire was filled describing seizure semiology and relevant investigations. 619 visiting patient were registered in the clinic. All files were reviewed. Seizure classification was documented in the files by two American Board Certified epileptologists. Patients with non-epileptic events were excluded. All MRI's were reviewed and MTS was identified using 2mm coronal MR slices. *Result:* 469 patients were diagnosed with epilepsy. These included 247(53.6%) males and 213(46.3%) females. Out of 186 patients with complex partial seizures with or without secondary generalization, 84 (45%) had TLE. EEG reports were available for 74/84 patients, out of which 66 (89%) showed temporal discharges. MTS was confirmed in 27%. Good seizure control was achieved in 21 (25%) while 24(28%) were refractory to drug therapy. *Conclusion:* TLE is a prevalent form of focal onset seizures with or without secondary generalization in Pakistan, a quarter of whom remain refractory to drug therapy and a third have MTS. The high number of TLE and MTS patients at our clinic emphasizes the need for comprehensive epilepsy surgical programs in Pakistan. Our numbers are in keeping with the published literature.

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P-091

Cortical reorganization and reduced efficiency of visual word recognition in right temporal lobe epilepsy: a functional MRI study.

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Background: The efficiency of lexical and semantic processing in right temporal lobe epilepsy (TLE) was investigated. Brain activation patterns during this processing were mapped using functional magnetic resonance imaging (fMRI). *Methods:* Ten participants with right TLE and 12 controls underwent a fMRI investigation during a lexical decision task. Lexical and semantic processing were examined by comparing behavioural and imaging data associated with words and nonwords (lexicality) and with concrete and abstract words (concreteness), respectively. *Results:* The right TLE group exhibited a larger lexicality effect compared to controls [control participants: words: 641 ± 62 msec, nonwords: 719 ± 64 msec, $t(11) = 4.93$, $p = 0.001$; right TLE participants: words: 926 ± 386 msec, nonwords: 1128 ± 417 msec, $t(9) = 4.24$, $p = 0.007$]. Both groups exhibited a significant effect of concreteness [$F(1,20) = 24.91$, $p < 0.001$]. The TLE group exhibited different patterns of brain activation compared to controls as measured by fMRI. Specifically, increased left hemispheric activation was seen, particularly in the left inferior frontal gyrus (IFG) during nonword processing. Although not as striking, differential patterns of activation was also seen during abstract and concrete word processing. *Conclusions:* Right TLE negatively affects the efficiency of lexical processing and lexical decision making. Increased involvement of the left IFG suggests that the neural networks involved in this decision making have been partly shifted outside of the pathological right IFG into the left hemisphere. Right TLE therefore alters the normal functioning of cortical networks involved in semantic processing.

P-092

The Clinical and EEG features of Rolandic Epilepsy in the adult

*A Ogunyemi (St. John's)**

Background: In children, Rolandic epilepsy is a benign syndrome with well-defined clinical features and EEG findings. The EEG shows diphasic spikes in the central-midtemporal region. The electroclinical features of adult patients with central-midtemporal spikes are less well known. *Methods (Case report):* Twenty-one years ago, this 54 year-old woman suffered brain hemorrhage secondary to thrombocytopenia caused by ITP. She had recurrent generalized tonic clonic seizures when she was hospitalized for the acute brain hemorrhage. During outpatient follow-up, she no longer has generalized tonic clonic seizures. Instead, her seizures manifest with (i) difficulty with articulated speech, (ii) drooling and (iii) a sensation of ""muscle spasm"" in her throat. *Results:* During follow-up, the seizures were completely controlled with a relatively low dose of Tegretol at 200 mg bid. The interictal EEG showed left central-midtemporal spikes, the morphology of which resembled those present in childhood Rolandic epilepsy. Despite the presence of profuse spikes, she remained seizure-free for many years even when her anti-epileptic drug was discontinued. *Conclusion:* In childhood and adult Rolandic epilepsies, the interictal and ictal discrepancy may reflect a specific physiological property of the neurons of the ventral sensori-motor (Rolandic) cortex.

P-093

Epilepsy Associated with Brain Arteriovenous Malformations: Outcomes of 205 Brain AVM Patients with Seizures Treated in a Multimodality Neurovascular Program

DJ Cook (Toronto), V Geib (Heidelberg), B Pohlmann-Eden (Halifax), M Wallace (Toronto)*

Patients with brain arteriovenous malformations(bAVMs) present with seizure in 25-30% of cases. Generally, these seizures are single or infrequent events; however, there are cases that do not respond to therapy. The current study presents outcomes for bAVM patients with seizures undergoing multimodality neurovascular therapy. The Toronto bAVM database was queried to identify all patients with seizure and minimum of 1-year follow-up between 1995-2005. An age and sex matched control group of patients without seizure presentation was also selected. Twenty-seven predictors based on prior literature review were collected. Engel Class, Modified Rankin Scale and anticonvulsant medication wean were the outcomes studied. Comparisons for selected variables between the groups were made. To evaluate the effect of clinical, morphological and imaging predictors on seizure outcome, multivariate logistic regression models were constructed for each outcome. The bAVM database contained 1075 new patient visits of which 205 met inclusion criteria. Generalized seizures(64%) were the most common. Engel-class-I was achieved in 61% of cases and 27% were weaned from medication. Complete obliteration and presentation with generalized seizure were predictors of a good outcome; whereas, longstanding seizure disorder, partial-complex seizures, post-treatment perilesional edema and mesial temporal sclerosis all significantly reduced the chance of a favourable outcome.

P-094

Pre-surgical Planning for Temporal Lobe Epilepsy using Functional Magnetic Resonance Imaging (fMRI) and Event Related Potentials (ERPs)

JR Gawryluk (Halifax), RC D'Arcy (Halifax), DB Clarke (Halifax), KD Brewer (Halifax), SD Beyea (Halifax), R Sadler (Halifax), DF Weaver (Halifax)*

Introduction: Functional brain mapping has tremendous potential to guide surgical planning for neurological disorders such as temporal lobe epilepsy. In surgery, there exists a delicate balance between removing epileptogenic tissue (to prevent seizures) and preserving healthy tissue (to prevent functional impairment). The challenge is that pre-surgical mapping must derive clinically applicable data from complex networks that support cognition. The current study used fMRI in a site-directed manner to evaluate the lateral and medial temporal lobes and ERPs in a process-specific manner to assess temporal lobe function prior to surgery. *Methods:* Participants performed control (object vs. non-objects), recognition (living vs. non-living objects), and retrieval (previously presented vs. novel objects) tasks to elicit temporal lobe activation. Data were acquired with a 4T MRI and a 64 channel EEG system. Individuals with epilepsy were compared to healthy controls in order to examine temporal lobe function prior to surgical intervention. *Results:* In a representative set of results, the patient and control both show fMRI activation in the lateral (superior temporal gyrus) and medial (parahippocampal gyrus and uncus) temporal lobes. This activation was present in the area of the patient's epileptogenic focus. The ERP results for the same patient and control indicated that the patient's

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information processing was intact, although increased amplitude and latency of a P300 response suggested that the tasks were more challenging for the patient than for the control. *Conclusions:* In combination, fMRI and ERP data can inform surgery and minimize impairments resulting from the removal of eloquent tissue in epileptogenic regions.

P-095

Utility of MEG in revealing epileptogenic foci despite generalized or contralateral EEG abnormalities

CY Go (Toronto), A Ochi (Toronto), H Otsubo (Toronto)*

Purpose: To understand the role of magnetoencephalography (MEG) in presurgical evaluation of patients with hemispheric brain lesion/atrophy despite generalized or contralateral scalp EEG abnormalities. *Patients and Method:* We collected presurgical scalp EEG discharges (ictal and interictal) showing predominant (>50%) generalized or contralateral to the atrophic/damaged hemisphere on MRI in 3 patients (2 boys, 1 girl; ages, 8;8.5;13.5 years). All patients underwent scalp video EEG, MRI and MEG. *Results:* Seizure onsets ranged from birth to 3.5 years. Interictal EEG showed high amplitude spikes in normal hemispheres and low amplitude or attenuated spikes on abnormal hemispheres in 3 patients. All patients presented multiple seizures with non-localized EEG onsets. Clinical semiology was lateralized in one patient only. MEG spike sources (MEGSSs) preceded EEG spikes or appeared without corresponding EEG. There were clustered small moment MEGSSs with random orientations in abnormal hemispheres. Large moment MEGSSs with identical orientation were located around Rolandic region in normal hemispheres. Moments of MEGSSs in abnormal hemispheres were significantly smaller than those in normal hemispheres ($p<0.02$). Residual errors of MEGSSs in abnormal hemispheres were significantly larger than those in normal hemispheres ($p<0.02$). Two patients underwent functional hemispherectomy with significant improvement in seizure control. The third patient is awaiting surgery. *Conclusion:* MEG can reveal small moment but clustered epileptogenic MEGSSs that cannot be seen on scalp EEG in the atrophic/damaged hemispheres. MEG is a useful tool in helping identify the children with early-onset congenital or acquired refractory seizures despite generalized or non-lateralizing/ contralateral scalp EEG abnormalities for epilepsy surgery.

P-096

Prevalence of photoparoxysmal response among epilepsy patients in Canada

BS Kumar (London), J- Chong (London), SM Mirsattari (London)*

Background: The proportion of patients with electro-encephalographic (EEG) evidence of photoparoxysmal response (PPR) vary substantially between studies. No study has investigated the prevalence of PPR among Canadian subjects. The objectives were: (1) to ascertain the prevalence of PPR among Canadian epileptic population. (2) To assess the EEG and clinical correlates of PPR in our cohort (3) to compare and contrast our results with that of similar studies from elsewhere and thereby examine the factors responsible for the reported variability in the frequency of PPR. *Methods:* We retrospectively studied the prevalence of PPR among 34000 patients who underwent EEG recordings at London Health Science Centre between January 1, 1977 to December 31, 2007. We utilized the guidelines for Visual -sensitive EEG testing (Task Force of the Canadian Society of Clinical Neurophysiologists, 2008) and defined epileptic syndromes according to the revised International League against Epilepsy (1989) classification. *Results:* Six hundred and fifty nine patients had PPR, a prevalence rate of 1.9% which is in striking contrast to published reports from other developed countries. *Conclusions:* The prevalence of PPR was low among epilepsy patients in Canada. Geographical differences, seasonal influences, patient selection and technique for photic stimulation could greatly influence the prevalence rate of PPR.

P-097

Fronto-temporal lobectomy for medically intractable epilepsy

JD Pearl (Saskatoon), JF Téllez Zenteno (Saskatoon), V Sadanand (Saskatoon)*

Medically intractable epilepsy is often debilitating resulting in poor quality of life. Epilepsy surgery can be effective. The best results accompany astute patient selection. Here, we present two patients, aged 27 and 45, with unusual intractable epilepsy. Pre-operative investigations revealed seizure foci in both frontal and temporal lobes leading to a right fronto-temporal resection. Detailed neurologic consultation assessed the seizure semiology. One patient failed three previous epilepsy surgeries. EEG telemetry localized the seizure focus to the right frontal lobe area in both patients. The surgery was planned in two stages. First, subdural grids were placed covering the frontal and temporal lobes. These showed seizure onset on the right frontal lobe with simultaneous onset in the right temporal lobe in the first patient and onset in the right temporal lobe with immediate frontal lobe focus on the second. The second stage allowed for ECOG guided resection of the epileptogenic foci. Removing one focus did not suppress the second focus in both patients. Post-operatively, the patients remain seizure free for the past 8-10 months. Fronto-temporal lobectomy is not a common surgical procedure for intractable epilepsy. Additionally, the age of these patients is greater than the typical population known to benefit from surgery. Here, the patients' seizures did not respond to medical therapy. Second, both patients experienced recurrent violent status epilepticus and risked death. Lastly, the epileptogenic foci were well localized during Stage 1. Fronto-temporal resection for intractable epilepsy may be a reasonable surgical procedure in older patients with life-threatening epilepsy and clear foci.

P-098

Chronic Atypical Absence Seizures in GABABR1b transgenic mice

M Sonkin (Toronto), MA Cortez (Toronto), OC Snead 3rd (Toronto)*

Background: GABAB receptors (R) consist of two subunits 1a and 1b that differ in only one sushi domain. GABABR1a/2 R are presynaptic heteroreceptors whereas GABABR1b/2 are postsynaptic K+ channels. GABABR1a and GABABR1b-transgenic (tg) mice are expected to have phenotypic similarities and fundamental differences in neuronal circuitry. *Methods:* Unrestrained GABABR1b-tg (n=4) with depth electrodes for ECoG baseline, and after gamma-butyrolactone (GBL) (100mg/kg) were used to determine seizure susceptibility and quantification versus controls (n=7) for 2 hours. We compared the thalamic paraventricular nucleus (TPVN), striatum (CPu), medial thalamus (MT), lateral globus pallidum (LGP), Cornu Ammonis 1 of the hippocampus (CA1), stria terminalis (st), bed nucleus of the stria terminalis (BSTS), and the

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frontal cortex in mutant (n=4) and control groups (n=4). *Results:* GABABR1b-tg mice showed slow (S) spike and wave (SWD) from cortex, TPVN, MT, LGP, CA1, CPu and BSTS compared to controls that showed SWD from the cortex, TPVN, CPu, and BSTS, but not from the CA1, MT, and LGP. SSWD amplitudes in GABABR1b-tg were higher than in controls, except in the CPu and TPVN. GABABR1b-tg amplitude, frequency, and quality of the TPVN SSWD were similar to those in the cortex, indicating that the SSWDs seen were merely because the channel used the cortex as a reference, unlike the GBL-induced SWD control mice.
Conclusions: Multiple targeting of subcortical regions is viable tool to unveil the differential seizure generating areas in transgenic mice compared to controls. Data suggest that the medial thalamus and lateral globus pallidum is involved in transgenic SSWD.

P-099

Electroencephalography in children treated with the ketogenic diet

O Bennett-Back (Toronto), A Ochi (Toronto), M Zak (Toronto), YC Liu (Toronto), C Go (Toronto), EJ Donner (Toronto)*

Background: The ketogenic diet (KD) is a well established treatment for medically intractable epilepsy in children. Independent of seizure reduction, it has been shown that children treated with the KD have improved developmental quotients, attention and social functioning. The relationship between interictal EEG abnormalities and cognitive functioning in children on the KD has not been well explored. The objective of this study is to examine the effects of the KD on the EEG of children with intractable epilepsy. *Methods:* A retrospective analysis of EEG obtained prior to and during KD treatment in 13 children was performed using Fast Fourier Transform. Interictal epileptiform discharges (IED) were quantified. Awake and sleep background activity was assessed. Clinical data on seizure frequency, seizure severity, attention and behaviour were compared. *Results:* EEG demonstrated a reduction in IED in 5 children, no difference in 5 children and increase in 3 children. All patients with EEG improvement reported improvement in degree of alertness and some progress in developmental and/or cognitive function. *Conclusions:* Changes in interictal EEG may result in clinical improvements beyond seizure reduction in children treated with KD.

P-100

Successful integration of intracranial EEG and fMRI at 3 Tesla.

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Background: Combining intracranial EEG (ICE) with functional MRI (fMRI) is of particular interest in the study of epilepsy as it would allow the detection of much smaller interictal epileptiform discharges than scalp EEG-fMRI, and may help further investigate the spatiotemporal mechanisms of seizures. To our knowledge, ICE-fMRI has never been performed. *Methods:* Functional MRI at 3 Tesla with concurrent intracranial EEG was performed on two subjects using a modified, but commercially available EEG-fMRI system. Data analysis was carried out using techniques in routine use in our laboratory. *Results:* Subject 1 showed BOLD signal increases in both superior temporal gyri associated with epileptiform discharges recorded in the left temporal lobe. This subject also demonstrated bifrontal and biparietal spike-associated BOLD signal decreases. Subject 2 showed a maximal positive BOLD change in both temporal lobes, which was greater on the side of discharge when left and right spikes were modeled independently. It was interesting to note that no BOLD signal increases were seen in subcortical areas in either study. *Conclusions:* Intracranial EEG-fMRI can be performed safely at 3 Tesla. Both BOLD increases and decreases were observed, and positive BOLD changes were generally concordant with location of discharges recorded by ICE. Of note, runs of only 5 or 10 min of EEG-fMRI were performed as part of our implementation protocol, yet a significant number of epileptiform discharges and meaningful analyses were obtained from each run. This highlights the ability of ICE-fMRI to record and analyze many epileptiform discharges over brief periods of time.

P-101

Refractory Symptomatic Occipital Lobe Epilepsy in Infants and Children: Clinical Characteristics and Surgical Outcome

R Hung (Toronto), H Otsubo (Toronto), A Ochi (Toronto)**

Background: Intractable symptomatic occipital lobe epilepsy is not well characterized in infants and children. Our goal is to characterize the history of refractory symptomatic occipital lobe epilepsy in infants and children and the surgical outcome. *Methods:* We identified patients who underwent pre-surgical evaluations for intractable symptomatic occipital lobe epilepsy. We analyzed seizure profiles, scalp video-EEGs, MEG, MRI and surgical outcomes. *Results:* Nine patients (5 female, 4 male) were collected. Median age of seizure onset was 1 month (0.25 to 42 months). Seizure semiology consisted of simple partial (3), complex partial (2), generalized tonic clonic (2) and infantile spasms (6). Ictal EEG onset was occipital (4), occipito-parietal (3), occipito-temporal (2). Seven patients underwent surgery (median 3.76 years; 0.8 - 15.7 years). Duration of time from seizure onset to surgery was 0.8- 15.4 years (median 1.48). Pathology was consistent with cortical malformations in all 7 patients. Five patients (71%) achieved post-surgical Engel's class I, one patient each achieved Class II and III with a median follow-up of 1.2 years. *Conclusion:* Infants and children who presented with intractable symptomatic occipital lobe epilepsy frequently had early onset infantile spasms secondary to cortical malformations. Surgical resection improved their seizure control in most cases.

P-102

Adult-onset medically intractable nonlesional epilepsy associated with antithyroid antibodies

*R Seetharam (London,)**

Background: Hashimoto's encephalitis is a well-known cause of epileptic seizures and neurological dysfunctions. This study examines the role of isolated serum antithyroid antibodies in patients with medically intractable epilepsy. *Methods:* During the routine presurgical evaluations in our epilepsy monitoring unit over 3 months, we identified 4 patients with medically intractable epilepsy and positive serum antithyroid antibodies. Despite extensive investigations, no other cause of epilepsy was identified. *Results:* All the patients were females (mean age 49±10.3years). Age at first seizure was 35.7±16.0years. Seizures frequency was daily to weekly attacks. One had history of thyroid disease, none had active systemic symptoms. One patient experienced recurrent episodes of status epilepticus, cognitive dysfunction and fluctuating encephalopathy. TSH was low (n=2), borderline low (n=1) and normal (n=1) while

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the free T3 and T4 were normal in all. Antithyroid peroxidase antibody was elevated in all (mean 784IU/ml, range 186-2089, normal <40IU/ml). Antithyroglobulin antibody was elevated in 2 (205IU/ml and 50IU/ml, normal <40IU/ml). Other autoimmune workup was negative. CSF was performed in 2 patients and was normal. Epileptic discharges were bitemporal (n=1), multifocal in the frontotemporal regions (n=1), left temporal and right frontotemporal (n=1) and left hemispheric (n=1). One patient had chronic left hemispheric PLEDs and improved with prednisone. *Conclusions:* An immune-mediated process associated with thyroid antibodies may account for some cases of nonlesional adult-onset epilepsy and should be excluded prior to surgical interventions in patients with medically intractable epilepsy.

P-103

Lateralized interictal epileptiform discharges during REM sleep correlate epileptogenic hemisphere in children with intractable epilepsy secondary to tuberous sclerosis complex

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Rationale: We assessed lateralization of interictal epileptiform discharges (IEDs) in children with intractable epilepsy secondary to tuberous sclerosis complexes (TSC) during rapid eye movement sleep (REM), compared with those in non-REM sleep (NREM) and wakefulness (W), to determine epileptogenicity of REM-IEDs. *Methods:* We collected 26 patients (11 girls; 15 boys; range 11 months-17 years; mean, 7.3 years) who underwent scalp video-EEG. We analyzed 100 IEDs during REM, NREM and W to classify right/left/generalized. We lateralized the largest tuber on MRI. More than 50% of ictal EEG/clinical semiology in one hemisphere/side were lateralized. We compared lateralization of IEDs with MRI and ictal findings. *Results:* REM-IEDs were lateralized in 26 patients (100%), NREM-IEDs in 19 (73%) and W-IEDs in 20 (77%). Lateralization of MRI and ictal findings were concordant in 15 patients (58%, Group A), discordant in 5 patients (19%, B). Ictal EEG/clinical semiology were not lateralized in 6 patients (23%, C). In all groups, lateralization of REM-IEDs was most concordant with lateralization of MRI and ictal findings. *Conclusion:* REM-IEDs were the most lateralized compared to NREM and W in children with multiple tubers. Lateralization of REM-IEDs demonstrated the best concordance with the largest tuber on MRI and ictal EEG/clinical semiology.

