P.215

Tumor Heatmaps – Feedback Tool for Virtual Reality Neurosurgical Simulation

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Background: Performance Heatmaps were designed to visualize the spatial distribution of performance metrics during resection of complex tumors. This novel methodology provides experts (neurosurgeons) and trainees (residents and medical students) with visual feedback on their neurosurgical performance during operative procedures. **Methods:** Neurosurgeons (NS), senior residents (SR), junior residents (JR) and medical students (MS) performed resection of a complex tumor on the NeuroVR simulation platform. Metrics including time spent, force applied, and tumor volume removed were used to create Performance Heatmaps for each group. **Results:** During complex operative procedures, greater expertise correlated increased time spent in critical areas (NS = 121.0 s, SR = 103.0 s, JR = 86.1 s, MS = 84.9 s), increased force application (NS = 387 N, SR = 317 N, JR = 340 N, MS = 304 N), and increased tumor removal (NS = .096 cc, SR = .081 cc, JR = .074 cc, MS = .069 cc). **Conclusions:** Performance Heatmaps further our understanding of neurosurgical expertise by identifying key differences between experts (neurosurgeons) and trainees (residents and medical students). With the adoption of competency-based curricula, intuitive feedback tools will prove essential for trainees seeking surgical mastery.

P.216

Improving access to neurosurgeons through an electronic consultation service

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Background: Timely access to neurosurgeons for clinical advice is limited depending on region and other social factors. An eConsult service providing access to neurosurgeons in Ontario, Canada may influence primary care provider (PCP) course of action and referral behaviours. **Methods:** The Champlain BASE (Building Access to Specialist Care via eConsult) service allows PCPs to access specialist care in lieu of traditional face-to-face referrals. We conducted a cross-sectional study of eConsult cases submitted to neurosurgeons by PCPs between Jan 1, 2017 and Dec 31, 2018. Usage data and PCP responses to a mandatory closeout survey were analyzed. **Results:** A total of 432 eConsults were submitted. Specialist median response time was 2.29 days with 86.8% of responses occurring within 7 days. PCPs received a new or additional course of action in 53% of cases. An unnecessary face-to-face referral was avoided in 57% of all eConsults, and 50% of cases where the PCP initially contemplated requesting a referral. Over 86% of cases were rated at least 4 out of 5 in value for PCPs and their patients. **Conclusions:** The use of eConsult improves access to neurosurgeons by providing timely, highly-rated practice-changing clinical advice while reducing the need for patients to attend face-to-face office visits.

SPINE AND PERIPHERAL NERVE SURGERY

P.217

Patient reported outcomes following surgery for lumbar spinal stenosis: Comparison of a universal and multitier health care system

O Ayling (Vancouver)*, *C FIsher* (Vancouver)

Background: Canada has a universal health care system while the United States utilizes a combined public and private payer system. The purpose of this study is to investigate whether there are differences in clinical outcomes between those surgically treated for spinal stenosis in Canada as compared to the United States. **Methods:** Surgical lumbar spinal stenosis patients treated in Canada that were enrolled in the Canadian Spine Outcome Research Network (CSORN) prospective multicenter registry were compared with the surgical cohort enrolled in the Spine Patients Outcome Research Trial (SPORT) study. Spine-related patient reported outcomes (PROs) were compared at 3 months and 1 year post-operatively. **Results:** The CSORN cohort consisted of 432 patients and the SPORT cohort was made up of 278 patients. The CSORN cohort had a higher proportion of patients with a symptom duration greater than 6 months (92.3% vs. 58.3%, p<0.0001). The CSORN cohort demonstrated significantly greater rates of satisfaction after surgery at 3 months (p=0.003) and 1 year (p<0.001). **Conclusions:** Patients undergoing surgical treatment for lumbar spinal stenosis in Canada (CSORN cohort) reported higher rates of satisfaction at 3 months and 1 year post-operatively compared to the United States cohort (SPORT) despite having longer durations of symptoms prior to surgery.

P.218

Patient reported outcomes following surgery for lumbar disk herniation: comparison of a universal and multitier health care system.

