(MSc, PhD, or ≥ 2 years of non-degree research) and full employment was determined by Fisher's exact test. *Results:* 60% and 26% of graduates currently have full-time staff positions in Canada and the US, respectively. "Underemployment," defined as failure to secure a full-time position in neurosurgery despite a desire to do so (including locums, additional fellowship positions, unemployment and career changes) is currently seen in 12% of graduates, with 20% having been underemployed at some point within 5 years of graduation. Pursuit of research during residency was significantly associated with obtaining full employment (94% vs. 73%, p=0.011). *Conclusions:* Underemployment is a significant issue in recent neurosurgical graduates from Canadian training programs. Research training during residency appears strongly associated with obtaining full employment.

F.03

Management of post-traumatic bilateral jumped facets: a systematic review

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Background: Bilateral jumped facets (BJF) are serious cervical spine injuries that require reduction and surgical stabilization. Closed reduction often performed, however, the argument of having disc herniation suggested deferred treatment until MRI is done. The later has been criticised for delaying the treatment. *Methodology:* We conducted a systematic review focusing on BJF in order to assess the validity of performing an MRI prior to closed reduction. The immediate neurological state after reduction and long term outcome were the primary goals. *Results:* A total of 49 articles were found (1973-2014). Only 20 of them fit our criteria. A total of 203 BJF were evaluated with C6/7 and C5/6 being the most common level of injury. Closed reduction was performed in 194 patients with no MRI in 118 patients. Clinical changes had occurred in 7 patients (3 improved, 2 worsened, 2 transient worsening). The long term outcome showed no significant difference between the two groups who had closed reduction before or after the MRI (p>0.05) *Conclusion:* The risk of neurological worsening with closed reduction prior to MRI is low and insignificant. The MRI will be helpful post reduction to assess the status of the cord and adequacy of closed reduction, especially in comatose patients.

F.04

Use of neuropathic pain questionnaires in predicting the development of failed back surgery syndrome following lumbar discectomy for radiculopathy

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Objective: Failed back surgery syndrome (FBSS) describes neuropathic pain that occurs when extremity symptoms in lumbar disease persist despite structurally corrective spinal surgery. It is unclear whether specific preoperative pain characteristics predict patients prone to such postoperative disabling symptoms. *Methods:* This prospective study analyzed surgical patients with painful radiculopathy secondary to lumbar degenerative disease. Clinical parameters included general demographic information, preoperative and postoperative clinical examination, self-reported pain and disability scores, and neuropathic pain scoring. The neuropathic pain screening tests used in this study were the Douleur Neuropathique 4 (DN4) and Leeds Assessment of Neuropathic Symptoms and Signs (LANSS), with correlation tested for ordinal score and screen positivity. Multiple logistic regression analysis defined predictors of postoperative symptomatology. *Results:* Among 250 surgical radiculopathy patients, 12% were classified with FBSS. The condition was highly associated with abnormal preoperative screens for neuropathic pain, but not gender, smoking status, or preoperative pain severity (multiple logistic regression, α=0.05). Good correlation was seen between the two screening tests used in this study for absolute ordinal score (Spearman's ρ=0.84, p<0.001) and thresholding for neuropathic pain features (Spearman's ρ=0.48, p<0.001). *Conclusion:* Higher neuropathic pain screening scores correlated with likelihood of postoperative leg pain. Further work will develop more accurate prognostication tools for radiculopathy patients undergoing structural spinal surgery.

F.05

Parachute Canada/ThinkFirst Hockey Spinal Injuries Registry update

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Background: The Registry has collected data on spinal injuries in hockey for 30 years. This paper identifies the nature and incidence of spinal injuries in Canadian ice hockey and the impact of prevention programs. *Methods:* Data about spinal injuries with and without spinal cord injury in ice hockey have been collected by Parachute Canada/ThinkFirst's Canadian Ice Hockey Spinal Injury Registry since 1981 through retrospective questionnaires from practitioners, ice hockey organizations and media reports. Injury risk factors assessed include age, gender, location, and injury mechanism. *Results:* From 1943-2011, 355 cases have been documented. Injuries were primarily sustained by males (97.7%), and were cervical (78.9%) in location, resulting mainly from impact with the boards (64.2%). Checking/pushing from behind (36.0%) was the most common cause of injury, although slightly lower during 2006-2011. Major differences between provinces continue; Ontario and Quebec, continue to show markedly different injury rates, with Ontario's more than twice that of Quebec. *Conclusions:* Spinal injuries in hockey continue to occur, although at lower rates than in the peak years from 1981-2000. Injury prevention education and rules reinforcement (e.g. no checking/pushing from behind). Data indicate that multifaceted prevention programs have reduced the risk of injury.