P-104

Genomic Imbalances in Children with Intractable Cryptogenic Epilepsy

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Objective: The cause of epilepsy is unknown or cryptogenic in about half of all affected children. Epilepsy is a common feature of many chromosome abnormalities detected by routine cytogenetic studies. Array-based methods perform high-resolution surveys of the entire genome and detect genomic imbalances at least twice as frequently as conventional cytogenetic analysis in individuals with unexplained mental retardation. Using array Comparative Genomic Hybridization technology, our objective was to estimate the frequency of pathogenic Copy Number Variants (CNVs) in children with intractable cryptogenic epilepsy and describe their electroclinical features. *Methods:* We studied 8 children with cryptogenic intractable epilepsy and normal karyotypes by use of 2 genomewide array Comparative Genomic Hybridization (AGH) platforms. *Results:* 3 likely pathogenic CNVs were found, including 2 de novo deletions and 1 de novo duplication in 3 out of 8 affected children using Agilent Microarray Kit 244A, and 385K NimbleGen oligonucleotide array platforms. *Conclusions:* This data suggests that array technology will be able to identify the cause of intractable epilepsy in a proportion of affected children. Larger studies will be required to better estimate the frequency of pathogenic CNVs in this group. This work was supported by BC Clinical Genomics Network.

HISTORY, EDUCATION

P-105

Documentation of ethical process in neuroscience research published in the CJNS

F Zeiler (Winnipeg), PJ McDonald (Winnipeg)*

Background: Research Ethics Boards (REBs) are a valuable safeguard for the protection of participants in human subjects research. The purpose of this study was to examine the frequency of documentation of REB review in human subjects research published in the Canadian Journal of Neurological Sciences (CJNS).
Methods: All reports involving human subjects research (excluding case reports) published in the CJNS between July 2002-June 2003, and July 2007-June 2008 were reviewed for the presence of ethical process mentioned within. A total of 23 articles were assessed in 2002-2003 and 33 in 2007-2008. *Results:* Documentation of ethical process was found in 28 of 56 (50.0%) human subject investigations. Comparing between the year of July 2002 - June 2003 and July 2007 - June 2008, the mention of ethical process increased within the CJNS from 9 of 23 (39.1%) to 19 of 33 (57.6%) respectively. Evaluation of subcategories of articles during these two time periods demonstrated an increase in ethical process review from 5 of 9 (55.6%) to 15 of 17 (88.2%) in prospective studies, while retrospective studies decreased from 4 of 14 (28.6%) to 4 of 16 (25.0%). *Conclusions:* Overall increases were noted in the documentation of ethical process from July 2002 - June 2003 to July 2007 - June 2008. There was a significant increase in ethical process documentation in prospective studies. Proper ethical process in human study can be ensured by editors requiring the adherence to national and international standards prior to publishing.

P-106

Neurosurgery Residents Morning Ward Rounds: QA pilot study

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Background: Ward rounds are essential activity for residents in hospital setting and represent complex tasks requiring not only medical knowledge but also communication, clinical, patient management and team-work skills. *Aim of the study:* Identify the characteristics, strengths and weaknesses of daily neurosurgery

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residents' morning ward rounds, investigate attitudes of neurosurgery ward staff personnel towards daily Neurosurgery Residents Rounds and to aid in the development of appropriate teaching tools. *Study design & methodology:* Study conducted in Neurosurgery Ward at Hamilton General Hospital, McMaster University in the period between July and August 2008 (3 weeks). A structured questionnaire was devised based on a modification of an externally validated survey. *Results:* 57 out of total 60 staff members were surveyed: 5 attending, 8 residents, 36 nurses and 8 allied health personnel with overall response rate of 42%. Forty one % of the staff believes it is a constructive use of nurses' time, 80% a constructive use of residents' time. 58 % do not believe it allows adequate communication between nurses & residents. 42% believe that residents spoke language understood by patients. 30% believe pt confidentiality was compromised. *Conclusions:* Staff attitude of residents rounds at our center was generally positive and majority believe it is constructive way of using residents and nurses times and significantly promote the team spirit and a good tool of providing adequate communication with patients but not with nurses. Nonetheless, this study highlighted the majority of staff had expressed some concerns regarding patient confidentiality during the course of ward rounds.

P-107

How Ancient Practitioners treated Parkinson's Disease?

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

Objective: To review how the ancient practitioner in history described and treated Parkinson's disease. *Background:* The features of many neurological conditions known today were noted by ancient practitioners and make the foundation of modern concepts. This shows the keen and close observation of ancient practitioners and their role in medical advancements. *Methods:* We reviewed web based information, chapters of many text books, and other publications on the subject of history of Parkinson's disease. *Results:* Although major features of Parkinson's disease were described by James Parkinson in 1817 in his essay Shaking Palsy but partial reports of Parkinson's disease are found since 5000 B.C. The medical doctrine of the ancient Indian civilization "Ayurveda" described the symptoms of Parkinson's disease and use of a tropical legume *Mucuna Pruriens*, called Atmagupta to treat these symptoms. The seeds of *Mucuna Pruriens* are a natural source of L-dopa which is precursor of dopamine. Other practitioners such as Erasistratus of Ceos (310BC- 250BC), Aulus Cornelius Celsus (c25BC-c50AD), Pedanius Dioscorides (c40-c90), Yahya Ibn Sarafyun in the second half of the 9th century, Ibn Sina (c980-1037), John Gerard (1545-1612), Nicholas Culpeper (1616-1654), John Aubrey (1626-1697), George Cheyne (1671-1743), Francois Boissier de Sauvages de la Croix (1706-1767), Johannes Baptiste Sagar in1776, John Hunter (1728-1793), and Marshall Hall in 1841described the features of Parkinson's disease. There are many different treatments they advised for PD. *Conclusion:* The close observation, continuous research and education is important in the advancement of the medical knowledge.

P-108

A team-based learning (TBL) approach to bioethics teaching for residents

CJ Watling (London), SL Venance (London)*

Background: TBL is a teaching strategy that allows one instructor to manage multiple small groups simultaneously, thus promoting active learning while retaining cost-effectiveness. Its focus on the application of conceptual knowledge to real world scenarios makes it an attractive approach for teaching bioethics to residents. *Methods:* We developed two, 2-hour TBL modules (topics: conflict of interest, research ethics) and delivered them to a mixed group of 22-25 residents from neurology, neurosurgery, and physiatry. All residents completed evaluation forms following each session. *Results:* Residents rated the sessions as highly engaging and relevant to their clinical practices, and felt that the team-based format enhanced their understanding of the material. Residents expressed comfort with the ambiguity inherent in some of the application exercises. The opportunity to learn in a collaborative atmosphere with residents from other specialties was also well-received, and virtually all residents indicated that they would like to attend more TBL sessions. *Conclusions:* TBL is an engaging strategy that can generate considerable enthusiasm among residents. TBL may promote collaborative learning among mixed-specialty resident groups for topics of broad relevance such as bioethics. Further work is required to determine whether TBL enhances residents' learning and retention more effectively than more conventional instructional approaches.

P-109

Who Introduced Levodop use in Parkinson's Disease?

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

Objective: To discuss how Levodopa was introduced for symptomatic treatment of Parkinson's disease. *Background:* Levodopa is still gold standard treatment of Parkinson's disease. Although levodopa was introduced in 1960's but review of literature shows that levodopa precursors have been used since 5000 BC. *Methods:* We reviewed the web based information and text book chapters to study the history of levodopa. *Results:* Levodopa is found in leguminous plants, with a highest concentration in bean plant Mucuna Pruriens which was used in ayurvidic medicine since 5000 B.C. to treat parkinsonism.In 1957 Arvid Carlsson a Swedish scientist found that dopamine was a neurotransmitter in the brain and that dopamine levels in the basal ganglia were particularly high. He then showed that decrease in dopamine levels resulted in bradykinesia seen in PD. In 1959 at the international pharmacology meeting, he speculated that dopamine deficiency was responsible for causing PD and won 2000 Nobel Prize. In 1960 Oleg Hornykiewicz, in Vienna found dopamine deficiency in striatum of Parkinson's disease patient in post mortem analysis and observed the decreased dopamine excretion in the urine in PD. In 1966 he concluded that dopamine deficiency was the cause of most of the motor symptoms of Parkinson's disease. Two separate centres from Vienna and Montreal, Canada independently reported beneficial effects of open label levadopa in PD in 1961.George Cotzias in 1966 started using very small doses of L-DOPA in PD patients. symptoms. Levodopa was developed by DuPont during 1970's. *Conclusions:* This is an interesting review of history of levodopa

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P-110

Pediatric Neurology Post-graduate Training in Canada: Current Status and Future Directions

*A Doja (Ottawa)**

Background: Post-graduate residency training in Canada has changed significantly over the past 15 years, with increasing numbers of trainees and many direct entry 5-year programs. This survey was conducted to examine similarities and differences amongst programs, as well as future directions for residency training. *Methods:* A web-based survey was sent to program directors (PD's) of active pediatric neurology training programs. General questions about the programs were asked, as well as about candidate success at the RCPSC exam, breakdown of rotations, views on CanMEDS roles and questions on the future of pediatric neurology training. *Results:* 8/9 (89%) PD's completed the survey. Respondents had been practicing for a mean of 14 years and had been PD's for a mean of 5.5 years. 96.5% of all trainees successfully passed their RCPSC exam over the past 5 years. Breakdowns of the number and type of rotations for each year of training were provided. All CanMEDS roles were deemed to be important by PD's, particularly Heath Advocate, Scholar and Professional. The majority of trainees (80%) chose to go into academic practice, with the most popular subspecialty training being epilepsy. PD's are in favour of joint training sessions for residents particularly with regards to the topics of neurogenetics and professionalism. Overall, PD's see an increasing need for pediatric neurologists in the future and suggest recruitment at the medical student level. *Conclusions:* This survey provides a view of the current state of pediatric neurology training in Canada and suggestions for further development of post-graduate training.

P-111

History of Non- dopaminergic Treatments of Parkinson's Disease

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

Objective: To review the historical developments of the non dopaminergic treatments of Parkinson's disease. *Background:* Anticholinergics, amantadine and MAOB inhibitors are currently available non dopaminergic treatments of PD. Indeed the precursors of some of these agents have been used for the treatment of PD since decades or centuries before these agents were obtained in the purified form. *Methods:* We reviewed the web based information and text book chapters to study the historical developments of non-dopaminergic treatments of PD. *Results:* In 1860s Ordenstein and Charcot in Paris used extracts of Belladonna and Datura Stramoniun containing anticholinergic compounds hyoscine and scopolamine to treat PD. The Belladonna alkaloid containing atropine was noticed to improve tremor and other symptoms of PD. Gowers in 1888 noticed beneficial effect of Indian hemp, containing cannabis sativa, hyoscyamine and scopolamine in reducing the tremor and rigidity. Therefore Belladonna alkaloid used to be the main treatment of PD before synthetic anticholinergics were introduced in the 1960s. Amantadine was initially introduced in 1960 as an antiviral agent against influenza virus but was also noted to improve the symptoms of PD. Its use in PD at large scale started in 1969. *Conclusion:* The history of development of non-dopaminergic treatments of PD is interesting.

P-112

Who gave James Parkinson idea of shaking palsy

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

Objective: To review the work of James Parkinson. *Background:* James Parkinson described the features of Shaking palsy today called Parkinson's disease. *Methods:* We reviewed the web based information and text book chapters to study the work of James Parkinson. *Results:* James Parkinson (1755-1824) was a general practitioner in England . In 1817 he published "An Essay on Shaking Palsy" . He described six individuals with ""Involuntary tremulous motion, lessened muscular power, in parts not in action and even when supported, with a propensity to bend the trunk forwards, and to pass from a walking to a running pace, the senses and intellect being uninjured."" He mentioned the prolonged duration of disease and thought toxins may have a causative role. James Parkinson attended lectures of John Hunter and took notes which were transcribed by James Parkinson's son John Parkinson after his father's death in a book "Hunterian Reminiscences" published in 1833. These observations of John Hunter may have given James Parkinson an idea of features of what he called Shaking Palsy. John Hunter (1728-1793), a Scottish surgeon in 1776 gave a description of Lord L, and said, "Lord L's hands are perpetually in motion, he never feels the sensation of them being tired. When he is asleep his hands are perfectly at rest but when he wakes in a little time they begin to move". These features are characteristic of resting tremor of Parkinson's disease. *Conclusion:* James Parkinson's description of Shaking Palsy makes foundation of current concepts of Parkinson's disease.

P-113

History of Surgery for Movement Disorders

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

Objective: To review the history of surgical treatments of Movement Disorders. *Background:* Surgical treatments of movement disorders in particular Parkinson's disease are increasingly being used. Carefully selected patients with PD benefit significantly from surgical treatments. In short surgical treatments have become an important adjunctive treatment of PD. The surgical treatments are also being used for other movement disorders. *Methods:* We reviewed the web based information and text book chapters to study this topic. *Results:* Victor Horseley used cortical motor strip resection for treatment of athetosis and tremor. During 1930s and 1940s cerebral pedunculotomies and partial cordectomies were introduced to treat choreoathetosis and hemiballismus. Myer in 1940s did anterior caudate nucleus resections for postencephlitic tremors. During 1950s and 1960s ablations of ventrolateral thalamus at the nucleus ventralis intermedius (VIM) and ventralis oralis anterior and ventralis oralis posterior nuclei (VOA-VOP) were done to relieve tremor and rigidity of Parkinson's disease. Because of introduction of levodopa in 1967 surgical treatments of Parkinson's disease became less popular but in 1980s surgical therapies remerged after levodopa induced motor fluctuations and dyskinesias were increasingly recognized. Surgical treatments such as deep brain stimulation and thalamotomy are used for patients who have very advanced and refractory essential tremor. Surgical treatments are also being used for other movement disorders. *Conclusions:* The review of history of surgical treatments of Movement disorders leads

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to an optimism that surgical treatments for movement disorders will keep on developing further to play an important role in improving the quality of patients.

P-114

History of Tremor- Relation with Longivity and Intelligence?

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

Objective: To review the history of tremor. *Background:* Tremor is the most common symptom of movement disorders. *Methods:* We reviewed the web based information and other resources from libraries to review this topic. *Results:* A Sanskrit book in the University of Benares, India, 2500 B.C. "Charakasamhita" compiled by Agnivesha in chapter 20 entitled Vepathu describes tremors. Old Testament: ""When the guardians of the house tremble, and the strong men are bent"" (Ecclesiastes 12 : 3). Aulus Cornelius Celsus (c25BC-c50AD), distinguished the fine tremor from a coarse tremor. Claudius Galen (130-201 AD) called tremor "an involuntary alternating up and down motion". Ibn Sina (980-1037), called tremor as " motor unrest". Leonardo da Vinci (1452-1519) described tremor "how nerves sometimes operate by themselves without any command from soul". William Shakespeare (1564-1616) referred to tremor as ""Why dost thou quiver, man ?"" ""The palsy, and not fear, provokes me."" John Hunter (1728-1793), described tremor as "Lord L's hands are perpetually in motion."" James Parkinson (1755—-1824) 1817, in essay on "Shaking Palsy" described resting tremor as ""Involuntary tremulous motion". In 1836 Most described several cases of tremor in a single family. In 1887 Danna reported three families with 45 patients with tremor within a single pedigree. In 1889 Charcot described head tremor. In 1909 Raymond related essential tremor to neuropathic shock. In 1948 Katzenstein and in 1920s a Russian neurologist Minor linked essential tremor with longivity. In 1949 Critchley linked tremor to high intelligence and accomplishment. *Conclusion:* These are interesting historical associations of tremor.

P-115

Evolution of Dystonia in History from Psychogenic to Orgnic illness

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

Objective: To review the history of dystonia. *Background:* Dystonia is the second common symptom of movement disorders after tremor *Methods:* We reviewed the web based information and other resources to study this topic. *Results:* Focal dystonias were initially termed as "cramps" or "occupational spasms". In 1836, Kopp described writer's cramp. In 1887, Wood described facial and oromandibular dystonia. In 1901, Destarac reported the idiopathic torsion dystonia (ITD), which he initially thought was a psychogenic condition. He also noted that sensory tricks improved dystonia whereas the motor activity worsened it. Schwalbe in 1908 wrote an essay on dystonic spasms "Tonic Cramps with Hysterical Symptoms" This created an uncertainty of dystonia as a neurological or psychogenic condition. In 1911, Ziehen described torsion neurosis and determined that it was not hysterical. In 1911, Oppenheim thought dystonia was associated with abnormal muscle tone. Oppenheim concluded that "dystonia" was an organic illness, and not psychogenic. In 1911 Flatau and Sterling objected the terms deformans and musculorum because it implied a muscle condition. In 1916, Hunt observed slow and twisting movements which he related to dystonia. In 1919 Mendel coined the term "Torison dystonia." He called it "a morbid disease entity." In 1923, Wimmer described dystonia as a syndrome after observing dystonia in Wilson's disease, perinatal and postencephalitic brain damage. In 1944 Herz compiled generalized dystonia as dystonia musculorum deformans. Herz particularly focused on the spread of dystonic movements from one body part to another. *Conclusion:* It is interesting to note how the concept of dystonia changed from a psychogenic to organic condition

P-116

Jean-Martin Charcot: His Life and Legacy, His Science and Students

C Prasad (London), A Prasad (London)**

Background: Description and categorization of neurological disorders used today were largely realized through contributions of the French physician Jean-Martin Charcot (1825-1893) and his students. *Methods:* Medline (PubMed) and literature review. *Results:* Using the méthode anatomo-clinique to describe core neurological archetypes and variants, Charcot, along with his mentors, colleagues, and students contributed to a revolution in clinical neurology. He organized and transformed Salpêtrière from a chaotic institution into an internationally renowned teaching hospital. His name is linked with disorders such as amyotrophic lateral sclerosis, multiple sclerosis, Parkinson's disease, tabetic arthropathy, spastic paraplegia, Charcot-Marie-Tooth disease, aphasia. Charcot's discoveries extended to the fields of internal medicine, and psychiatry. As a brilliant diagnostician and teacher, he left a legacy which his most famous students took further. Georges Gilles de la Tourette, Joseph Babinski, Pierre Marie, Sigmund Freud and other pupils went on to make their own historic mark in the neurosciences. *Conclusion:* The many contributions of Charcot and his students at the Salpêtrière fundamentally changed the study of neurological disorders. The concepts that he identified and promoted continue to influence current medical thought. The flourishing field of modern neuroscience as a scientific medical discipline owes much to the stellar efforts of this giant.

P-117

A review of hisotory of history of Momement Disorders-When,Where and Who?

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

Objective: To review when, where and who described different Movement Disorders. *Background:* Although most of the movement disorders were described by the individuals after which they are named, but features of some of the movement disorders have been know in human history for centuries due to their uniqueness of attracting visual attention. *Methods:* We used web based information and text book chapters to study the history of movement disorders. *Results:* James Parkinson in London, England described features of Parkinson's disease in 1817.George Huntington in United States in 1872 described chorea, one of the major features of Huntington's disease. George Gilles de la Tourette in 1885 described features of tic disorder called Gilles de la Tourette's syndrome. Kinnier Wilson in England described the features of Wilson's Disease in 1912. Features of Hellervorden-Spatz disease were described by Hellervorden and Spatz in 1922. Steele Richardson and Olszewski in 1964 described the clinical features of a condition called Steele

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Richardson Olszewski syndrome which is also known as progressive supranuclear palsy. Corticobasal degeneration was first described by Rebeiz in 1968. *Conclusion:* This is an interesting review of history of Movement disorders.

P-118

Parkinson's Disease and Celebrities, is it caused by Stress, Hardwork or Exposure to Media?