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Background: Canada has a universal health care system that is funded by the government while the United States utilizes a combined public and private payer system. The purpose of this study is to investigate whether there are

differences in clinical outcomes between those surgically treated for lumbar disk herniation in Canada as compared to the United States. **Methods:** Surgical lumbar disk herniation patients enrolled in the Canadian Spine Outcome Research Network (CSORN) prospective registry. were compared with the surgical cohort enrolled in the Spine Patients Outcome Research Trial (SPORT) study. Spine-related patient reported outcomes (PROs) were compared at 3 months and 1 year. **Results:** The CSORN cohort consisted of 443 patients and the SPORT cohort was made up of 573 patients. Patients in the CSORN cohort were older (p<0.001), and were more likely to be employed (p=0.003). The CSORN cohort demonstrated significantly greater rates of satisfaction after surgery at 3 months (87.2% vs. 65.5%, p=0.003) and 1 year (85.6% vs. 69.0%, p<0.0001). The CSORN cohort was a significant independent predictor of patient satisfaction at 1 year. **Conclusions:** Patients undergoing surgical treatment for lumbar disc herniation in Canada reported higher rates of satisfaction at 3 months and 1 year post-operatively compared to the United States.

P.219

The effect of peri-operative adverse events on long-term patient reported outcomes after lumbar spine surgery

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Background: Peri-operative adverse events (AE) lead to patient disappointment and greater costs. There is a paucity of data on how AEs affect long-term outcomes. The purpose of this study is to examine peri-operative AEs and their impact on outcome after lumbar spine surgery. **Methods:** 3556 consecutive patients undergoing surgery for lumbar degenerative disorders enrolled in the Canadian Spine Outcomes and Research Network were analyzed. AEs were defined using the validated Spine AdVerse Events Severity system. Outcomes at 3,12, and 24 months post-operatively included the Owestry Disability Index (ODI), SF-12 Physical (PCS) and Mental (MCS) scales, visual analog scale (VAS) leg and back, Euroqol-5D (EQ5D), and satisfaction. **Results:** Adverse events occurred in 767 (21.6%) patients, 85 (2.4%) suffered major AEs. Patients with major AEs had worse OD (physical disability) scores and did not reach minimum clinically important differences at 2 years (no AE 25.7 ±19.2, major: 36.4±19.1, p<0.001). Major AEs were associated with worse ODI (physical disability) scores on multivariable linear regression (p=0.011). **Conclusions:** Major AEs after lumbar spine surgery lead to worse functional outcomes and lower satisfaction. This highlights the need to implement strategies aimed at reducing adverse events.

P.220

Mechanism of injury is associated with neurological outcomes in cervical sensorimotor complete traumatic spinal cord injury

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Background: There is significant heterogeneity in neurological recovery after complete (ASIA A) traumatic spinal cord injury (tSCI). Neurological recovery is often associated with a conversion to a higher letter grade of the American Spinal Injury Association's impairment scale (ASIA). The mechanism of injury (MOI) may play a significant role in the primary injury and should be considered for greater precision in care. **Methods:** We isolated ASIA A cervical tSCI patients from three multicenter prospective randomized controlled trials (NACTN, STASCIS, Sygen). Chi-square test with pairwise comparisons with Bonferroni corrections was performed to compare the proportion of ASIA A patients that converted to a higher ASIA grade between different MOI. **Results:** We identified 486 complete cervical tSCI patients. For patients who developed tSCI as a result of a fall, a significant proportion converted to a higher ASIA grade by 52 weeks (p = 0.009). For patients who developed tSCI as a result of a sports injury, a significantly smaller proportion did not convert to a higher ASIA grade compared to those that converted (p = 0.034). **Conclusions:** Due to the difference in outcomes, tSCI patients should be treated differently depending on their mechanism of injury.

P.221

Frailty is an Important Predictor of 30-day Morbidity in Patients Treated for Lumbar Spondylolisthesis Using a Posterior Surgical Approach

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Background: A non-operative approach has been favoured for elderly patients with lumbar spondylolisthesis due to a perceived higher risk with surgery. However, most studies have used an arbitrary age cut-off to define "elderly." We hypothesized that frailty is an independent predictor of morbidity after surgery for lumbar spondylolisthesis. **Methods:** The American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database for years 2010 to 2018 was used. Patients who received posterior lumbar spine decompression with or without posterior fusion instrumented fusion for degenerative lumbar