F.06

Regional variation in lumbar spine surgery in Saskatchewan: a population-based analysis

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Background: Unexplained significant variation may suggest a quality care problem in a health care system. The objective of this study was to determine the extent of variance in spine surgery Saskatchewan and determine possible causes. *Methods:* Provincial billing

records for new spine surgery consultations from May 2011 through October 2012 were correlated with subsequent lumbar surgery. Two tertiary centers (TC1 and TC2) were compared with reference to the Health Region of origin of the patient. Wait times for surgery and utilization of spine pathway clinics was analyzed. *Results:* TC1 had significantly higher rates of spine fusion and lumbar spine surgery. The percentage of new referrals that went to surgery was 14.0% in TC1 and 11.8% in TC2 ($p<0.0001$, Z-Test). Population-based calculation of the rate of new referrals was 1581/482387 = 0.33% for TC1 vs. 970/601739 = 0.16% for TC2 ($p<0.0001$, Z-Test). Utilization of the spine pathway clinic was lower and wait times for surgery were longer in TC1. *Conclusions:* Causes of regional variation are unknown and likely multifactorial. In Saskatchewan, the most striking variance was that the rate of primary care referrals for lower back conditions in regions served by TC1 was double that for TC2. This could potentially be reduced through more regionally consistent utilization of the spine pathway.

F.07

Utilizing NeuroTouch, a virtual reality simulator, to assess and monitor bimanual performance during brain tumor resection

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Background: NeuroTouch simulator provides the potential to determine performance metrics, but validation and easily utilized software are essential before implementation of this platform into neurosurgical training. *Objectives:* Evaluate and validate neurosurgical performance metrics for simulated brain tumors resection. Develop software and a global web based system to allow utilization of these metrics. *Methods:* The bimanual resection of 8 simulated brain tumors with differing complexity was evaluated. Software was developed to automatically generate all the metrics from NeuroTouch data output including: blood loss, tumor percentage resected, total brain volume removed, maximum and sum of forces utilized, efficiency index, ultrasonic aspirator path length index (UAPLI), coordination index and ultrasonic aspirator bimanual forces ratio (UABFR). Six neurosurgeons and 12 residents were evaluated. *Results:* Resident performance was significantly more impaired than neurosurgeon by increasing tumor complexity. Significant differences were found between neurosurgeons, senior, and junior residents on efficiency index and UAPLI. UABFR outlined significant differences between senior and junior residents. Coordination index demonstrated significant differences between junior residents and neurosurgeons. *Conclusions:* Utilizing metrics employed the NeuroTouch platform differentiated novice from expert performance. Software was developed for metrics and will be made available online for all NeuroTouch users allowing global comparison of neurosurgical performance.

F.08

Endoscopic resection of colloid cyst: long-term followup with 65 patients

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Introduction: Colloid cysts of the third ventricle are rare, histologically benign lesions that can be associated with obstructive hydrocephalus. Endoscopic removal developed as an alternative to microsurgical craniotomy as a less invasive surgical treatment. This review examines the endoscopic surgical experience for a consecutive series of patients with colloid cyst of the third ventricle. *Methods:* Patients with a diagnosis of "colloid cyst of the third ventricle" who were treated in Calgary between January 1994 and July 2014 were reviewed using a clinic database and registry. *Results:* 95 patients were identified. 30 patients without hydrocephalus underwent serial MRI and clinical observation with one patient developing hydrocephalus leading to surgical treatment. 65 patients underwent endoscopic treatment of their colloid cyst (male=34; female=31). The mean age at diagnosis was 45.5 years. 3 patients had been previously treated with other surgical approaches. All surgically treated patients had hydrocephalus and hydrocephalus resolved in all 65 patients. 1 patient sustained an injury to the internal capsule with transient hemiparesis. Mean followup was 8.2 years (range 0.1-19.3 years). 3 patients experienced colloid cyst recurrence treated with a second endoscopic removal. *Conclusion:* Endoscopic treatment of third ventricle colloid cysts can be performed with low risk as an alternative to microsurgical resection.

F.09

Disparity of volumetric and linear measurements of meningioma response to gammaknife radiosurgery

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Objective: To identify clinical, radiological, and dosimetric predictors of meningioma response to stereotactic radiosurgery (SRS), and post-SRS adverse radiation events (ARE). *Methodology:* A retrospective review was conducted. Seventy-five patients had at least 24 months of clinical and radiological follow-up. Tumor control was defined as any volumetric/diametric change less than +10%. Volumetric measurements were made using T1-Gadolinium enhanced 3T MRI scans with ITK-SNAP2.2 software. Univariate statistics were used to identify predictors of post SRS AREs. *Results:* Females comprised 69.3% of patients, mean treatment age was 58.6 years, and median follow up was 36.2 months. Twenty-one patients had undergone prior surgical resection. Volumetric tumor control (52%) was inferior to diametric control (92%). Twenty-six patients (34.6%) experienced some form of new-onset complication after SRS: Headache (17.3%), cranial neuropathy (10.6%), speech impairment (2.7%), tremor (2.7%), and ataxia (1.3%). Fourteen patients (18.7%) experienced new onset T2 signal change signifying of edema; eight of these patients were symptomatic. Lower Conformity index (1.24 vs. 1.4), and higher treatment-volume ratio (TVR) (0.80 vs. 0.72) were significantly associated with development of edema after SRS ($p<0.05$,