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

Objective: To review if Parkinson's Disease has affected more Celebrities than any other Neurological Condition? *Background:* When Parkinson's Disease is mentioned in media, names of lots of celebrities are also mentioned. This may be one of the reason Parkinson's Disease is mentioned in the press and media more than any other neurological condition. *Methods:* We reviewed the web based information and many other resources to study this topic. *Results:* Some of the pictures of historical personalities such as General Francisco Franco of Spain (1892-1975), Mao Tse-Tung (1893-1976), show flexion of trunk, neck, elbows and knees, staring eyes, lid retraction and depression suggesting that they might have had Parkinson's disease. Other famous personalities with Parkinson's Disease include late Pierre Trudeau(1919-2000), Pope John Paul II (1920-2005), Muhammad Ali, Ray Kennedy and Micheal J. Fox. *Conclusions:* This is likely coincidental that that these famous personalities have been affected with Parkinson's disease. However this does raise a question, is Parkinson's disease more common in celebrities?

P-119

The earlier the better? Teaching the neurological exam to first year medical students

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

Background: Graduating medical students often lack of confidence in performing the neurological examination (NE). We have previously shown that identifying the elements of the NE which are important does not appear to be a problem for graduating students. Instead, it may be that teaching of the skilled elements of the NE, such as muscle stretch reflexes, is inadequate. We sought to determine whether focused teaching and evaluation of the technique of examining muscle stretch reflexes in the preclinical first year would enhance medical students' facility with this skill in their subsequent clinical rotations. *Methods:* A one-hour lecture on reflex physiology in the first-year neuroscience unit at McGill University was modified to include active teaching and demonstration of the technique of testing muscle stretch reflexes. Students were given opportunities to practice their technique during small group sessions with neurologist tutors, and were told that they would undergo an OSCE-style test of reflex technique on the day of the neuroscience unit's final examination. We devised a checklist for grading student reflex technique, and made this available to the students. We then evaluated reflex technique using the same checklist in two cohorts of second-year medical students, only one of which had received the formal teaching intervention in first year. *Results and Conclusions:* Preliminary data available by June 2009 will be presented. We also hope to stimulate discussion about the merits of early exposure of medical students to the neurological examination, and to encourage investigation in this area.

P-120

Consortium Of Multiple Sclerosis Centers (CMSC) Guidelines For A Standardized MRI Protocol For The Diagnosis And Follow-up Of Multiple Sclerosis: 2008 Revision

A Traboulsee (Vancouver), D Li (Vancouver), J Simon (Portland), L Stone (Cleveland), J Wolinski (Houston), E Radue (Basel), J Halper (Teaneck)*

MRI is widely used in the diagnosis of multiple sclerosis and increasingly in follow-up. Consensus guidelines for a standardized brain and spinal cord MRI protocol had been published. An international group of neurologists and radiologists met in Vancouver, BC, October 11th, 2008 to develop revised guidelines and indications. *Results:* Standardized brain MRI protocol with gadolinium is recommended for the diagnosis and follow-up of suspected and definite MS patients. In suspected MS, a spinal cord MRI is recommended if the brain MRI is non-diagnostic, or presenting symptoms are at the level of the spinal cord. A follow-up brain MRI with gadolinium is recommended to demonstrate dissemination in time (in the absence of new clinical symptoms), to evaluate unexpected clinical worsening, to re-assess the original diagnosis, and prior to starting or modifying therapy. A brain MRI should be considered every 1 to 2 years depending on the course. The brain MRI protocol details: 3mm thick, non-gapped, sagittal FLAIR, axial FLAIR/T2, axial pre and post single dose gadolinium enhanced T1. The spinal cord MRI protocol details: 3mm (sagittal) and 4mm (axial) thick, non-gapped, sagittal T2, Proton Density or STIR, axial T2 and axial pre and post single dose gadolinium enhanced T1 through lesions. The radiology report should be descriptive and compared with previous studies. MRI studies should be permanently retained and available. *Conclusion:* The 2008 revision incorporates new information and practice recommendations. Implementation (www.mscare.org) of useful and useable guidelines for standardized MRI protocol in MS will benefit patients and be helpful to neurologists and radiologists.

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

P-121

How is Blephrospasm associated with Ideopathic Parkinson's Disease?

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

Objective: To present a case of an interesting patient with blephrospasm who developed idiopathic Parkinson's Disease 2 ½ years later. *Background:* Essential Blephrospasm is an idiopathic adult onset dystonia and has been known to occur with increased frequency in association with atypical Parkinsonism especially Progressive supranuclear palsy but its increased occurance in association with idiopathic Parkinson's disease is not very clear. *Methods:* We present a 55 year old male who was diagnosed with blephrospasm 2 ½ years ago and was being successfully treated with Botulinum Toxin A. Later he developed idiopathic asymmetrical onset Parkinson's disease with resting tremor. There was no history of use of any drugs causing movement disorders or any exposure to

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toxins. *Results:* MRI brain was normal. *Conclusion:* This is interesting case in which blehprospasm preceeded idiopathic Parkinson's disease by 2 ½ years. This case underscores the importance of screeing patients with dystonic disorders for Parkinsonism.

P-122

A rarely Reported Movement Disorder-Task Specific Dystonia of Foot upon Walking

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

Objective: To Report an Interesting Case of Task Specific Dystonia of Foot Upon Walking. *Background:* Task specific limb dystonia is involuntary condition characterized by abnormal twisting, curling or other posturing of the involved limb upon certain activity. Task specific dystonias usually involve learned, skilled and automated type of activities such as writing and are absent during other activities. Adult onset task specific dystonia are usually seen in upper limbs invloving hands and are rare in feet. We are aware of only one case but only few cases of this conditon may have been reported before. *Methods:* We present a case of 55 years old gentleman with 3 years history of right foot toes curling in only while walking. He also noticed excessive sweating of the right foot. The inward toe curling was only present upon walking forward, and was absent on walking backwards. All five toes of his right foot were involved. *Results:* MRI of the spine showed mild spinal stenosis of cervical spine, Nerve conductions studies were normal. *Conclusion:* Task specific dystonia is usually seen in hand and rarely seen in foot. This is an interesting case of task specific foot dystonia upon walking.

P-123

A newly reported severe Tremor with Combination of Chipmax and Fluoxetine

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

Objective: To report an interesting case of a severe disabling postural and kinetic tremor on combination therapy of chipmax and fluoxetine. *Background:* Chipmax is a new drug used for smoking cessation. It is vareniciline tartarate which binds to alpha 4, beta 2 nicotine acetylcholine receptor with simultaneous partial agonist and antagonist activity which is believed to play a major role in addiction pathway. It partially stimulates dopamine release and prevents binding of nicotine. Slective serotonine reuptake inhibitors are frequently used to treat depression associated with Parkinson's disease and are considered to have a very low side effect profile in terms of exacerbating tremor and Parkinsonism. *Methods:* We report a case of a 66 year old female Mrs. E. L. who was started on chipmax to help quit smoking. One month later while she was chipmax, she was started on fluoxetine 20 mg for depression and within few days she developed a high amplitude, 10-12 Hertz disabling, flexion, extension, symmetrical, postural and kinetic tremor of both upper extremities. *Results:* On lowering the dose of fluoxetine to 10 mg the tremor improved significantly. *Conclusions:* SSRIs should be started very carefully in patients on new drug Chipmax.

P-124

Anticholinergics associated Chorea and importance of Follow up visits

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

Objective: To report a case of severe generalized chorea and orofacial dyskinesia in a Parkinson's disease patient with exposure to trihexyphenidyl. *Background:* Anticholinergic medications are used in Parkinson's disesease for control of resting tremor. These medications are known to cause anticholinergic side effects. In literature there have been reports of anticholinergics causing chorea but the exact mechanism by which they cause chorea is unknown. *Methods:* We report a case of a 81 year old female who was seen with a tremor dominant Parkinson's disease and was started on trihexyphenidyl. About 6 weeks later trihexyphenidyl was stopped and she was advised to take levodopa but unfortunately she never started herself on levodopa and continued taking trihexyphenidyl. She did not come for a follow up visit. Three years later she was referred by her family physician for severe generalized choreform movements and orofacial dyskinesias. Trihexyphenidyl was stopped and choreform movments resolved. *Results:* MRI and blood tests were unremarkable. *Conclusion:* Anticholinergic medications can cause a very disabling chorea and orofacial dyskinesias, especially in the elderly and in patients with Parkinson's disease and should be used with caution.
Video is available

P-125

A Family with Paroxysmal Kinesogenic Dyskinesia?

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

Objective: To report a case of Paroxysmal kinesogenic dyskinesia in a patient whose daughter developed the same condition. *Background:* Paroxysmal kinesogenic dyskinesia is a very rare genetic condition which is infrequently seen even in movement disorder clinics. It is characterized by brief attacks of abnormal jerking or twisting triggerd by sudden movements. The attacks may be as frequent as 100 per day or as infrequent as twice a year. It is autosomal dominant and responds to carbamazepine. The mutation responsible is localized to chromosome 16 p12 to q 12. *Methods:* We report a case of a 43 year old female who presented to our clinic with history of brief episodes of twisting of her hand induced by sudden movements lasting about 2 minutes. She was started on carbamazepine and responded well.Interestingly her 13 year old daughter developed similar episodes and responded to carbamazepine. *Results:* MRI brain was normal. *Conclusion:* In patients with suspected paroxysmal kinsogenic dyskinesia, history of children being affected with the similar condition should be asked carfully even if the children are young.

P-126

Holmes Tremor- a very Rare and very Risistant Movement disorder

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

Objective: To report an interesting case of a Holmes tremor which did not respond to pharmacological treatments. *Background:* Holmes tremor, also called rubral tremor is a 2-5 Hz rest, postural and kinetic tremor of an upper extremity and is caused by lesion in

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the vicinity of red nucleus resulting in demage to the cerebellothalamic, cerebello-olivary and nigrostriatal fibers. It has also been called midbrain tremor because isolated lesions of red nucleus may not cause tremor. Holmes tremor may only partially respond to levodopa and dopamine agonists but responds significantly to stereotactic thalamatomy and DBS in ventralis intermedius. *Methods:* We report a case of 75 year old male who suffered from an ischemic stroke involving left thalamus and left midbrain. Soon after he developed a moderate to severe amplitude, 5 Hz resting, postural and action tremor of right upper extremity. He was tried on levodopa, pramipexole, benztropin, amantadine without any significant improvement. He declined surgical options. *Results:* MRI showed Left thalamic and left midbrain ischemic infarct. *Conclusion:* Holmes tremor is a treatment challenge and surgical options should be presented to the patient. Video is available.

P-127

A combination of Blephrospasm and Apraxia of Eye Lid Opening in PSP- Diagnostic and Treatment Chellange

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

Objective: To report a case of a patient with PSP who had combination of both blephrospasm and apraxia of eyelid opening and did not respond to Botox. *Background:* Some patients with PSP may have apraxia of eye lid opening and others may have blephrospasm. The combinations of both blephrospasm and apraxia of eyelid opening in a single patient with PSP is very infrequent. These patients may not respond well to Botulinum toxin and require partial myomectomy as the combination of these two treatments is better than single intervention. *Method:* We describe a case of 67 year old male who had progressive supranuclear palsy and blephrospasm initially and was injected with Botox. He had no response on high dose of botox twice. He was noted to have features of AOL as well and was referred for partial myomectomy. *Results:* MRI brain was normal. *Conclusion:* About 10-30 % of the patients with atypical Parkinsonism and blephrospam who don't respond to Botox have underlying AOL and partial myomectomy in combination with botulinum toxin is a better treatment than single intervention.

P-128

Do we need to Chagne? Is Parkinson's Disease a Non Motor Disorder?

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

Objective: To discuss the importance of the non motor symptoms of Parkinson's disease addressing of which improves the quality of life of patients. *Background:* Traditionally Parkinson's disease have been known as a motor disorder. There is much less awareness of non motor symptoms of Parkinson's disease as compared to motor symptoms. The non motor symptoms cause significant disability, poor health related quality of life and caregiver's stress. With more awareness of Parkinson's disease the list of non motor symptoms is rapidly growing. Addressing non motor symptoms improves the quality of life of patients significantly. *Methods:* we reviewed the medline, pubmed and other resources such as text book chapters to make a comprehensive list of non motor symptoms of Parkinson's disease. *Results:* We were able to collect about 40 non motor symptoms of Parkinsons's disease from literature. *Conclusion:* The exhaustive list of non motor symptoms underscores the importance of screening the patients for these symptoms and raises the question whether Parkinson's disease should be regarded a motor or a non motor disorder.

P-129

Review of Clinical Trials to develop a protocol and address the Controversy of first drug of choice in Parkinson's

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

Objective: To review different clinical trials for Parkinson's disease to develop a simplified protocol to address teh controversy of frist agent of choice for PD. *Background:* There has always been discussion among neurologists about the drug of choice for initiation of treatment of PD. There has been a knee jerk response of starting levodopa among general practitioners for any patient of Parkinson's disease irrespective of individual variation from patient to patient. Neurologists and in particular movement disorder neurologists may have to deal with complications of less optimal treatment in these patients. *Methods:* We reviewed web based information about different drug trials for treatments of Parkinson's disease including DATATOP, ROPINAROLE study, SINEMET-CR study, CALM-PD, STRIDE-PD, ELLDOPA, PRESTO, LARGO, ADAGIO, TEMPO study. *Results:* We tried to formulate a simplified protocol in this regard. *Conclusion:* Individual variations such as age, stage of disease, comorbidity, nature of symptoms, functional status and risk of side effects should be considered from patient to patient when deciding initiation of treatment in PD patients.

P-130

Levodopa Sparing in not optimally Practiced in Young Onset Parkinson's Disease?

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

Objective: To review the use of levodopa sparing strategy in young PD. *Background:* Young PD patients are particularly sensitive to levodopa induced motor fluctuations and dyskinesias. In spite of evidence, levodopa is still used as first line drug in young patients by general neurologists and many patients develop motor complications soon after the drug is started. *Methods:* We studied the first drug of choice started by non movement disorder neurologists in young onset PD. Our inclusion criteria was idiopathic PD, age 20-39, seen by non movement disorder neurologist. Four of our patients met this criteria. *Results:* First patient K.K., a 35 year old male who was started initially on mirapex by a neurologist but a second neurologist stopped low dose mirapex and initiated levodopa. Patient developed severe uncontrollable motor fluctuations within few days of introduction of levodopa. Second Patient A.S., a 39 year old female who was started on levodopa as first line treatment. Patient seeked a second opinion from a movement disorder neurologist and levodopa was changed to mirapex. Patient did not develop any motor fluctuations. Third patient K.M., a 35 year old male who was started on levodopa as first line drug and also developed motor fluctuations. The Fourth patient A. R. , a 38 year old female seen by a non movement disorder neurologist in a teaching hospital and was started on mirapex as first line drug. *Conclusion:* There is increased need of education among community neurologists about levodopa sparing strategy in young patients.

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P-131

Dissociation of the 900 kDa neurotoxin complex from C. Botulinum under physiological conditions

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Objective: This study assesses the stability of the 900 kDa neurotoxin complex from clostridium botulinum and its dissociation under physiological conditions. *Background:* The medicinal botulinum neurotoxin product Xeomin® consists of the 150 kDa neurotoxin molecule free of complexing proteins. In contrast, first-generation neurotoxin products contain the 900 kDa neurotoxin complex consisting of the 150 kDa neurotoxin molecule and several non-toxic proteins known as complexing proteins. It has been claimed that these complex proteins serve to prolong neurotoxin persistence and inhibit neurotoxin diffusion into adjacent tissues. *Methods:* The 900 kDa neurotoxin complex was exposed to various pH values and then separated to differentiate between the resulting neurotoxin entities. Separation conditions were qualified by Western blot and the toxin activity. *Results:* The 150 kDa neurotoxin molecule is released from the 900 kDa complex in less than a minute when exposed to physiological pH values. This time frame is extremely short in comparison to the onset of the therapeutic effect which is measured in days. Therefore, the complexing proteins cannot stabilize the neurotoxin or inhibit its diffusion as claimed. Accordingly, the necessity of these complexing proteins in medicinal formulations must be questioned. Finally, these data aid in understanding the clinical equipotency of Xeomin®, the 150 kDa neurotoxin molecule free of complexing proteins, and botulinum neurotoxin preparations containing complexing proteins.

P-132

Equivalent Potency of Xeomin® and Botox®

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Objective: To compare the potency of the two botulinum toxin (BT) type A drugs Botox® (Allergan, USA) and Xeomin® (Merz Pharmaceuticals, Germany), a formulation free of complexing proteins. *Background and Method:* The biological potency of BT drugs is determined in a mouse LD50 bioassay as described in the European Pharmacopeia. It has been discussed whether there are potency differences when compared in the product-specific mouse LD50 bioassay. However, both drugs show equal therapeutic potency in clinical trials. The biological potencies of 5 commercially available unexpired batches of Xeomin® and Botox® were determined using the LD50 bioassay for batch release of Xeomin® in a blinded fashion. Relative potencies were subjected to a quantal response parallel-line probit analysis. Potency quantification was performed using the Xeomin® reference standard qualified against the NIBSC standard. Mean values of repeat measurements were compared by a two-tailed t-test for independent data. The biological potencies of the Xeomin® and Botox® batches studied were within the range specified in the European Pharmacopeia. The potencies of the Xeomin® (103.0 ± 5.7, n = 5) and Botox® batches (101.7±! 6.2, n=5) were not statistically different (p=0.734). *Conclusion:* The potency of Xeomin® and Botox® is equivalent and confirms previous clinical experience. Conversion of Botox® and Xeomin® dosages can be performed in a 1:1 ratio allowing exchange of both BT drugs in a therapeutic setting.

P-133

Comparative Antigenicity of Three Preparations of Botulinum Neurotoxin Type A in the Rabbit

S Manara (Toronto), J Bluemel (Frankfurt am Main)*, J Frevert (Potsdam), A Schwaier (Frankfurt am Main)*

Background and Method: NT 201 is a new Botulinum Neurotoxin Type A (BoNT/A) containing preparation, free of clostridial hemagglutinins and non-toxin non-hemagglutinating proteins naturally associated with the neurotoxin. In contrast, currently marketed products containing BoNT/A generally comprise various amounts of these clostridial non-toxin proteins, which may enhance the immunogenicity during therapeutical use. To compare the immunogenicity of NT 201 with two currently marketed products, Botox® and Dysport®, the formation of specific, BoNT/A neutralizing antibodies was assessed after repeated intradermal injection in NZW rabbits. The sera were first screened with an ELISA for antibodies directed against BoNT/A. Antibody-positive sera were further tested for their potency to neutralize the paralytic activity of BoNT/A in the mouse hemidiaphragm assay. *Conclusions:* Consistent with a potential clinical relevance of the overall clostridial protein burden for the immunogenicity of BoNT/A preparations, it could be demonstrated that repeated treatment with NT 201, in contrast to Botox® or Dysport®, did not induce the formation of BoNT/A neutralizing antibodies in rabbits.

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

P-134

Primary extra-axial medulloblastoma: A case report

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Background: Medulloblastoma is a fast-growing, invasive childhood tumour usually located in the cerebellum. The vast majority of these tumours are found intra-axially arising from the cerebellar vermis and apex of the 4th ventricle. There are previously described cases of cerebellopontine angle medulloblastoma, which have been intra-axial. We present an extremely rare case of extra-axial cerebellopontine angle medulloblastoma in a previously healthy adult patient. *Clinical Presentation:* This 47 year old gentleman presented with a recent history of headaches, nausea and vomiting. MR imaging with gadolinium demonstrated a large, homogenously-enhancing extra-axial lesion at the right tentorium in the posterior fossa. This lesion was thought to be a meningioma. *Intervention:* A right image-guided suboccipital infratentorial craniotomy for tumour resection was performed. Intraoperatively, the tumour was confirmed to be completely extra-axial and there was no involvement of the cerebellar tissue. Permanent histopathology confirmed the lesion to be medulloblastoma. *Conclusion:* While medulloblastoma commonly presents intra-axially, its diagnosis must not be excluded for extra-axial lesions.

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P-135

Human bone marrow-derived mesenchymal stem cells for systemic delivery of oncolytic adenovirus Delta-24-RGD

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Delta-24-RGD is an infectivity-augmented, conditionally replicative oncolytic adenovirus with significant antiglioma effects. Although intratumoral delivery of Delta-24-RGD may be effective, less invasive systemic delivery methods are critical for its successful application in humans. Due to their known tropic properties, we hypothesized that human mesenchymal stem cells (hMSCs) could be harnessed as effective systemic delivery vehicles of Delta-24-RGD to gliomas. Nude mice were implanted with orthotopic human glioma xenografts. After 7 days, hMSCs carrying Delta-24-RGD were delivered via internal carotid artery injections. Sacrifice of mice immediately after injection revealed hMSCs localized to xenografts in serpiginous arrangements and clusters, suggesting rapid adherence to tumor vessels and extravasation. hMSCs did not localize elsewhere in the brain. After 3 days, hMSCs became diffusely arranged within the tumors, indicating that they had migrated away from vessels. Immunofluorescence microscopy revealed loss of hMSCs due to lysis and spread of Delta-24-RGD from hMSCs to glioma cells over time. Parallel experiments using two rounds of treatment in mice harboring bioluminescent xenografts demonstrated significant slowing of tumor growth compared to controls ($p<0.0001$, extra sum-of-squares F test). This corresponded to an improvement in median survival from 42 days to 75.5 days ($p<0.0001$, log-rank test) and an increase in 80-day survival from 0% to 37.5%. These experiments show for the first time that hMSCs carrying Delta-24-RGD can inhibit the growth of orthotopic glioma xenografts and produce a significant survival benefit in mice after systemic delivery. This is the first demonstration of an efficacious means of systemically delivering virotherapy to brain tumors.

P-136

Intradural Extramedullary Extraosseous Ewing's Sarcoma in Middle-Aged Adults

FJ Mateen (Rochester), A Bardia (Baltimore), DH Lachance (Rochester), A Jatoi (Rochester), MG Haddock (Rochester), A Nassar (Rochester), JC Buckner (Rochester)*

Extraosseous Ewing's sarcoma (EES) involving the central nervous system is rare, but can now be diagnosed by identification of the chromosomal translocation (11;22)(q24;q12). We describe a favourable therapeutic response in two middle aged adults diagnosed with EES arising in the intradural, extramedullary space. Multimodal therapy, including radiation and alternating vincristine, cyclophosphamide, and doxorubicin (VCD) and ifosfamide and etoposide (IE) led to local tumor control. The patient with subtotal resection of the tumor, given an initial suspicion of ependymoma, required a more protracted course of chemoradiation. This report confirms that EES is not confined to the earliest decades of life and can occur with no evidence of systemic tumor involvement in extended follow up.

P-137

Multiple Ependymomas with Unusual Torsion of the Filum

AA Al Jishi (Montreal), RF Del Maestro (Montreal), M Guiot (Montreal)*

Background: Multiple isolated ependymomas of the filum terminale are rarely present. Subarachnoid hemorrhage from ependymomas is also not common. *Method:* A 43 year old male presented with history of low back pain associated with fever. His general examination demonstrated back pain and neck stiffness but no weakness. Lumbosacral MRI showed multiple non-enhancing intradural lesions. The larger cystic lesion at L2/3 was causing compression of the cauda equina. A smaller lesion was seen at T12/L1. A lumbar puncture demonstrated xanthochromia but no evidence of infection. *Results:* Intraoperatively, the larger lesion was found to be hemorraghic secondary to the tumour having undergone torsion around the filum terminale with subsequent infarction and hemorrhage. The second smaller lesion at T12/L1 was also removed. CSF did not demonstrate any malignant cells. Neuropathological examination of the removed filum terminale demonstrated other sites of isolated ependymoma. Cerebral and spine MRI did not demonstrate any other ependymal tumours or a primary intracranial tumour. For that reason, the remaining filum terminale was removed in a second procedure. No further ependymomas were identified in this tissue. The patient's postoperative course was uneventful and he has continued to do well. *Conclusion:* Torsion of a tumour involving the filum terminale is a very rare event since no other case is present in the literature. Multiple primary ependymomas of the filum terminale are also rare and a literature review will be presented. These results suggest that the large numbers of residual ependymal cells present in the filum have all undergone similar neoplastic genetic alterations.

P-138

Opsoclonus-myoclonus and VGCC antibodies with associated paraneoplastic syndromes

CB Josephson (Halifax), IA Grant (Halifax), TJ Benstead (Halifax)*

Background: Multiple paraneoplastic syndromes occurring in the same patient are extremely rare. Opsoclonus-myoclonus has not previously been described in association with anti-voltage gated calcium channel (VGCC) antibodies. *Methods:* We report a 48-year-old male with a history of squamous cell (SCC) and limited stage small cell lung cancer (SCLC) who developed a previously undescribed combination of opsoclonus-myoclonus syndrome (OMS), subacute cerebellar degeneration (SCD), and Lambert-Eaton myasthenic syndrome (LEMS). *Results:* OMS was diagnosed clinically. SCD was diagnosed clinically and through MRI while LEMS was diagnosed through electrodiagnostic testing. Extensive investigation did not reveal tumour recurrence. Paraneoplastic serology was positive for anti-VGCC antibodies. Both OMS and LEMS improved after treatment with intravenous immunoglobulin, pyridostygmine, and 3,4-diaminopyridine. *Conclusions:* Associations between SCC and neurological paraneoplastic syndromes are rare. Anti-VGCC antibodies block inward calcium currents in SCLC cell lines and paraneoplastic neurological syndromes are commonly seen in this type of cancer. Thus, this patient's presentation is likely related to the SCLC. Anti-VGCC antibodies have been described in SCD and LEMS but not in OMS.

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While an as yet unidentified antibody may have caused OMS, the role of calcium channels in OMS may be an interesting candidate for future research.

P-139

Extracranial extension of ependymoma in 16 year old boy -case report and Literature review

FE Alotaibi (Riyadh), A Maqsood (Riyadh)*

Background: Direct extracranial extention of ependymoma is very rare most of the cases the tumor metastasized to the distant organs hematological. *Methods:* We report a case of anaplastic ependymoma in 16 year old male with tumor invading to the left cheek, zygoma and left orbital cavity. *Results:* in the literature we found 4 cases as part of retrospective study of about 1600 glioms All the tumors showed invasion of meninges and/or ventricle walls, and in four cases the transgressed the dura and surrounding bone or soft tissue. *Conclusion:* Direct extracranial extension of ependymoma is very rare only reported in 4 cases but those patients patient were had distance metastases to the other organ while our patient not.

P-140

Brain tumors in the first year of life: The CHEO experience

N Mehrotra (Ottawa), MF Shamji (Ottawa), M Vassilyadi (Ottawa), EC Ventureyra (Ottawa)*

Background: Brain tumors in infants are uncommon. There is scant literature about their presentation, management and outcome. *Methods:* A retrospective review was performed of all children with brain tumors in the last 34 years treated at CHEO, including patient functional outcome, and analyzed using ANOVA and chi-squared statistics. *Results:* Eighteen infants (4.8%) were identified with an average age of 5.2 months; twelve suptratentorial, eight with benign histology, and six infratentorial all with malignant histology. The age of presentation, 5.2 months (0-10 months), did not differ by lesion location ($p=0.20$). Glial tumors were most common (n=7). Raised intracranial pressure was more than twice as prevalent with posterior fossa lesions ($p<0.01$), whereas seizures were more frequent with supratentorial tumors ($p=0.04$), and there were no differences in symptoms of apnea ($p=1.0$) or increasing head circumference ($p=0.74$). Gross total resection was achieved in 47% of patients, with greater likelihood of cerebrospinal fluid diversion among infratentorial lesions ($p=0.02$). Adjuvant therapy was more utilized for the infratentorial lesions ($p<0.01$); median survival 10 months. Among the eight surviving infants, seven had supratentorial tumors, five have survived to adulthood, and six have Karnofsky performance scores of requiring no special care. *Conclusions:* 4.8% of children with brain tumors treated at CHEO presented in their first year of life. The mode of presentation, utilization of adjuvant therapy, and survival of these infants were all dependent on tumor location and histology, with worse prognosis for infratentorial lesions. One-third of patients in this series had excellent functional outcome requiring no special assistance.

P-141

Recurrent Metastatic Papillary Thyroid Carcinoma to The Central Nervous System

QS Al Hinai (Verdun), D Sinclair (Montreal)*

Background: Papillary Thyroid Carcinoma (PTC) is the most common malignant neoplasm of the thyroid gland, corresponding to 65 to 80% of all tumors in this gland. PTC usually exhibits slow progression and a long natural history. The incidence of PTC cerebral metastases is 0.1 to 5%. The anatomic sites in the central nervous system to which PTC metastasize are the cerebrum (69%), the cerebellum (13%), and the spinal cord (18%). The risk for distant metastases seems to be dependent upon the extension and the pathological characteristics (multi-centricity and extra-thyroidal invasion) of the primary thyroid neoplasm. There is a high mortality rate associated with pulmonary or cerebral metastases. *Method:* We present a case of an adult diagnosed initially with local PTC but presenting some years later with metastases to the lung, pleural space, and central nervous system(CNS). *Result:* He has had three cerebral metastases, recurring over a 13 month period, each successfully resected. He has also received adjuvant chemotherapy, radioactive iodine & radiosurgery. At present, he is stable and has no neurodeficit. *Conclusion:* We use this interesting case to search the literature and review the subject on the current treatments and prognosis of this relatively rare cerebral lesion.

P-142

Population-based Study of Pseudoprogression after Chemotherapy in Patients with Glioblastoma

MG Hamilton (Calgary), G Roldan (Calgary), J Scott (Calgary), P de Robles (Calgary), A Magliocco (Calgary), P Forsyth (Calgary), G Carincross (Calgary), J Easaw (Calgary)*

Introduction: Chemoradiotherapy followed by monthly temozolomide (TMZ) is the standard of care for patients with glioblastoma multiforme (GBM). Case reports have identified GBM patients who experienced transient radiological deterioration after concurrent chemoradiotherapy which stabilized or resolved after additional cycles of adjuvant TMZ, a phenomenon known as radiographic pseudoprogression. Little is known about the natural history of radiographic pseudoprogression. *Methods:* We retrospectively evaluated the incidence of radiographic pseudoprogression in a population-based cohort of GBM patients and determined its relationship with outcome and MGMT promoter methylation status. *Results:* Out of 43 evaluable patients, 25 exhibited radiographic progression on the first MRI after concurrent treatment. Twenty of these went on to receive adjuvant TMZ, and subsequent investigation demonstrated radiographic pseudo-progression in 10 cases (50%). Median survival (MS) was better in patients with pseudoprogression (MS 14.5 months) compared to those with true radiologic progression (MS 9.1 months, $p=0.025$). The MS of patients with pseudoprogression was similar to those who stabilized/responded during concurrent treatment ($p=0.31$). Neither the extent of the initial resection nor dexamethasone dosing was associated with pseudoprogression. *Conclusions:* These data suggest that physicians should continue adjuvant TMZ in GBM patients when early MRI scans show evidence of progression following concurrent chemoradiotherapy, as up to 50% of these patients will experience radiologic stability or improvement in subsequent treatment cycles.

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P-143

Postoperative Surveillance Magnetic Resonance Imaging for Low-Grade Posterior Fossa Astrocytic Tumors

M Vassilyadi (Ottawa), MF Shamji (Ottawa), D Keene (Ottawa), Z Tataryn (Ottawa), E Ventureyra (Ottawa)*

Introduction: Patients with low grade astrocytomas generally have good prognosis when total resection can be achieved, but surveillance neuroimaging is commonly performed to detect recurrence or progression. This study evaluated utility and yield of such strategy for pilocytic and diffuse cerebellar astrocytomas. *Methods:* A 20-year retrospective review was performed of patients undergoing resection of cerebellar astrocytoma at a single institution. A negative MRI string (NMS) ratio was computed as the fraction of total follow-up period over which surveillance neuroimaging was negative for recurrence or progression. Chi-squared analysis differentiated NMS ratio by resection extent and lesion histopathology. *Results:* Twenty-eight patients with pilocytic (n=15) and diffuse (n=13) astrocytoma underwent 34 craniotomies, with total resection in 19 cases. Surveillance MRIs (n=167) among total resection patients were uniformly negative for recurrent disease at average 7 years follow-up (NMS ratio = 1.0). The 43 surveillance MRIs among subtotal resection patients revealed disease progression in 2 patients within 6 months of operation (NMS ratio = 0.78, $p<0.05$), with second craniotomy performed in six cases. No differences in NMS ratio were observed between pilocytic and diffuse astrocytoma subtypes (Table 1).

	Pilocytic			Diffuse		
Resection	Total	Subtotal	p-value	Total	Subtotal	p-value
N	11	4		8	5	
Age (years)	7 ± 3	7 ± 5	0.95	7 ± 6	8 ± 4	0.63
Gender (% female)	45%	57%	0.57	38%	80%	0.27
MRIs / patient	7 ± 2	7 ± 2	0.55	8 ± 5	9 ± 4	0.82
Fraction of MRIs with GA	42%	55%	0.57	47%	30%	0.49
Recurrent or Progressive Disease	None	25%	N/A	None	20%	N/A
Re-operation	None	50%	N/A	None	80%	N/A

Discussion: This study illustrates pediatric patients with low-grade cerebellar astrocytomas undergoing total resection may not benefit from routine surveillance neuroimaging, primarily because of low recurrence likelihood. Patients with subtotal resection may benefit from surveillance of residual disease, with further work planned to evaluate optimal scheduling for such observation.

P-144

Postoperative Surveillance Magnetic Resonance Imaging for Pediatric Brain Tumors

M Vassilyadi (Ottawa), MF Shamji (Ottawa), D Keene (Ottawa), Z Tataryn (Ottawa), E Ventureyra (Ottawa)*

Introduction: Pediatric brain tumors have highly variable prognosis, dictated by lesion histopathology and extent of tumor resection. Surveillance neuroimaging is commonly performed to detect recurrence or progression, although the utility of such tactic remains uncertain. This study evaluated the yield of such strategy for various benign and aggressive pediatric brain lesions. *Methods:* A 20-year review was performed of surgically-treated brain tumor patients at a single institution. A negative MRI string (NMS) ratio ranging from 0 to 1 was computed as the fraction of total follow-up period over which surveillance neuroimaging was negative for recurrence or progression. For a given surveillance strategy, low NMS ratio characterizes aggressive lesions or inefficient screening strategy. Chi-squared analysis differentiated NMS ratio by intracranial compartment and lesion histopathology. *Results:* Of 152 patients with average 5.3 years follow-up and 6 MRIs, lesion location was supratentorial in 80 patients and infratentorial in 72 patients. Distribution of tumor histopathology is summarized in Table 1, with clinical and radiological follow-up and recurrence likelihood. Over 900 surveillance MRIs were performed, with detection of recurrent disease depending on lesion histology ($p=0.02$) but not intracranial compartment ($p=0.18$). NMS ratios varied by tumor type ($p<0.01$) as high as 0.84 for pilocytic astrocytoma and less than 0.3 for anaplastic astrocytoma and ependymoma.

Tumor type	Number	Number of recurrences	Average number of MRIs	Follow-up duration	NMS Ratio
Pilocytic astrocytoma	21	1	11	7	0.84
Diffuse astrocytoma	23	1	8	7	0.78
Anaplastic astrocytoma	16	3	7	9	0.25
Ependymoma	11	4	12	6	0.27
Medulloblastoma	35	9	10	6	0.74
Oligodendroglioma	5	0	7	5	1.0
Ganglioglioma	14	0	8	7	1.0
Pituitary adenoma	5	0	8	5	1.0
Craniopharyngioma	13	4	9	4	0.92
DNET	9	1	8	4	0.89

Discussion: This study suggests that surveillance neuroimaging may be tailored by lesion histopathology and resection extent. Low-grade cerebellar astrocytomas may not benefit from routine surveillance because of low recurrence likelihood. Aggressive lesions like anaplastic astrocytoma may benefit from repeated evaluation of residual disease.

P-145

Metastatic Craniopharyngioma - Case Report and Literature Review

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Background: Distant spread of craniopharyngioma is a rare but important complication. Most cases are a result of spread along the surgical path. We describe a rare case of metastatic leptomeningeal craniopharyngioma as a result of dissemination along CSF pathways. A review of previously described cases is provided. *Case Presentation:* A 14 year old male was diagnosed with metastatic craniopharyngioma on routine follow-up imaging after multiple surgeries and radiation for locally recurrent craniopharyngioma. The lesion was erosive through the right parietal bone, but had remained clinically silent. The lesion was distant from previous surgical paths. *Intervention:* The patient underwent right parietal craniotomy and resection of the lesion. Duraplasty and cranioplasty were necessary for closure. Histopathology confirmed adamantinomatous craniopharyngioma. *Conclusion:* One year follow-up demonstrated no recurrence. A review of reported cases suggests that

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leptomeningeal implantation may be an important step in metastases of craniopharyngioma, although the mechanism is poorly understood. Attention to tumor spillage at the time of surgery may be important in preventing distant recurrences.

P-146

Pilomyxoid astrocytoma in two different age groups

AO Alobaid (Hamilton), B Lach (Hamilton), K Reddy (Hamilton), S Singh (Hamilton)*

Pilomyxoid astrocytoma (PMA) is a newly identified tumor entity, previously was consider as a variant of pilocytic astrocytoma. It is a pediatric disease mainly, but some adult cases have been reported. This article presents two cases of PMA, believed to be the only cases reported in our center. The first case is a 19-year-old girl who presented with a headache and decreased vision of the left eye. She underwent a three-stage surgical resection. She is presently living with decreased but stable vision of the left eye with cognitive impairment. The second case was for a 15-month-old boy, who presented with failure to thrive, frequent falls and blindness. He underwent a two-stage procedure, but unfortunately, he sustained left hemiparesis and a vegetative state, and subsequently passed away. Most of the reported cases in the literatures located in hypothalamic/ chiasmatic region, only eight cases in other locations. PMA are more aggressive than PA. Local recurrence as well as CSF spread occurs more often in PMA than pure PA. In conclusion, PMA is a rare, pediatric disease, but it should be considered in adults especially late teens and early twenties. Further studies are required regarding other location prognosis and the optimal treatment.

P-147

Intraoperative Neurophysiology with high field intraoperative MRI for brainstem tumors.

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Background: Brainstem tumors are among the most challenging tumors to operate. The combination of Intraoperative high field (1.5T) Intraoperative MRI (iMRI) with intraoperative neurophysiology (iNP) is a novel technique that is currently used to surgically address these tumors at King Fahad Medical City. *Methods:* We prospectively collected data on patients with brainstem tumors done in the iMRI suite between January 2008 to January 2009. *Results:* Eight patients had iMRI and iNP (including, sensory, motor evoked potentials and auditory brainstem evoked responses). Mean age was 12.3 years (range 14 months to 42 years), All but one patient were symptomatic. None developed lead related complications. One patient had a complete resection of the tumor with complete resolution of preexisting ataxia and dysphagia; Six patients had a subtotal resection of the tumor (>60%) 2, compared to preoperative state, 2 patients improved, 1 patient had resolved ataxia but a new left upper extremity weakness, 1 patient had worsened ataxia but able to walk, 1 patient had worse lower cranial nerve functions but improved over 3 months, 1 patient developed cerebellar mutism that improved over a period of 2 months; One patient had a biopsy with out change in pre existing state. Five patients had a pre, intra and post op MRI. Two a pre and a post op MRI. One had a pre, 3 intra and a post op MRIs. *Conclusion:* The use of iNP in an iMRI setting is safe. It is useful method to resect as much as safely possible from a brainstem tumor.

P-148

The Temozolomide RESCUE study: A Phase II trial of continuous (28/28) dose-intense temozolomide (TMZ) for recurrent malignant glioma

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Background: Surgery, then radiotherapy with concurrent temozolomide (TMZ) and adjuvant TMZ is standard for glioblastoma multiforme (GBM). However, most tumours will recur after this treatment and current 2nd-line therapy is ineffective. Continuous dosing and dose intensification of TMZ reduce levels of O-6-methylguanine-DNA methyltransferase (MGMT), a protein associated with TMZ resistance. *Methods:* Patients with high-grade glioma who failed standard adjuvant TMZ received continuous dose-intense TMZ 50 mg/m^2 for 28/28 days for up to one year. The primary endpoint was 6-mo progression-free survival (PFS). The trial used a two-stage design. *Results:* 120 pts were enrolled in 11 centres. Pts were from 4 cohorts: GBM failing during the first 6 mos of therapy (Early, B1); GBM failing after 6 mos of therapy (Extended, B2); GBM patients who recurred after stopping treatment (Completed, B3); and anaplastic glioma (Anaplastic, A). Median age was 52 yrs (25-73 yrs). 66% were male. ECOG performance status was 0 in 47%, and 1 in 53%. An interim analysis was performed on the first 90 patients. The 6-mo PFS rates were 28.6% (B1), 9.5% (B2), 30% (B3), and 38% (A). Progressive lymphopenia was observed in 40% of patients but no infections were seen. No other significant toxicities were detected. *Conclusions:* Continuous dose-intense TMZ 50 mg/m^2 is active and well tolerated despite prior use of conventional TMZ. Efficacy compares favorably to other second-line agents. Continuous dosing may offer the advantage of anti-angiogenic activity and may induce low MGMT levels. Continuous TMZ is an ideal regimen for combination with new targeted therapies.

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

P-149

Hereditary Myopathies and Chronic Respiratory Failure: Identification is the first step in improving outcomes for at-risk individuals.

*SL Venance (London), BL Howe (London Health Sciences Centre)**

Background: Inherited myopathies are a heterogeneous group of disorders. Chronic respiratory failure (CRF), often due to diaphragm weakness, develops in a proportion of affected individuals. Acute on CRF may lead to unexpected hospitalizations, invasive ventilation and intensive care bed utilization. Identifying at-risk patients is the first step in determining how best to inform and educate patients, their families and healthcare providers. *Methods:* A retrospective chart review of 159 patients with hereditary myopathies followed at the London Health Sciences Neuromuscular Clinic (LHSC NMC) was undertaken. Diagnosis, age at onset, symptoms of CRF, results

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of pulmonary investigations and use of assisted ventilation (AV) was collected. *Results:* Patients with DM1 (54), FSHD (28), LGMD (20), OPMD (18), dystrophinopathies (11) and DM2 (9) accounted for 88.1% of the clinic population. CRF was diagnosed on the basis of symptoms and signs in 11.3% (18/159). Patients with a diagnosis of DM1, Duchenne muscular dystrophy or LGMD were more likely to have CRF. AV was recommended in 17% (27/159) of patients for CRF and/or obstructive sleep apnea. *Conclusions:* Not surprisingly, CRF was more common in DM1, some LGMD and advanced Duchenne dystrophy. Education and prevention strategies may now be developed that target specific groups and/or individuals that may be at risk for acute on CRF.

P-150

Infantile Botulism—First in Newfoundland, Canada

CW Lim (St. John's), M Alam (St. John's)*

Background: Infantile botulism is a rare disorder and diagnosis is often missed. Majority of botulism reported in Canada are food borne related especially in Inuit population. *Methods:* Literatures search for infantile botulism database in Canada. *Results:* We report the first case of confirmed infantile botulism in Newfoundland, Canada. Patient is a 4-month-old Caucasian boy who otherwise healthy presented with 5 days history of progressive lethargic, hypotonic, weak cries, poor feeding and constipation. His developmental history was unremarkable. On examination, he had bilateral cranial neuropathy with sluggish pupils and symmetric descending motor weakness and hypotonia. He was suspected to have infantile botulism after septicemia was ruled out. Brain MRI and EEG were normal. Repetitive nerve stimulation revealed incremental resposne at 50Hz stimulation and small compound muscle action potentials which are consistent with infantile botulism. Botulinum toxin Type B was isolated from his stool. His source of exposures were from environmental dust and he was solely breast fed. He responded well to baby botulinum immunogloblulin treatment. *Conclusions:* The diagnosis of infantile botulism should be suspected in any infant with acute onset of weak suck, ptosis, lethargic, and constipation as suggested in our case.

P-151

Amyloid myopathy a mimicker of polymyositis—Case report

CW Lim (St. John's), G Alan (St. John's), B Jane (St. John's)*

Background: Amyloid myopathy is often misdiagnosed as inflammatory myopathy as their clinical presentation is similar. *Method:* We report a case of amyloid myopathy that mimicked polymyositis. *Result:* A 65 year-old female presented with proximal muscle weakness after a recent history of bilateral pneumonia. Her connective tissue, vasculitic, infectious works up were negative. Her CK was elevated (1100). Her initial muscle biopsy only showed a small focus of endomysial inflammation. Initial EMG study was negative and nerve conduction study showed mild distal sensorimotor axonal polyneuropathy but normal repetitive nerve stimulation study. She was diagnosed as polymyositis and treated with steroids. Her weakness continued to progress despite treatment. Further workup showed dysproteinemia (monoclonal (IgG) gammopathy) with free Kappa light chain in urine and bone marrow biopsy confirmed myeloma. A repeat EMG and muscle biopsy 3 months later showed classic myopathic changes with positive congo red material deposited in the vessels in the endomysium and perimysium. This was further confirmed with electron microscopy. *Conclusions:* Amyloid myopathy is an uncommon but important cause of myopathy especially in the elderly. Amyloid screening should be standard in routine muscle biopsy especially in cases where one suspected myositis.

P-152

Duchenne muscular dystrophy - 30 year incidence in Nova Scotia

JM Dooley (Halifax), KE Gordon (Halifax), L Dodds (Halifax), J MacSween (Halifax)*

Background: Duchenne muscular dystrophy (DMD) affects between 1/3500 to 1/6000 male births.1 There is little data available on the stability of the incidence of DMD over the past 30 years. *Methods:* All patients with DMD in Nova Scotia are followed by the Pediatric Neurology Division at the IWK Health Center. The dates of birth and diagnosis of all patients born between 1969 and 2008 were reviewed. Statistics Canada data on annual male births in Nova Scotia was obtained for each year. Analysis was performed for 5 year intervals during the study period. As the average age at diagnosis of DMD is approximately 5 years, we limited the study to those born up to 2003. *Results:* The incidence has fluctuated from 1 per 3,745 to 1 per 7,711 male births over the last 30 years, but this difference is not statistically significant. Similarly the age at diagnosis has not changed significantly (Table).

Period	Number of Male Births	Number with DMD	Rate: 1 per	Mean age at Diagnosis (yrs)
1969-1973	34,583	8	4,323	3.6
1974-1978	39,492	7	5,624	4.4
1979-1983	31,471	5	6,294	4.2
1984-1988	31,414	5	6,283	4.8
1989-1993	30,845	4	7,711	3.8
1994-1998	26,218	7	3,745	6.0
1999-2003	22,690	4	5,673	2.8
1969-2003	190,521	40	4,700	

Conclusions: This population based study shows that both the incidence and age at diagnosis of DMD have remained unchanged over the last 30 years. *Reference:* 1: Miller LA, Romitti PA, Cunniff C et al. The Muscular Dystrophy Surveillance Tracking and Research Network (MD STARnet): Surveillance Methodology. Birth Defects Research (Part A) 76;793-797:2006.

P-153

Very late functional deterioration in neurological injury: A postpolio-like syndrome?

M del Campo (Toronto), F Paiz (Toronto)*

Spontaneous functional recovery after injury of anterior horn cells or motor axons is evident in a variety of pathological conditions, including infection, autoimmune processes and trauma. The degree and rate of recovery depend on a variety of circumstances including the age of the patient, the pathological process and therapeutic efforts. Purely demyelinating processes are generally deemed as having full potential for recovery, whereas neuronal or axonal injury confer a more uncertain prognosis. In many cases, recovery is

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compatible with normal function of the affected limbs. We report 3 cases of late functional deterioration after different pathological processes affecting the peripheral nervous system. It is proposed to consider these as examples of a process of motor unit remodeling and subsequent decay due to anterior horn cell death by natural attrition and other mechanisms of axonal degeneration similar to post-polio syndrome.

Patient	**1**	**2**	**3**
Age at presentation (y.o.)	78	67	57
Mechanism	missile injury	intracanalicular Schwannoma	perinatal brachial plexopathy
Neurological deficit	radial nerve palsy	bilateral L5 root	Complete C5, partial C6
Degree of recovery	complete	complete	partial
Functional recovery (yrs)	49	26	35
Relevant comorbidities	possible small Fiber polyneuropathy	ethanol intake	sedentary life

P-154

Neurosurgical Patients Positioning Related Nerve Injuries

AA Al Jishi (Montreal), L Jacques (Montreal)*

Safe intraoperative patient positioning is an important aspect in neurosurgical field. In addition to skin changes and pressure sores, the procedure might be complicated by nerve injury related to non-proper or prolonged positioning of the patient. Patient age, chronic illnesses, and duration of surgery are other contributory factors. In fact, postoperative nerve injuries have been reported also by other surgical disciplines. Over stretching of the limbs, insufficient control of pressure points, circumferential limb tightness, exceeding neck range of motion and applying head braces seem the most mechanism of injury. We present our experience at Montreal Neurological Hospital for the most common neurosurgical patients positioning related nerve injuries (supine, prone, lateral, knee-chest, park-bench and sitting positions). Incidence, risk factors, ways of prevention, management and outcome are discussed.

P-155

Canadian neuromuscular disease registry

C Campbell (London), J Puymirat (Quebec City), J Mah (Calgary), D Biggar (Toronto), H Kolski (Edmonton), P Ray (Toronto), C Swaby (Calgary)*

Background: The recent successes with genotype specific therapies for neuromuscular diseases warrant the mobilization of resources to identify and recruit patients to clinical trials. With the successful international effort to develop neuromuscular patient registries, interested parties in Canada have come together to fund and implement a national registry for Myotonic Dystrophy (DM1) and Duchenne Muscular Dystrophy (DMD), with a future goal of accommodating additional neuromuscular diseases. Other priority objectives are to disseminate information to patients, facilitate collaborative research amoungst Canadian investigators, and to improve clinical care via knowledge translation elements within the database. *Methods and Results:* All Canadian neuromuscular centres will be eligible to participate with patient enrollment directly through neuromuscular clinics. Database content will be determined through concensus of Canadian and international DMD and DM1 experts. All Canadian neuromuscular centres will be eligible to participate. Data from the clinical encounter and standardized outcome measures will be entered via secure internet access. A central steering committee and research coordinator will assure accuracy and approve access to database information. *Conclusions:* The realization of a national database for DM1 and DMD patients will allow Canada to remain congruent with international research efforts in neuromuscular disease and provide more opportunities for patients to participate in clinical trials.

P-156

Optimal intraoperative SSEP stimulus intensity can be determined by nerve action potential amplitude

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Background: The optimal stimulus intensity for somatosensory evoked potential (SSEP) testing is typically determined by muscle twitch threshold. Unfortunately, muscle twitch is often not visible during surgery so an alternative method is required. *Method:* Ulnar and tibial nerves were stimulated at the wrist and ankle respectively in patients who were anaesthetized and under neuromuscular blockade (NMB). The stimulus intensity necessary for just maximal ulnar nerve action potential (NAP) amplitude at Erb's point, and tibial NAP at the popliteal fossa were compared to that for hypothenar and plantar foot muscle twitch threshold (x 2) respectively (after NMB was gone). *Results:* Thirty patients undergoing spine and brain surgery were tested. There was no significant difference between the stimulus intensity for hypothenar and plantar foot muscle twitch threshold (x 2) and that for just maximal NAP amplitude in ulnar and tibial nerves respectively (paired t-test). *Conclusion:* NAP amplitude may be used to determine optimal SSEP stimulus intensity when muscle twitch is not visible. This method should improve the success of intraoperative SSEP monitoring and decrease erroneous interpretation.

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

P-157

Ischaemic stroke in a young patient with endometriosis, migraine and use of oral contraception and tranexamic acid

G Pfeffer (Vancouver), S Yip (Vancouver)*

Background: Endometriosis is characterised by the presence of ectopic endometrial tissue. Treatment includes oral contraception (OCP) and tranexamic acid (an inhibitor of plasminogen activator) for menorrhagia. Patients with endometriosis have higher incidence of migraine with and without aura. We report a patient with endometriosis and migraine with aura, who was on treatment with OCP and tranexamic acid, and developed ischaemic stroke. *Methods:* Case report. *Results:* This 30 year old woman had endometriosis and migraine with aura, treated with OCP and tranexamic acid. She developed sudden onset left hemiparesis which resolved over one hour. CT angiogram demonstrated intraluminal

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thrombus in the right MCA M1 segment. MRI revealed an acute stroke in the head of the right caudate nucleus and a chronic infarct in the right parieto-occipatal area. Treatment with ASA was initiated and thrombus resolved on repeat imaging after 24 hours. Patent foramen ovale with spontaneous right to left shunting was observed on echocardiogram. Anticoagulant therapy was initiated. OCP and tranexamic acid were discontinued. *Conclusion:* In patients with coexistent endometriosis and migraine, tranexamic acid and OCP should be used with caution. In this case intraluminal thrombus resolved without use of anticoagulants.

P-158

CADISS cervical artery dissection in stroke study

J Norris (London), H Markus (London)*

Background: There may be a high early (1 month) stroke risk after cervical artery dissection. No evidence based data exists to decide whether antiplatelet agents or anticoagulation are preferable for secondary prevention. A previous Cochrane analysis calculated that 900 patients per therapeutic arm would be needed. *Methods:* We are currently conducting a UK prospective, multicentre, randomised trial comparing antiplatelets vs anticoagulants. In this preliminary feasibility phase, funded by the UK Stroke Association, we are recruiting 250 patients. If sufficient end points are generated a larger definitive trial of 3000 patients is planned. *Results:* In this feasibilty phase 35 patients have so far been randomised with one endpoint (stroke). *Conclusion:* Optimal treatment of cervical dissection will only be determined by prospective randomised trials such as CADISS.

P-159

Life Threatening Hemorrhage Complicating Cerebral Venous Thrombosis: A Report of Two Cases and Review of the Literature

D Yavin (Edmonton), JM Findlay (Edmonton), S Naik (Edmonton)*

Background: Cerebral venous thrombosis (CVT) is a rare, life-threatening form of stroke. Current practice guidelines recommend anticoagulant therapy following CVT irrespective of the presence of intraparenchymal hemorrhage. *Methods:* We report the details of two cases of CVT managed with anticoagulant therapy. The English language literature was reviewed for studies evaluating the safety and efficacy of anticoagulant therapy in the management of CVT. *Results:* Neuroimaging on presentation in both cases revealed intraparenchymal hemorrhage. Once CVT was identified on subsequent magnetic resonance venography a continuous infusion of intravenous heparin was begun. Repeat imaging prompted by a neurologic deterioration revealed progressive intraparenchymal hemorrhage. Both patients required emergent surgical decompression. In follow-up one patient had a complete functional recovery while the other remained moderately disabled. *Conclusion:* A consensus in the literature exists regarding the benefit of anticoagulant therapy in CVT although direct evidence supporting its role is limited to observational studies. We propose the initiation of anticoagulant therapy be delayed in setting of CVT with intraparenchymal hemorrhage until repeated neuroimaging excludes progressive hemorrhage. Furthermore, clear indications for decompressive surgery in CVT are needed to allow early recognition of those who would benefit and thereby reduce the resulting morbidity and mortality.

P-160

Successful Hemicraniectomy for Malignant MCA Stroke post TPA failure—A case report

CW Lim (St. John's), S Mark (St. John's)*

Background: Report a case of successful hemicraniectomy on a 27 year-old female with acute Malignant MCA Stroke after failing thrombolytic therapy. *Methods:* Routine stroke works up and imaging study were performed. *Results:* Our patient presented to the emergency room with acute onset of left sided hemiparesis, hemianopia and dysarthria. (NIHSS=8). Her risk factor includes recent use of oral contraceptive. Initial Head CT showed a right hyperdense middle cerebral artery. She was diagnosed as right MCA stroke and was given rTPA at 90mins of symptoms onset. Despite the thrombolytics, her neurological status deteriorated. She became obtunded on day 2 (NIHSS=18) and on repeat imaging, it shown massive edema but no hemorrage. Other stroke works up were negative. Due to her decline, an emergency right temporal craniectomy with duroplasty was performed at 44-hour post stroke. She improved remarkably well post-op with no complication and nearly complete resolution of infarcted area previously seen on initial CT. At 3-month follow up visit, she has full resolution of her weakness (mRS 0). *Conclusion:* Previous literatures had shown hemicraniectomy improved morbidity and mortality in malignant MCA stroke. Our case suggests young malignant stroke patients whom had failed thrombolytic therapy should be considered for surgical decompression.

P-161

Assessment of Risk Factors in Cerebrovascular Disease Among Chinese-Canadians: An 8 Year Retrospective Case-Mix Pilot Study

JY Chu (Toronto), A Cheng (Toronto), D Ly (Toronto)*

Objective: To examine the frequency of risk factors among Chinese-Canadians with strokes and diabetes compared to non-Chinese-Canadians. *Methods:* This is a retrospective, case-mix pilot study examining the medical records from year 2000-2007 of a Toronto community neurologist (JYC) . Chart reviews were performed to collect data on risk factors among Chinese-Canadians with stroke and comparisons were made to age and sex-matched non-Chinese patients. Particular emphasis was placed on diabetes-related risk factors. *Results:* Thirty seven Chinese-Canadians with a stroke diagnosis were compared to 25 age- and sex-matched Caucasians with a similar diagnosis. The mean age of onset was 64 years. Hypertension and hyperlipidemia were the two most common risk factors among both the Chinese and non-Chinese cohorts. Diabetes was present in 27% of the cases for Chinese-Canadians and 24% for Caucasians. The frequency of other risk factors, type, location, side and etiology of the stroke were also similar between the cohorts. *Conclusions:* This small retrospective pilot study examining the frequency of risk factors among Chinese-Canadians with stroke compared with non-Chinese-Canadians with stroke is suggestive that the frequency is similar among the two groups. The findings are similar to a previous study study(1). There is a definite need for further research into the unique pattern and epidemiology of strokes among Chinese-Canadians with diabetes. This will have significant therapeutic implications and in stroke prevention within this population. *Reference:* 1. Chu, J.Y. et al. Epidemiology of cerebrovascular disease among Chinese-Canadians: A ten years retrospective case-mix study. Neurology Asia 2006: 13-18.

P-162

Familial Cavernous Malformations in the Maritime Provinces

AC Orr (Halifax), IG Fleetwood (Halifax), C Macgillivray (Halifax), S Blowers (Halifax), DL Guernsey (Halifax), RM Sadler (Halifax)*

Background: Cerebral cavernous malformations (CCM, MIM 116860), are uncommon vascular malformations that may involve any part of the CNS. Three CCM genes (CCM1 - 3, also known as KRIT1, CCM2 and PDCD10, respectively) have been implicated in familial forms of the disease. Most prominently described in individuals of Hispanic descent, only a few Canadian families have thus far been described. Here we report the ascertainment of two nuclear families from Prince Edward Island and Nova Scotia segregating autosomal dominant CCM, their clinical features and preliminary molecular findings. *Methods:* Following informed consent, saliva samples were obtained from nine affected (MRI documented) members of the first family, from which DNA was extracted by standard techniques. Four samples were then genotyped using the llumina HumanHap610 SNP Chip. The resulting data were analyzed using the Homozygosity Haplotype (HH) method, which enables the exclusion of genomic regions not shared identical-by-descent from a common ancestor. *Results:* HH analysis excluded two of the three known CCM genes as causal in this family. Direct sequencing of the third CCM gene, and further genotyping, is underway. *Conclusions:* Two Caucasian families of European descent with CCM have been identified in the Maritimes. Clinical features, pedigrees, and molecular data will be presented.

P-163

Thrombosis of a Ruptured Cerebral Aneurysm Following Administration of Factor VIIa

NE Parks (Halifax), IG Fleetwood (Halifax)*

Background: Spontaneous thrombosis of a ruptured cerebral aneurysm is rarely described. Factor VIIa is not typically administered following SAH due to theoretical increase in risk of hydrocephalus or vasospasm. *Methods:* We report a 59 year old man taking warfarin for an aortic valve replacement who presented with Hunt and Hess Grade IV SAH and had a significant deterioration from aneurysm rebleed with hydrocephalus requiring emergent ventriculostomy. Factor VIIa was administered to facilitate this. *Results:* A CT angiogram prior to Factor VIIa clearly demonstrated a 4.5 mm right PCA aneurysm, which disappeared after Factor VIIa administration on subsequent catheter angiography and MRA. After the initial deterioration, his family opted for palliative measures only and he succumbed. They refused post mortem examination. *Conclusions:* The administration of Factor VIIa in the setting of a small aneurysm (presumably with damaged endothelium at the site of aneurysm rupture) may have led to aneurysm thrombosis in this unique case.

P-164

Ruptured intracranial aneurysm: clip or coil?

*C Haw (Vancouver)**

Background: Ruptured intracranial aneurysms are usually treated with surgical clipping or endovascular coiling. The publication of the International Subarachnoid Aneurysm Trial (ISAT) may have shifted treatment patterns toward endovascular coiling. The author's neurosurgical practice includes aneurysm clipping and coiling. *Methods:* A retrospective review of the author's personal experience in the treatment of ruptured intracranial aneurysms. *Results:* 151 ruptured intracranial aneurysms were treated over a 5 year period. Twenty eight percent of the patients presented with Hunt and Hess grade IV-V. 78 had surgical clipping and 73 had endovascular coiling. Good outcome (modified Rankin Scale score 0-2) was achieved in 76% of patients (79% surgical clipping, 73% endovascular coiling). *Conclusions:* Good results can be obtained with surgical clipping or endovascular coiling. Patient selection seems paramount.

P-165

Cardioembolic Stroke in Manitoba Children - A Clinical Presentation and Outcome Study

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Background: Although cardiac disease is a common cause of arterial ischemic stroke (AIS) in children, limited information is available about long term outcome. We hypothesized that, in children with cardioembolic AIS, clinical and radiological characteristics may predict outcome including stroke recurrence, death and neurological impairment. *Methods:* A retrospective study of consecutively enrolled children, between birth to 18-years, with cardioembolic AIS, seen at the Children's Hospital Winnipeg, between January 1992-December 2006. *Results:* We identified 84 children with AIS; 17(20%) neonates, 67(80%) non-neonates. Eighteen (21%) children had cardioembolic AIS. Seventeen children (ages 3 days to 15-years) fulfilled study inclusion criteria. We found that Aboriginals(28.6%), females(58.8%), and children <5-years(64.7%) were disproportionately represented. Stroke onset occurred commonly during in-hospital care(64.7%). Presenting features were identified on awakening in 64.7%. Cardiac shunts and intervention(52.9%) presented increased stroke risk. Clinical symptoms were focal neurological deficits(70.6%), seizures(29.4%), altered consciousness(29.4%) and headache(17.6%). At 2-year follow-up, poor outcome(58.8%) was the most common assessment; Pediatric Stroke Outcome Measure (PSOM) score equal to or >2.0 (35.3%), death(11.8%) and recurrent strokes(11.8%). In univariate analysis, predictors of poor outcome at 2-years included headache(p=0.048), Pediatric National Institute of Health Stroke Severity score at presentation(r=0.57,p=0.05) and discharge(r=0.76,p=0.003) and PSOM score at discharge(r=0.77,p=0.0008). In multivariate analysis, none of these predictors reached statistical significance. *Conclusion:* Our cohort is the first reported population based study of pediatric cardioembolic AIS. The predictors identified by this study may help in early prognostication of such children. However, small sample size was a limiting factor. Further study in a large multicentre cohort is required.

P-166

Correlation of carotid stump pressure with carotid back flow during carotid endarterectomy

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Background: The circle of Willis is the primary provider of collateral blood flow during carotid endarterectomy. Hypoperfusion

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due to inadequate collateral flow is one of the main causes of intraoperative stroke. To reduce such risk, pre-surgical evaluations have been conducted to assess the efficiency of the circle to determine if a shunt is required during surgery. One indicator, the carotid stump pressure (CSP), has been shown to correlate significantly with carotid retrograde back flow (BF) and indirectly predict collateral circulation (DeLaurentis et al. 1993). A lower CSP correspondingly yields less BF. A mean CSP of 60% or more of the patient's mean systemic pressure usually indicates good collateral circulation (Kurata et al. 1996). We wished to conduct an investigation of CSP in relation to BF. *Methods:* A prospective database of surgical carotid endarterectomies was used to select cases in which both CSP and BF were measured. Mean CSP versus BF were plotted using a linear regression model. Analysis was done with y= mx+b (y=BF, m=slope, x=CSP, b= intercept). R2 was noted. *Results:* A positive correlation was observed between CSP (mm Hg) and BF(cc/min). A higher stump pressure yielded more back flow (y=2.634x + 25.157) on a linear scale. R2 was 0.5199. *Conclusion:* Internal carotid arteries normally transmit a mean blood flow of approximately 200 cc/min (ranging from 112 to 348) (Schebesch et al. 2004). Stump pressure can be useful in predicting the volume of carotid back flow during endarterectomy. Further studies may help determine whether one or both measurements reliably predict the efficiency of the circle of Willis.

P-167

Foreign Accent Syndrome Following a Ruptured Anterior Communicating Artery Aneurysm

H Lee (Toronto), Z Kaderali (Toronto), J Spears (Toronto)*

Background: Foreign Accent Syndrome (FAS) is a controversial disorder of speech where the speaker is perceived by listeners to adopt a foreign accent as the result of focal brain damage. While the majority of reports of FAS are attributed to lesions of the left hemisphere including the dorsolateral frontal cortex, basal ganglia, and internal capsule, there are a limited number of FAS patients exhibiting lesions of the right hemisphere or normal structural neuroimaging. We describe the case of a 52 year old, right-handed woman who developed FAS following clipping of a ruptured right anterior communicating artery (AComm) aneurysm. *Method:* This case was investigated using neuroimaging, clinical follow-up, and a review of current literature on FAS. *Results:* Post-operative imaging demonstrated a lesion involving the right posterior gyrus rectus, orbitofrontal cortex, and underlying white matter. During recovery, her speech was described as Southern American opposed to her native Southern Ontarian accent. She also experienced symptoms of frontal lobe syndrome, anterograde amnesia, and facial motor tics during speech. *Conclusions:* The development of FAS following isolated damage to basofrontal regions of the right hemisphere suggests the articulatory deficits of FAS arise from disruption of connections between the right frontal lobe and other speech production areas. Peri-operative occlusion or damage to the recurrent artery of Heubner or other medial lenticulostriate branches, which perfuse structures implicated in FAS, may also contribute. Although FAS resulting from right hemispheric lesions is rare, this case illustrates mechanisms which may precipitate this speech disorder following rupture of an AComm aneurysm.

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A case report of an isolated pulmonary arteriovenous malformation causing stroke.

M Alhazzaa (Ottawa), G Stotts (Ottawa), M Sharma (Ottawa)*

Background: Pulmonary arteriovenous malformations (PAVM) leading to paradoxical emboli are a recognized but rare cause of stroke. *Methods:* We present a case of stroke associated with PAVM which was treated by embolization. Results of a literature search are presented. *Results:* A 43-year-old woman reported a transient episode of dysarthria and hemibody numbness. She had no features of Hereditary Hemorrhagic Telangiectasia (HHT). MRI of the brain demonstrated a left cortical infarction. Transesophageal echocardiogram revealed a significant right to left shunt with delayed appearance of bubbles in the left atrium. The interatrial septum was intact. An intrapulmonary shunt was suspected and then confirmed by a pulmonary CT angiogram which showed a large left PAVM. She had no recurrent symptoms after a successful PAVM embolization. *Conclusions:* Pulmonary AVMs may be congenital or acquired with the majority of identified cases linked to HHT. There are few reports of isolated pulmonary AVMs causing strokes. This condition should be suspected in the setting of embolic strokes with delayed appearance of bubbles in the left atrium and an intact interatrial septum. A chest CT angiogram can confirm the diagnosis. Occlusion of the shunting vessels by interventional embolization reduces the risk of further emboli.

P-169

Predictors of outcome in patients with acute disabling ischemic strokes but no intracranial vascular occlusions

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Background: Patients presenting acutely with focally disabling deficits but no visible intracranial vessel occlusion represent an intriguing subset of patients who pose a challenging dilemma.We sought to study the predictors of prognosis in this population. *Methods:* As part of institutionally approved retrospective CT angiographic database we analysed all acute disabling stroke patients (NIHSS>6) who underwent CT-angiography within 24h of symptom onset. We analyzed clinical and imaging variables for prediction of both 24h dramatic recovery (24h NIHSS equaling 15 pt improvement or NIHSS <3) and 3 month outcome (mRS). *Results:* In a database of 1186 patients, we identified 111 patients with final diagnosis of stroke with follow up imaging. 74.8% patients had infarcts on their follow-up imaging. The predictors of dramatic recovery (35.1%) were younger age, male gender, and non smokers. Good outcome (mRS≤ 2) was seen in 60%. Baseline predictors of good outcome were baseline NIHSS, younger age and absence of any extracranial carotid disease. TPA was given in 43.2% of patients with a 2% parenchymal hematoma rate. *Conclusions:* Acute disabling deficits without intracranial occlusion is a heterogenous entity. Only a proportion of cases had a normal scan at follow-up. A significant number of patients had dramatic recovery and good outcome which was not predicted by TPA administration.

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A prospective analysis of correlation between cerebral oximetry monitoring and stump pressure during carotid endarterectomy

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Background: To reduce this risk of cross-clamp ischemia during CEA, internal carotid artery stump pressure and cerebral oximetry can be monitored as indicators of cerebral perfusion guiding carotid shunt placement. We wish to assess the relationship between carotid artery stump pressure and cerebral oximetry monitoring. *Methods:* 25 consecutive patients (out of a planned 100) undergoing CEA have been studied to date. Cerebral oximetry changes were monitored in each patient both at baseline and after carotid cross-clamping. Following arteriotomy, a stump pressure was measured from the distal internal carotid artery. Measurements obtained using both intraoperative monitoring methods were then analyzed to determine if they demonstrated any statistical correlation. *Results:* A preliminary scatter plot graph of the % change in oxygen saturation vs. stump pressure revealed a correlation coefficient of -0.3, suggesting a weak negative correlation between stump pressure and cerebral oximetry. Four patients with significant drops in oximetry (> 10%) had stump pressures consistent with adequate collateral cerebral perfusion (>40mmHg), and oximetry returned to baseline following shunt placement in all four. *Conclusions:* Contrary to published reports to date, our preliminary results suggest changes in cerebral oximetry and stump pressure do not correlate closely during carotid cross-clamping for CEA. Cerebral oximetry may be a more sensitive measure of cerebral tissue perfusion and therefore a preferred monitoring technique during CEA.

P-171

Case Report: Noonan's Syndrome with Moyamoya in an Adult Patient

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Background: Noonan's syndrome is a relatively common genetic disorder characterized by multiple, congenital, anatomical and systemic abnormalities. Reports of cerebrovascular anomalies including aneurysms and moyamoya-like changes have also appeared, predominantly in the pediatric literature. *Summary:* We report the first case of an adult patient with Noonan's syndrome, platelet dysfunction and symptomatic supravalvular aortic stenosis who presented with a catastrophic spontaneous intracerebral hemorrhage. Bilateral moyamoya was evident from the admission CT angiogram. Despite urgent decompressive surgery to evacuate the blood clot, the patient succumbed to her illness. Subsequent family testing identified a son with similar moyamoya features. *Discussion:* The association between Noonan's Syndrome and momamoya disease has only been previously described in children. Given the risk of major intracerebral hemorrhage in adult patients with this condition, screening for intracranial vascular abnormalities should be strongly encouraged. Investigations should also be considered for those with a positive family history, especially children.

P-172

Hemorrhagic Transformation of Ischemic Stroke after Decompressive Craniectomy and its Effect on Outcome

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Hemorrhagic transformation of ischemic stroke is reported to occur in 30% of ischemic strokes with worsening of the overall outcome. Hemorrhagic transformation of ischemic strokes after decompressive hemicraniectomy is seldom reported in the literature. We reviewed our recent series of patients (2007-2008) with decompressive craniectomy for hemispheric strokes and studied the rate of hemorrhagic transformation. Out of 8 craniectomies performed on 7 patients, 2 patients (28.5%) developed new hemorrhagic transformation within the stroke territory. It is unclear how thrombolysis in the acute sitting of ischemic strokes my influence hemorrhagic transformation. Other potential risk factors that were studied included age, premorbid disease, coagulation status, hypertension, degree and timing of decompression, and relative hematoma size. Our sample size precludes any valid predictive value of hemorrhagic transformation on clinical outcome.

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De-Novo Formation and Evolution of Familial Cerebral Aneurysms

HM Al-Jehani (Montreal), D Tampieri (Montreal), R Leblanc (Montreal)*

Introduction: The etiology of cerebral aneurysm remains a topic of interest. We present the case of a patient with a familial history of cerebral aneurysm who developed multiple cerebral aneurysms sequentially over a 20 year period. *Case Report:* A 24 year-old woman whose grandfather had died from a ruptured cerebral aneurysm presented to hospital in 1989 with a severe headache from a sub-arachnoid hemorrhage due to a ruptured aneurysm arising at the bifurcation of the right internal carotid artery. The aneurysm was successfully clipped and she returned to her usual activities. She remained well until 1998 when she again experienced a sub-arachnoid hemorrhage. Angiography demonstrated 4 new aneurysms, one at the origin of the right posterior communicating artery, one arising from the anterior cerebral artery complex, one at the first segment of the left middle cerebral artery and a smaller one at the second segment of the left middle cerebral artery. The former three aneurysms were treated by clipping and coiling respectively but the smaller M-2 segment aneurysm was left untreated. She again returned to her previous activities and remained well until 2008 when the left M-2 aneurysm was noted to have enlarged on CT angiography. *Discussion:* This case adds further support for a possible genetic etiology of cerebral aneurysms and highlights the importance of continued follow-up of patients with these lesions. It also raises the question of elective treatment of small, asymptomatic aneurysm. All of these points will be discussed.

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A Novel Treatment of Distal Cerebral Vasospasm: Case report

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Background: Cerebral vasospasm is known as the commonest cause of mortality and morbidity post aneurysmal subarachnoid haemorrhage aSAH. The exact mechanism of the disorder is still poorly understood. The endovascular management of this pathology continues to evolve. In this case we present a novel modality in treatment of vasospasm using NeuroFlo™ device. *Method:* case report. *Result:* A 22 year-old female had aSAH due to Acomm aneurysm rupture. She was treated successfully with endovascular coiling. Few days later, patient developed severe clinical and radiological distal vasospasm. She was treated with triple H therapy and also angioplasty was done twice on different occasions with no improvement. Finally, a novel modality of treatment using NeuroFlo™ device was tried and the patient showed substantial clinical and radiological recovery and was discharged home few weeks later with a out-patient follow up with rehabilitation program. *Conclusion:* we demonstrated excellent outcome and substantial recovery using a novel treatment of distal cerebral vasospasm with the NeuroFlo™ device. Further pilot study is needed to prove the concept of this new potential interventional treatment for proximal and distal vasospasm after aSAH.

P-175

Delayed Cystic Necrosis Post Stereotactic Radiosurgery for Arteriovenous Malformation

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Background: Stereotactic radiosurgery has become an important treatment technique for cerebral Arterio-Venous Malformations (AVMs). Delayed radiation-induced complications remain a significant problem in some patients treated with radiosurgery. The majority of these adverse events occur within 3 years of radiosurgical treatment. Radiation necrosis has been reported with a frequency of 1.7 to 7.6% for AVMs. *Method:* We present 2 cases of delayed cystic necrosis post stereotactic radiosurgery for AVM. The AVM in the first patient was treated with embolization, surgical resection & stereotactic radiosurgery whereas the AVM in the second patient was treated with embolization & stereotactic radiosurgery. Result: The 2 patients developed the radiation-necrosis 12 & 3 years post radiosurgery respectively. In both cases, the radionecrosis had a "pseudo-tumoral" appearance characterized by an inner component iso-intense to CSF in all MRI sequences, a thin capsule partially enhancing and perilesional vasogenic edema. The posterior fossa lesion was resected due to the significant mass effect on the IV ventricle. *Conclusion:* Radiation necrosis can occur more than a decade after stereotactic radiosurgery, necessitating patient follow up during a longer period of time than currently practiced. A cooperative multicenter database of the outcomes of stereotactic radiosurgery is needed to better define patient risk factors and to decrease the incidence of late radiation necrosis.

P-176

Prognosis after Cerebral AVM Rupture in Patients Presenting with Coma.

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

Introduction: Although it is believed that brain AVM rupture generally has a benign course, there is a subgroup of patients that present comatose. We reviewed our experience to determine prognostic factors and outcome in this population. *Methods:* Retrospective review of patients admitted with a ruptured cerebral AVM between 2003 and 2008 that presented comatose and required immediate surgical attention. Outcome was assessed at 6 months using the modifed Rankin scale (mRS). *Results:* There were 5 males and 5 females with a mean age of 31 years (range 14-47). All patients had admission GCS of 8 or less, most with dilated pupils and/or posturing movements. All patients had intraparenchymal hemorrhage. Angiography was performed in 5 patients pre-operatively and 4 patients postoperatively. Venous aneurysms and stenosis were angiographically documented in 6 and 3 patients, respectively. Nine patients underwent decompressive craniectomy and evacuation of hematoma while 1 patient only received ventriculostomy. AVM excision was never attempted in the acute phase. Three patients died, all with extensive brain infarction on postoperative imaging. In the remaining 7 patients, the AVM was treated electively. Regardless of the initial clinical condition and AVM location, all survivors had good functional outcome at 6 months (mRS 3 or less). *Conclusion:* No clinical or radiological factor could predict outcome at admission. However, the appearance of brain infarction postoperatively was constantly associated with a poor prognosis. Even when they present in a poor condition, AVM patients should be managed aggressively since their young age often allows significant neurological recovery.

P-177

Neuroimaging findings in giant cell arteritis presenting as a stroke

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Background: Giant cell arteritis (GCA) is a rare cause of stroke. We report clinical and radiological findings in a case of GCA that presented with stroke and review the literature. *Method:* An 85 year old man presented with a 1 week history of ataxia, and recent weight loss and headache. MRI showed acute infarcts in the brainstem, bilateral cerebellum and occipital lobes. CT angiography showed thickened vertebral artery walls causing stenosis. The patient was anticoagulated for a presumed dissection. 10 weeks later he developed worsening ataxia, dysarthria, and decreased level of consciousness. The MRA demonstrated occlusion of the vertebral arteries, and new stenosis of the left internal carotid artery(ICA). Vasculitis was suspected and the patient was treated with daily IV solumedrol. Cerebral angiography demonstrated beading of the superficial temporal arteries, bilateral vertebral artery occlusion and stenosis of the left ICA. Temporal artery biopsy confirmed giant cell arteritis. The patient died the next day. *Results:* 20 cases of GCA presenting with stroke have been previously reported. Headache was reported as absent 3 of 14 cases. In 13 cases, the infarcts were exclusively in the posterior circulation. The prominent wall thickening in the vertebral arteries on CT angiography has not

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previously been reported in GCA however similar changes have been documented by ultrasound. *Conclusion:* GCA should be considered as a cause of stroke in patients over the age of 50 who present with headache, vertebrobasilar infarcts, or arterial wall thickening on imaging studies.

P-178

Canadian Experience with Hemicraniectomy for Malignant MCA Stroke

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Background: Malignant MCA infarction has a mortality rate of 80%. Randomized trials of decompressive hemicraniectomy in Europe have shown benefit. We pooled results from two centres for review. *Methods:* All known cases of hemicraniectomy after stroke at two Canadian neurosurgical centres over an 11-year period were reviewed. Details regarding the stroke etiology, surgical timing, technique and clinical outcome were collected. *Results:* Fifteen patients (mean age 44 years) were identified. Ten had right hemisphere strokes. There was involvement beyond MCA territory in four. Stroke etiology was cardiac embolism (6), carotid dissection (3), iatrogenic (2), traumatic (1) and unknown (3). There was pupillary dilatation in five prior to surgery. Thirteen patients had surgery based only on CT imaging and two had MRI. Mean time to surgery was approximately 2.2 days. Two required secondary procedures to expand the decompression. Mortality rate was 13.3%. Objective and subjective results are shown in the Table.

	mRS 1	2	3	4	5	6
Patients (#)	0	1	7	4	1	2
Satisfied?	-	100%	100%	50%	n/a	n/a
Mean F/U (months)	-	18	18.5	7	1	6.25

Conclusions: Hemicraniectomy is used infrequently and for atypical stroke etiology consistent with the younger patient population reviewed here. The operation is typically associated with dependent outcome of mRS ≥3 (93.3%), yet most patients/families (73.3%) paradoxically indicate satisfaction with this outcome. Results will be discussed in the context of European data.

P-179

Early Toronto experience with the Pipeline Endovascular Device for complex intracranial aneursyms

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Background: The management of large wide necked aneurysms remains challenging. This morphology generally precludes effective endovascular reconstruction while surgical intervention is equally difficult, often necessitating vessel sacrifice with or without bypass. The Pipeline Endovascular Device (PED) has emerged as an option for treatment of these difficult lesions. This stent is deployed in the parent vessel, redirecting flow away from the aneurysm while maintaining flow through any adjacent branches included in the stent coverage. Over time this redirection promotes thrombosis of the aneurysm. *Methods:* Through January 2009, 5 patients have been treated with a PED in Toronto at St. Michael's Hospital and the Toronto Western Hospital, with a further 5 cases planned. Our early technical and clinical experience with this novel device is reviewed. *Results:* All aneurysms treated to date were in either the cavernous or supraclinoid segments of the internal carotid artery. Size ranged from 16mm to 30mm. Four were unruptured with the fifth being a recurrence of a ruptured aneurysm previously treated with stent assisted coiling. Mean procedure time was 2.5 hours, significantly lower than matched controls. One aneurysm was completely closed by the end of the procedure, while the remaining showed varying degrees of stasis. Subsequent closure has been confirmed in two of these patients, with investigations pending in the other two. All were discharged home within two to four days without neurologic deficit. *Conclusions:* Preliminary experience with the PED is encouraging. We expect this device will significantly alter the management of difficult intracranial aneurysms.

P-180

Transcranial Approach for Direct Embolization of a Cavernous Sinus Dural AV Fistula: Technical Case Report

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Introduction: Dural AV fistulas (dAVF) represent 10-15% of all intracranial arteriovenous malformations. These are often acquired lesions in the cavernous or transverse sinus. We present a rare case of a transcranial approach to directly embolize a cavernous sinus dAVF. *Case:* An 82-year-old woman presented with diplopia, left sixth cranial nerve palsy, intra-ocular hypertension and bilateral chemosis. Angiography revealed a dural AVF supplied by distal branches of both external carotid arteries and the left meningohypophyseal trunk, with venous outflow via pial veins. Only limited transarterial embolization was possible via the left accessory meningeal artery. Transvenous access to the fistula was not possible. A frontotemporal craniotomy was performed to access the superficial middle cerebral veins in the left Sylvian fissure. Under fluoroscopic guidance, a catheter was advanced along the sphenoid wing to the floor of the middle cranial fossa where it passed posteriorly to the cavernous sinus, and coils were advanced occluding the AV fistula. *Conclusion:* This technical case report illustrates a valuable technical alternative to obliterate a dAVF when transvenous embolization is not feasible. Remarkably only a single previous case of transcranial transvenous embolization of a dAVF via the vein of the Sylvian fissure has been reported.

P-181

Tentorial branch of the superior cerebellar artery: a potential feeder for dural arteriovenous fistulae

AG Weil (Montréal), MW Bojanowski (Montréal)*

Background: A comprehensive understanding of the vascular supply of a dural arteriovenous fistula (DAVF) is essential for its appropriate endovascular or surgical management. We demonstrate a tentorial DAVF fed partially by a branch of the superior cerebellar artery (SCA). Although a tentorial branch of the SCA has been described in cadaveric studies, its contribution to tentorial DAVFs has not been well described in the literature. *Methodology:* Case report and review of the literature. *Results:* A 53-year old male was referred for a thalamic haemorrhage. Cerebral angiography revealed a right-sided tentorial DAVF supplied mainly by the tentorial branch of the internal carotid artery with some contribution from a SCA feeder. Venous drainage was via the lateral mesencephalic vein, through a dilated basal vein of Rosenthal. The lesion was approached surgically through a subtemporal approach.

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Intraoperatively, a tentorial branch originating from the lateral pontomesencephalic segment of the right SCA was identified in the ambient cistern. This artery was clipped, coagulated, and sectioned. The draining vein was ligated at its exit from the tentorium. Angiography demonstrated complete obliteration of the tentorial DAVF and the patient improved significantly. *Conclusion:* This is the first report of a surgically confirmed SCA feeder to a tentorial DAVF. Recognition of this variant is relevant for angiographic diagnosis and endovascular or surgical management of DAVFs.

P-182

Fatal Posterior Reversible Encephalopathy Syndrome (PRES)

D Jichici (Hamilton), B Lo (Hamilton), J Grynspan (Hamilton), B Lach (Hamilton), K Reddy (Hamilton)*

Background: Posterior Reversible Encephalopathy Syndrome (PRES) represents an uncommon entity related to multiple pathologies, hypertension crisis being most common. This condition is usually transient and completely reversible, but ischemic injury and irreversible damage have been reported. Death from PRES is extremely rare. *Methods:* We report a case of fatal PRES syndrome. *Results:* The patient was a 28-year-old woman with end-stage renal failure secondary to diabetes on hemodialysis. Past history includes hypothyroidism, hypertension, and seizures thought to be hypoglycemic. Following routine hemodialysis she had a witnessed and proglonged grand mal seizure. She was treated with Diazepam, Phenytoin, endotracheal intubation and transfered to ICU. Her elevated blood pressure was controlled with Labetolol infusion. Further seizures were treated with Midazolam drip and Phenobarbital. The admission blood work was unrevealing. A lumbar puncture was normal. Serology for West Nile, fungus and opportunistic infections were negative. Initial brain CT was normal. Repeat CT head next day revealed occipital lobes sulcal effacement. A continuous EEG monitoring showed diffuse slowing. A brain MRI on the 3th day revealed diffuse cerebral edema and increased posterior hypodensities. ICP monitoring showed elevated ICP. She was treated with Manitol, hypertonic saline and mild hypothermia. She deteriorated and was declared brain dead 3 days after admission. Her brain autopsy revealed brain edema. *Conclusions:* PRES is a clinical syndrome characterized by headaches, seizures, hypertension and radiographic finding of cerebral edema affecting the posterior regions of the cerebral hemispheres. This entity needs to be promptly recognized and urgently treated as it can be fatal.

P-183

Mechanical Thrombectomy for Acute Stroke with the Alligator Retrieval Device

ME Kelly (Saskatoon), MS Hussain (Cleveland), D Fiorella (Phoenix)*

Background: Recanalization of occluded vessels in acute ischemic stroke is associated with improved outcome. Devices which can quickly and safely remove thrombus and promote recanalization are useful in the management of these patients. The Alligator retrieval device (ARD), developed for endovascular foreign body retrieval, may also be useful for thrombus removal. *Methods:* Seven acute ischemic stroke patients (age 31 - 88) who underwent intra-arterial therapy with the ARD at our center are presented. *Results:* The ARD was able to retrieve the thrombus in 5 of 7 cases, with good to excellent recanalization seen. 3 of 7 patients had good outcome at 3 months. *Conclusion:* The Alligator retrieval device was successfully able to remove thrombus in the majority of cases, even where other methods of intra-arterial treatment were unsuccessful. It appears to have increased success in proximal occlusions. In properly selected cases, it may be a useful device in intra-arterial stroke management.

P-184

Improved Aneurysm Packing Density with the Enzo Microcatheter

ME Kelly (Saskatoon), R Dodd (Stanford), MP Marks (Stanford), D Fiorella (Phoenix)*

Introduction: The Enzo is a deflectable-tipped microcatheter. We hypothesized that this feature could be used to achieve better packing densities in aneurysm models. *Methods:* 10 silicone aneurysms (467 mm^3 each) were coiled using either the Enzo or SL-10 microcatheters under fluoroscopic control. Coils were introduced until the microcatheter was rejected from the aneurysms. The microcatheter could be driven back into the aneurysm over a coil, but could not be repositioned with a microwire. When resistance to coil introduction was felt, the operator could either deflect the tip (Enzo only), or reposition the microcatheter by retracting it slightly as the coil was removed. When the catheter could not be manipulated back into the aneurysm or when coils could no longer be introduced, the experiment was stopped. The coil sequences were kept as similar as possible. *Results:* The average packing density achieved with Enzo (39.1%) was greater ($p < 0.05$) than with the SL-10 (29.6%). The packing densities achieved were much more consistent with the Enzo than with the SL-10. Changing the tip configuration in response to resistance (rather than withdrawing the microcatheter) seemed to allow the introduction of additional coils while maintaining microcatheter purchase within the aneurysm. Often coils could be introduced through the Enzo to the point of microcatheter failure, rather than loss of intra-aneurysmal position. *Conclusions:* Using primarily -18 and -14 sized coils, it is feasible to achieve packing densities near 40%. These higher packing densities could be achieved more consistently with the Enzo microcatheter, because of the improved microcatheter stability.

P-185

Delayed symptomatic coil migration after initially successful balloon assisted aneurysm coiling

ME Kelly (Saskatoon), D Fiorella (Phoenix)*

Introduction: To describe delayed migration of a coil loop after adjunctive balloon remodeling of an anterior communicating artery aneurysm. *Materials and Methods:* A 56 year old male with subarachnoid hemorrhage from a small anterior communicating artery aneurysm underwent successful coil embolization with adjunctive balloon remodeling. *Results:* Eight days after the procedure, the patient returned with an acute left anterior cerebral artery (ACA) territory infarction secondary to the delayed migration of a coil loop out of the aneurysm and into the left A1-2 junction. *Conclusion:* Delayed migration of a coil loop after adjunctive balloon remodeling can be observed but is very uncommon. To our knowledge this represents the first known case of delayed coil loop migration in the literature.

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Curative Reconstruction of a Giant Mid-basilar Trunk Aneurysm with the Pipeline Embolization Device

ME Kelly (Saskatoon), PK Nelson (New York), FC Albuquerque (Phoenix), D Fiorella (Phoenix)*

Introduction: To demonstrate the curative reconstruction of a giant circumferential basilar trunk aneurysm using the Pipeline Embolization Device (PED). *Methods:* A 13-year-old female patient was referred for the treatment of a four centimeter, partially thrombosed, circumferential mid-basilar trunk aneurysm. Her presenting symptoms included headache, nystagmus and left upper extremity ataxia. Open surgical and conventional endovascular treatment options were thought to be of unacceptably high risk and unlikely to achieve cure. The patient underwent PED treatment. *Results:* An endovascular construct was built across the affected segment of the basilar trunk with seven serially placed, telescoping PEDs which bridged the 33 mm aneurysm neck. Completion angiography demonstrated considerably decreased flow into the aneurysm with stasis persisting into the venous phase of angiography. No technical complications were encountered. No new neurological symptoms were evident and her original presenting symptoms resolved completely within 24 hours of procedure. Computed tomography on POD 5 demonstrated no change in the size of the collective aneurysm-thrombus mass. Conventional angiography on POD 7 showed anatomical reconstruction of the basilar artery and complete occlusion of the circumferential aneurysm. Six month CTA and MRI showed marked reduction in the mass effect and continued complete occlusion of the aneurysm. She remains neurologically normal. *Conclusions:* The PED provides a safe and definitive constructive treatment option for large, giant and fusiform/circumferential aneurysms. The PED can achieve complete aneurysm occlusion without embolization coils. When applied judiciously, the PED may be used safely in vascular segments giving rise to eloquent perforators.

P-187

Treatment of Ruptured and Unruptured Intracranial Aneurysms with the Nexus 3D Morpheus CSR Coil

BW Lo (Hamilton), A Alobaid (Hamilton), G Belovay (Hamilton), T Gunnarsson (Hamilton), P Klurfan (Hamilton)*

Background: We characterize the Nexus 3D Morpheus CSR Coil for aneurysm coiling at McMaster University. This is a soft, conformable platinum alloy coil with absorbable polymer microfibrils. Unlike nitinol coils, these do not sacrifice compaction resistance. There is limited clinical data on their safety and efficacy. *Methods:* We analyzed several variables from a prospective aneurysm database at Hamilton General Hospital. They include patient demographics, aneurysm location and size, clinical presentation, types of coils used, peri-procedural complications, clinical outcome and recanalization on follow-up. *Results:* 25 patients were treated with Morpheus coils alone or with other coils. 9/25 had ruptured aneurysms. 1/25 underwent carotid occlusion for treatment of giant supraclinoid ICA aneurysm. Satisfactory complete coil packing: 21/24 cases. Peri-procedural complications: aneurysm perforation with subsequent packing - 1, thrombus treated with thrombolytics -2. Mortality - 5 cases, all had ruptured aneurysms and post-procedural diffuse severe vasospasm. On the 12-month follow-up, 13/20 showed no filling, 4/20 residual neck, 3/20 residual aneurysm filling. *Conclusions:* The Nexus 3D Morpheus CSR Coil can be used effectively to treat intracranial aneurysms. It has the benefit of stability, although it cannot be followed by MRI/MRA because of signal interference. The recanalization rate on available follow-up cases is low.

P-188

Sex differences in stroke outcomes in patients with hyperglycemia

LK Casaubon (Toronto), J Wang (Toronto), MK Kapral (Toronto)*

Background: Elevated glucose levels are associated with poor stroke outcomes. As differences exist in glucose metabolism between sexes, we evaluated whether there were sex differences in the effect of glucose on stroke outcomes. *Methods:* Using data from the Registry of the Canadian Stroke Network (July 1/03-June 30/07), we examined the association between admission blood glucose and death at six months from index stroke and modified Rankin Score (mRS) at hospital discharge. We adjusted for age, comorbid conditions, and other risk factors using multivariable regression including an interaction term for sex*glucose. *Results:* Our cohort comprised 4,630 patients without diabetes (non-DM) and 1,998 with diabetes (DM). There was an interaction between sex and glucose in the non-DM group; with each mmol/l increase in admission glucose, male patients were less likely to achieve good functional outcome (mRS 0-2) at discharge (OR0.8975 per mmol/l increase, p=0.0014). Sex was not a predictor of functional status in the DM group and was not associated with death after stroke in either group. *Conclusions:* Men with no history of diabetes and higher glucose levels upon hospital admission after a stroke had worse functional outcomes than women. The reasons for this sex difference are unclear and warrant further study.

P-189

The Use of Enterprise Stent for Endovascular Treatment of Aneurysms

P Klurfan (Hamilton), T Gunnarsson (Hamilton)*

Objectives: The use of self expandable stents for the treatment of intracranial aneurysms has widened the therapeutic options for aneurysms that would not have had an endovascular treatment alternative. The Enterprise self expandable stent was recently approved for use in Canada. *Methods:* Between January 2008 and January 2009, 8 patients underwent 9 endovascular stent assisted coiling with the Enterprise stent at the Hamilton General Hospital. All patients were pre-loaded with Plavix and Aspirin. We reviewed the technical and peri-procedural complications as well as clinical and radiological outcomes. All patients had follow-up imaging with DSA, CTA or MRA. *Results:* Even though navigation of the microcatheter was difficult in some cases, all stents were deployed satisfactorily. No intra-procedural complications occur. In one patient with a giant partially thrombosed aneurysm, bilateral small thalamic strokes were detected on MRI post procedurally. No vessel occlusion or stenosis was observed on follow-up imaging. *Conclusion:* The Enterprise stent has shown to be a reliable endovascular tool for stent assisted techniques. In our experience this device is easier to navigate and deploy compared to previously available intracranial stents approved for aneurysm treatment.

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Parent Vessel Occlusion with HydroCoil for the Treatment of Cerebral Aneurysms

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Objective: Parent vessel occlusion for treatment of intracranial aneurysms can be achieved with detachable balloon or coils. The use of HydroCoil may allow rapid and effective occlusion of the artery. *Methods:* 4 patients (3 females and 1 male) with 2 large and 2 giant aneurysms were treated by scarifying the parent artery with HydroCoil. All aneurysms were unruptured but symptomatic. Two aneurysms were on the internal carotid artery (supraclinoid and cavernous segments), one on the A2 segment of the anterior cerebral artery and one on the P2 segment of the posterior cerebral artery. Clinical and neuro-imaging finding were reviewed. *Results:* Parent vessel occlusion was achieved in all patients. All patients tolerated procedures well with no new neurological deficits. One patient had a hematoma at the puncture side that resolved with no intervention or clinical consequences. Follow up neuro-imaging in 3 patients showed no evidence of aneurysmal filling with good supply from collateral circulation. In one case there was partial aneurysm filling in a giant aneurysm. *Conclusion:* The use of HydroCoil for parent vessel occlusion is effective for complete and rapid sacrifice of the artery in a short segment. This technique is useful in treating aneurysms when conventional coiling is not feasible.

P-191

Clinical and radiological progression of middle cerebral artery (MCA) giant fusiform aneurysm in an 11 year old girl: case report and review of the literature

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Background: Giant fusiform middle cerebral aneurysms are unique in presentation, morphology, and clinical progression, and are distinct from saccular aneurysms. *Methods:* We report an 11 year old girl who presented with a dense hemiplegia due to a perforator ischemic stroke, found to have a giant fusiform aneurysm involving the entire M1 segment of the right middle cerebral artery (MCA), including the M1/2 bifurcation. There was significant intramural thrombus. She improved, and followup was conducted over two-years. Serial imaging, with computed tomographic angiography (CTA), magnetic resonance angiography (MRA), and conventional digital subtraction angiograms, demonstrated radiologic progression. Selective right MCA balloon occlusion and xenon CT assessed the adequacy of collateral circulation. *Results:* Over two years, the patient's hemiplegia fluctuated, with associated new ischemic parenchymal lesions. The aneurysm and intraluminal thromsosis enlarged despite adequate antiplatelet and anticoagulant therapy. Cerebral perfusion studies revealed regional ischemia in the right MCA territory. Surgical strategies to isolate the aneurysm while ensuring cerebral perfusion are being formulated. *Conclusions:* This case illustrates the clinical and radiological characteristics of an unusual entity. Giant fusiform MCA aneurysms may enlarge and cause recurrent ischemic injury despite antiplatelet and anticoagulant therapy. Cerebral perfusion studies are important for functional assessment and treatment planning.

P-192

A Bayesian method to quantify the significance of clusters obtained from fMRI exploratory data analysis

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Background: A key problem in employing exploratory analysis methods to fMRI is that after the voxels have been clustered into groups, the significance of the clusters remains unknown. Statistical hypothesis tests are not appropriate, being designed to operate on balanced groups of data. We propose a Bayesian approach to calculate cluster significance by fitting a hierarchical model of underlying signal sources to the observed clusters. *Methods:* FMRI data results from the mixture of interesting localized sources, i.e., cerebrovascular events, with uninteresting global sources from motion and noise, which can be modelled in a hierarchical manner. We fit the hierarchical model to a univariate temporal feature based on the cross-correlation of each cluster with the stimulus paradigm. Cluster significance is then calculated as the probability of observing each cluster feature solely from the model's global sources. *Results:* Exploratory data analysis software EvIdent (NRC, Winnipeg, Canada) was used to cluster cerebral fMRI data from healthy volunteers performing an event-related motor task. For each data set, the Bayesian approach correctly identified clusters within the sensorimotor cortex. For comparison, the software Statistical Parametric Mapping (Wellcome Trust, London, UK) was also used and produced similar results. We also report performance estimates using simulated data. *Conclusion:* The proposed Bayesian approach provides an objective framework to assess the significance of clusters identified from the exploratory analysis of complex data sets acquired during fMRI.

P-193

Incidence of Recurrent Stroke in Patients at Risk of Cardioemboli

*M Sabih (Mississauga), N Pageau (Mississauga), AG Douen (Mississauga)**

Background: Apart from atrial fibrillation (AF), other cardiac anomalies including chamber dysfunction, valve disease, conduits, aortic arch plaque and masses have been implicated as potential causes of cardioembolism. Objective: To assess the incidence of recurrent stroke in patients in whom a non-AF cardiac cause of stroke may be implicated. *Methods:* We reviewed 325 charts and excluded those with ipsilateral moderate-severe vasoocclusive disease, AF, and absence of heart disease plus normal ECHO findings. 132 patients were analyzed with ~ 4 month clinic follow-up. *Results:* 20 patients had a history of CAD, 16 had poor LV function, 59 had LV hypertrophy, 18 LA dilatation, 2 mechanical valves, 64 mitral valve anomalies (mainly calcifications), 76 aortic valve disorder (predominantly sclerosis), 3 PFO, 2 ASD, 1 with both PFO/ASD, 3 masses (2 thrombi, 1 vegetation). At discharge, 113 patients (86 %) were on antiplatelet therapy and 19 patients (14%) were on anticoagulants (12 were using anticogulants before admission and 1 had pulmonary emboli). Antiplatelets were switched to anticoagulation in only 6 patients. There was only 1 recurrent stroke during follow-up. *Conclusions:* There is a low incidence of recurrent stroke within the first ~4 months in patients at potential risk of non-AF associated cardioembloism and antiplatelet therapy appears to be adequate for most.

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Endovascular Therapy of Neonatal and Infantile Intracranial Vascular Malformations

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Introduction: Intracranial vascular malformations discovered during the neonatal period and infancy, are extremely uncommon. We present our experience with endovascular treatment of these rare disorders, with an emphasis on discussion of new adjunctive techniques to facilitate vascular access and improve degree of lesional occlusion. *Methods:* Based upon case logs from the angiography suite, we performed a retrospective review of healthcare and radiological records from 2001-2008. *Results:* Since 2001, we treated six patients who were diagnosed with Vein of Galen malformation (3), high-flow arteriovenous fistula (2), and dural arteriovenous malformation (1). All lesions were symptomatic and except in one, required urgent attention and critical care support as life-saving measures. All patients were neonates except two (aged 13 and 21 months). Repeated embolization was performed in four patients (range 2-4 procedures) in the pursuit of significant flow reduction. Due to the known challenges of blind arterial puncture, we utilized open femoral artery cut-down with microsurgical technique to facilitate speedy vascular access. Embolic materials deployed include coils and cyanoacrylate, but our recent use of the new polymeric agent, Onyx, has allowed substantial and favorable angiographic penetration of the target lesion. One fatal intra-procedural complication occurred and two patients died related to their underlying disease. *Conclusions:* Despite advances in endovascular technology, the treatment of neonatal and infantile intracranial vascular malformations remains extremely challenging. Judicious patient selection, careful endovascular technique, and a multidisciplinary team-based approach remain critical to achieve satisfactory clinical outcomes.

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Neoangiogenesis of a giant serpentine middle cerebral artery aneurysm

N McLaughlin (Montreal), M Laroche (Montreal), MW Bojanowski (Montreal)*

Introduction: Giant serpentine aneurysms (GSA) represent a subcategory of cerebral arterial trunk aneurysms. Their natural history and growth mechanism remain unknown. *Methods:* We present a case of GSA in whom the progression of intimal neovascularisation has been imaged and discuss the importance of supraselective catheterization in such circumstances. *Results:* A 28-yr-old female presented with sudden onset of a severe headache with a short period of production dysphasia. Neurological examination was normal. Nonenhanced CT demonstrated a spontaneously hyperdense oval mass. No subarachnoid hemorrhage (SAH) was documented. Initial angiography documented a partial filling of a GSA arising on a distal branch of the left MCA. Three days later, follow-up angiography prior to treatment revealed spontaneous occlusion of the aneurysm. One month later, the patient presented similar transient symptoms. Nonenhanced CT showed a hyperdense rim within the aneurysm wall, representing either an intramural hemorrhage or residu of the prior thrombus. Once again, no SAH was documented. MRI showed similar complex signals with the aneurysm with ring enhancement following gadolinium administration. Initial angiography did not image a permeable vascular channel or aneurysm. A supraselective injection in the MCA branch confirmed the absence of flow through the aneurysm but opacified numerous neovessels giving a pseudotumor appearance to this GSA. This neoangiogenesis is possibly responsible for the intramural hemorrhage and contrast enhancement observed on MRI. *Conclusion:* In cases of GSA, supraselective catheterization should be done to document the permeability of the intrathrombotic canals. It may also enable visualization of the neoangiogenesis, possible precursor of intramural hemorrhage.

P-196

Endoscopic treatment of distal choroidal artery aneurysm

N McLaughlin (Montreal), M Lévêque (Montreal), M Laroche (Montreal), MW Bojanowski (Montreal)*

Introduction : Distal choroidal artery aneurysms are rare and mostly associated with moyamoya disease. Thirty-three cases have been reported in the literature and only half were treated surgically. Given their deep location, the treatment of such aneurysms is challenging. *Method:* We report the first case of a distal choroidal artery aneurysm treated entirely by surgical endoscopy. The treatment strategy is discussed and the English literature reviewed. *Results:* A 60-year-old woman followed for moyamoya disease with a left distal choroidal artery aneurysm presented with two intraventricular hemorrhages. Cerebral angiography showed an aneurysm located on the left distal choroidal artery. MRI also showed it to be protruding from the lateral wall of the trigone of the left lateral ventricle. Using MRI-guided stereotactic localization, the aneurysm was accurately reached by endoscopy and successfully resected from the parent artery. The patient was discharged neurologically intact. *Conclusion:* This is the first report of a successfully treated distal anterior choroidal artery aneurysm entirely by endoscopy. Thus, endoscopic surgery may be added to the armamentarium in the treatment of intraventricular aneurysms allowing minimal brain dissection.

Trauma, Critical Care

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Orbitocranial Injury with Pulsatile Proptosis: Report of Two Cases

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Background: Proptosis is forward displacement of the globe and orbital contents secondary to increased IOP. Commonly the etiology is secondary to orbital mass effect from inflammation, infection, hemorrhage or a neoplasm. Less commonly proptosis is secondary to venous congestion. We report two interesting cases of delayed proptosis secondary to craniofacial trauma and discuss their management. *Method:* First case: 47-year-old male fell under the influence of alcohol and sustained polytrauma. CT showed a left parietal epidural hematoma and bifrontal contusions. After evacuation of the epidural hematoma, he developed progressive proptosis of left eye. Imaging showed a type A, carotid- cavernous fistula. Patient underwent endovascular obliteration of the fistula and recovered from a transitory ophthalmoplegia. Second case: 38-year-old male involved in MVA. CT of head revealed right frontal

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cerebral hemorrhage and orbital roof fracture. One week later, he underwent a frontal craniotomy to elevate and reconstruct depressed orbital fracture. However, post-operatively, the proptosis worsened as he developed orbital compartment syndrome. He underwent a lateral canthotomy to reduce orbital pressure. *Results:* In the setting of craniofacial trauma, acute proptosis is frequently observed secondary to orbital soft tissue swelling. In these two cases, proptosis was delayed because the etiology was not due to orbital mass effect, but may have been due to venous congestion. When orbital pressure exceeds arteriolar perfusion pressure, orbital ischemia occurs, resulting in loss of ocular functions. *Conclusion:* It is important to remain vigilant of acute and delayed orbital manifestations of trauma, and act swiftly to save vision and ocular functions.

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Decompressive craniectomy in the treatment of traumatic brain injury. How aggressive should we be?

AA Al Jishi (Montreal), HM Al Jehani (Montreal), R Saluja (Montreal), MH Maleki (Montreal), J Marcoux (Montreal)*

Background: Intracranial hypertension is believed to be one of the main factors in secondary injuries after a traumatic brain injury (TBI). Aggressive medical treatment might not be sufficient to alleviate such pressure and the patients subsequently suffer from secondary intracranial damage. Decompressive craniectomy can create more extracranial space for the brain to expand and relieve the risk of pressure effects on vital brain structures, and may lead to better outcome. *Method:* Between Sep 2004 and Sep 2008, 70 patients admitted for TBI (mean GCS = 7) at the Montreal General Hospital (Level I Trauma Center) had decompressive craniectomy. Early craniectomy (43 patients) was done within 24 hours of the injury for mass evacuation and high intracranial pressure (ICP) of early onset due to severe TBI. Late craniectomy (27 patients) was done after at least 24 hours and purely for the treatment of high ICP that was not responding to maximal medical therapy. *Results:* The early decompressive craniectomy group achieved a good outcome (GOS 4 and 5) in 41.9% of the cases. None remained in a vegetative state (GOS 2). The mortality rate was 39.5%. In the late craniectomy group, the ICP decreased by a mean of 24mmHg, and good outcome was achieved in 59.3% of the cases. 11.1% had a GOS of 2 and the mortality rate was 18.52%. *Conclusion:* Decompressive craniectomy has shown to be effective in controlling the ICP and, despite the severity of the TBI, a good outcome was achieved in a majority of patients.

P-199

Irreversible posterior encephalopathy syndrome

M Alzawahmah (London), M AlTurkustani (London), GB Young (London)*, M Sharpe (London)*

Background: Posterior Reversible Encephalopathy Syndrome (PRES) has become synonymous with a unique pattern of vasogenic oedema seen in the setting of neurotoxicity or hypertension. On CT or MRI the oedema is widespread but with posterior predominance. *Method:* Case Report: 39 years old female patient, known to have Wilson disease with orthotopic liver transplantation at age of 18 years and maintained on Tacrolimus, presented with a one week history of generalized fatigue, weakness, confusion, slurred speech, nausea, and vomiting. This was initially diagnosed as hepatic encephalopathy when she was admitted under Hepatology . Her level of consciousness deteriorated and she required admission to ICU. On examination in ICU she was drowsy, opened eyes spontaneously, showed no verbal output and responded to visual threat from both sides, with normal eye movements and pupillary reactivity. . She had recurrent, stimulus-provoked myoclonic jerks affecting four limbs with generalized rigidity and increased reflexes. EEG showed recurrent high frequency low voltage right centroparietal focal epileptiform discharges and a moderate encephalopathy picture. As the serum Tacrolimus concentration was elevated, it was held. An MRI showed diffusion restriction in posterior hemispheric regions suggestive of PRES. She continued to deteriorate with disseminated intravascular coagulation (DIC). After developing a right third nerve palsy a CT scan showed massive bilateral intracerebral hemorrhage with, subarachnoid hemorrhage, and signs of herniation. She died shortly thereafter. *Conclusion:* Cases of PRES with significant diffusion restriction may indicate irreversibility and with DIC may produce fatal white matter confluent haemorrhages.

P-200

Spinal cord perfusion pressure following spinal cord injury

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Background: Patients with spinal cord injury (SCI) may benefit from elevated spinal cord perfusion pressure (SCPP). *Methods:* As part of a 2X2 factorial randomized controlled trial investigating the utility of blood pressure management and matrix metalloproteinase inhibition, the present analysis describes SCPP (mean arterial pressure - lumbar subarachnoid pressure via lumbar drain) in controls. Mean arterial pressure was maintained above 65 mm Hg. Transducers were leveled at site of injury. *Results:* 2722 hourly observations were collected on 18 patients. Mean age was 37(range 16-69). 61% were male. 61% of patients suffered cervical injuries and 39% suffered thoracic injuries. Six patients had incomplete injuries. Median (IQR) daily minimum SCPP ranged from 46 (40, 53) on day1 to 56.5(45.5, 63.5) mmHg. Generalized estimating equation regression analysis revealed the lowest panel averaged SCPP on the day of injury (60 mmHg; 95%CI: 54,67) and SCPP increased over the course of the study to day 6 (71 mm Hg; 95%CI: 66,75) reaching statistical significance compared to the day of injury at day 3. SCPP was significantly lower in those with cervical injuries only on day 7 (-18 mmHg, 95%CI: -36,-0.8; P=0.04). SCPP was not significantly different among those with complete compared to incomplete injuries. *Conclusions:* These data define baseline SCPP following SCI.

P-201

Implementing Transcranial Doppler as Confirmatory Test in Brain Death Criteria

HM Al-Jehani (Montreal), B Sheikh (Dammam)*

The determination of brain death has assumed importance for the ability to support vegetative functions for prolonged periods after brain death and for the need for organs donation for transplantation. The idea of utilizing transcranial Doppler (TCD) in the evaluation of cerebral circulatory arrest is not new but this has not been implemented routinely into brain death criteria evaluation protocol.

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To be able to prove this value we conducted a prospective analytic study over 12 months to evaluate on the specificity and sensitivity of transcranial Doppler wave forms in confirming brain death in unconscious patients. Sixty unconscious patients were included in this project. Underlying pathology for unconsciousness included: head injury, brain tumors, cerebrovascular accidents, and cardiac arrest. 86 % of the patients had reliable acoustic window that allowed accurate TCD evaluation. Of this group, 93 % showed the characteristic cerebrovascular flow arrest presented by the to-and-fro oscillation on the TCD recordings. Interestingly, two patients who initially showed full indication of brain death on clinical evaluation, showed normal TCD tracings. Both patients were given full management for their primary pathology, and both regained consciousness. This study confirms the high value of transcranial Doppler in confirming brain death. The investigators recommend for this modality to be incorporated as part of brain death criteria.

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Aggressive management of severe traumatic brain injury improves survival and outcome in patients with low GCS

RS Saluja (Montreal), R Dudley (Montreal), M Feyz (Montreal), T Razek (Montreal), A Gursahaney (Montreal), M Maleki (Montreal), J Marcoux (Montreal)*

Background: Severe traumatic brain injury (TBI) is a major cause of death and disability worldwide. Not all the damage from TBI, however, occurs at the time of injury but evolves over the following hours to days, a concept known as secondary injury. Prevention of secondary injury is the major objective in the treatment of severe TBI. Despite this, however, there continues to be debate whether aggressive management of TBI improves outcome. *Methods:* In September 2004, the neurosurgical group at the Montreal General Hospital decided to take an aggressive approach toward the management of severe TBI with closer adherence to the "Guidelines for the Management of Severe Traumatic Brain Injury" and increased use of ICP control measures including decompressive craniectomy. In the current study, we performed a retrospective review of all severe TBIs (n=789) that presented between April 2000 and December 2008 to compare outcomes before and after the decision to be more aggressive in management. *Results:* In comparison of the two groups, we discovered that there was an improvement in the global outcome of our patients although it did not reach statistical significance. On sub-group analyses, however, there was a statistically significant (p=0.01) decrease in mortality and increase in good outcome (GOS 4 and 5) in patients who presented with GCS 3 or 4 when aggressive management was applied. *Conclusions:* Aggressive management of severe traumatic brain injury improves the outcome in patients with low initial GCS.

P-203

Risks and benefits of venous thromboembolic event (VTE) prophylaxis in traumatic brain injury (TBI) patients. A large scale, 5-year review.

RW Dudley (Montréal), RS Saluja (Montréal), B Kalmovitch (Montréall), A Bonnici (Montreal), M Maleki (Montréal), A Gursahaney (Montreal), T Razek (Montreal), J Marcoux (Montréal)*

Background: Traumatic brain injury (TBI) patients are at high risk for venous thromboembolic events (VTE). The Brain Trauma Foundation Guidelines (2007) state that low-molecular weight heparin or unfractionated heparin should be used to prevent these serious life threatening complications, but suggest that there is an increased risk of expansion of intracranial hemorrhages with VTE prophylaxis. In addition, it is unclear which treatment regimen (i.e., medication, dose, timing) provides the best risk-to-benefit ratio in TBI patients. *Methods:* We reviewed the Montreal General Hospital TBI Database for all moderate-to-severe (GCS 3-12) TBI patients admitted between January 2004 and December 2008 to examine VTE prophylactic treatment regimens, deep vein thrombosis (DVTs), pulmonary embolisms (PEs), and late intracranial hemorrhages occurring while on VTE prophylaxis. In this population of 711 TBI patients, VTE prophylaxis was started, at least 48hrs post-trauma in all individuals who had no other confounding coagulopathy or bleeding issues, when two or more consecutive CT scans revealed hemorrhage stability. *Results:* Below-the-knee and above-the-knee DVTs occurred in 11.3% and 3.8% of treated patients, respectively. PEs occurred in another 3.8% of treated patients. There was no significant difference between the percentage of patients suffering VTEs while on dalteparin and enoxaparin. Importantly, only one patient had a late intracranial hemorrhage causing death while on VTE prophylaxis. *Conclusions:* These results suggest that current regimens of VTE prophylaxis used in our TBI population provide quite an acceptable risk-to-benefit ratio, with a relatively high level of protection against VTEs and an extremely low risk of recurrent intracranial hemorrhage.

P-204

Improved organ donation rates in patients with brain death after adopting a comprehensive program

BW Lo (Hamilton), D Jichici (Hamilton), N Hemrica (Hamilton)*

Background: In 2007, Hamilton Health Sciences (HHS) was recognized as a center of excellence leading Ontario in the number of multiple organ donors. Why this change? No standardized approach to donation existed before creation of Ontario's Trillium Gift of Life Network (TGLN) in 2002. To overcome barriers plaguing successful donation, HHS has developed a comprehensive donation program. *Methods:* HHS made organ/tissue donation a priority. Adopted strategies include: dedicated organ/tissue committee with participating ICU physicians, chiefs of practice, nursing and senior administration, clinical triggers, "pre-approach plan" to ensure timely discussion, public and healthcare team education and standardized protocols. TGLN was operational (2002), with full time, on-site nurse since 2003. *Results:* HHS's trauma volumes increased: 398 patients (2001/2) vs. 526 (2006/7). Cornea donation: 48 (2001/2) vs. 145 (2006/7). Multiple solid organ donors: 12 (2001/2) vs. 32 (2006/7). Our referral rate, approach and consent rates were 100%, 86%, 61% (2007/8).
Conclusions: In 2007, HHS was Ontario's leader in donations with 32 multiple organ donors. Implementation of above strategies has helped achieve greatly improved referral, approach and consent rates. Timely referrals with clinical triggers have led to benchmark of 100% referral rate. The experience for HHS has been rewarding, yet we continue to strive for excellence in donation due to resource challenges, education barriers and cultural diversity.

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Case Report of Opsoclonus-Myoclonus in an Intoxicated Patient

CR Gebhardt (London), GB Young (London)*

Opsoclonus-mycolonus (OM) was first described by Dr Kinsbourne in 1962 as "myoclonic encephalopathy of infants" in the Journal of Neurology, Neurosurgery and Psychiatry (JNNP 1962). Its synonym dancing eyes and dancing feet is described in pediatric literature associated with neuroblastoma. As rare as OM is in pediatrics, it is even more so in adults. In adults, OM is more commonly associated with paraneoplastic syndromes. Only a handful of case reports exist describing OM secondary to drug intoxication. We describe a case report of a 16 year old female who developed OM secondary to amitriptyline, quetiapine, and citalopram intoxication. Random, multidirectional, conjugate saccades were visible clinically and capture on EEG leads. Although a rare sequela of intoxications, this case provides another example of the complex interplay of neurotransmitters and some insight into the pathophysiology of opsoclonus-myoclonus.

P-206

Neurological Determination of Death in Patients on Extracorporeal Membrane Oxygenation

CR Gebhardt (London), GB Young (London), D Fortin (London), M Sen (London)*

The concept of brain death, the irreversible absence of brain function, is widely accepted in the medical community. The term was first adopted by Mollaret & Goulon in 1959 as 'coma depasse' (irreversible coma). Not until 1968 was the definition reexamined, by Harvard Medical School. Since then, numerous guidelines for the neurological determination of death (NDD) have been instituted. Canadian Guidelines have been revised within the past 5 years. Clinical examination remains the standard for NDD. A key aspect of the exam is the apnea test, which is standardized in many countries; guidelines in Canada require a drop in pH of 7.28 or less, a rise in $PaCO_2$ of >20 mm Hg and a final $PaCO_2$ of >60 mm Hg. We introduce two case reports of patients who were declared brain dead using clinical criteria alone, including the apnea test, while on extracorporeal membrane oxygenators (ECMO). It was possible to adjust oxygenation, to maintain perfusion and to declare NDD in a valid manner during this support. To our knowledge, there are no previous reports of NDD upon patients receiving extracorporeal oxygenation.

P-207

Comparison of the APACHE ll score on admission, CT scan change and in-hospital Mortality in Acetaminophen - induced Acute Fulminant Hepatic Failure patients.

S Thayaparajah (London), I Gulka (London), R Butler (London), S Das (London), GB Young (London)*

Introduction: We wanted to determine whether APACHE ll scores on admission correlated with cerebral edema in acetaminophen - induced acute fulminant hepatic failure (AFHF) patients. *Methods:* Retrospective chart review of AFHF patients admitted to the ICU: tabulation of: age, sex, date of admission, discharge or death, cause of death and APACHE ll score on ICU admission. CT scans were re-read with blinding to clinical information and catalogued for changes. For inclusion encephalopathy and hepatic failure occurred within 8 weeks of onset of liver disease and CT scans of head was performed. Chi-square/Fisher Exact testing was used to compare categorical variables between acetaminophen overdose (AOD) and non AOD AFHFpatients and between survivors and nonsurviviors. *Results:* Of 25 AFHF patients AOD was the most common cause of AFHF. There was no statistically significant difference between AOD patients and nonAOD patients with respect to the APACHE ll scores on admission (chi square test statistic = 0.73, df = 1, p value = 0.4). Of the 9 AOD patients. 8 (90%) developed cerebral edema;5 (55%) needed liver transplantation; four (36%) died, each of whom developed cerebral edema, even though the cause of death was not always due to cerebral edema directly. *Conclusions:* Apache II scores on ICU admission for AOD versus non AOD patients were not significantly different overall. APACHE ll score on ICU admission may not be useful as an early indicator of impending cerebral edema in AOD- induced AFHF.

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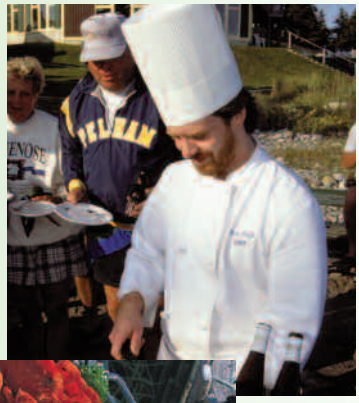
It will come as no surprise to long time Congress participants that the annual social event this year in Halifax will feature a lobster feast!



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Reception: 18:00, Dinner and Dancing 19:00

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