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Canadian Spine Society

23rd Annual Scientific Conference
Wednesday, March 1 – Saturday, March 4
Fairmont Le Château Frontenac
Québec, Que., Canada

Abstracts

The Canadian Spine Society is a collaborative organization of spine surgeons advancing excellence in research, education and patient care.

Accreditation: This event is an Accredited Group Learning Activity (Section 1) as defined by the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada, approved by the Canadian Orthopaedic Association.

Course Objectives: The 2023 Annual Scientific Conference of the Canadian Spine Society (CSS) will be an in-person event with a program that offers ample opportunity for professional contact between spine specialists from across the country to share ideas, solve problems, exchange proposals and promote innovation. Once again held in conjunction with the Canadian Paediatric Spine Society (CPSS), the program is a mixture of didactic presentations, symposia, group discussions and proposed research. Symposia will address the spinal pathologies related to connective tissue disease and examine the lessons learned in clinical practice, combining the aspirations of new graduates with the reflections of senior spine surgeons. The transition from pediatric to adult spine care will be viewed through the changes in management of isthmic spondylolisthesis. Continuing a feature initially part of the virtual format, the 2023 conference will host a series of debates between prominent clinicians. This year, topics include the best method of neural decompression in degenerative lumbar spondylolisthesis, the optimal order of treatment in patients with concomitant hip and spine pathology, and the place for neuromonitoring during surgery for cervical myelopathy. Principal investigators with the Canadian Spine Outcome and Research Network (CSORN) will meet to review ongoing research and propose new initiatives. Clinical case studies aimed at resident and spine fellow attendees broaden the scope of the educational experience. E-posters will be displayed throughout the meeting and receive special attention during dedicated poster-review sessions. The meeting format is a continuing medical education–approved blend of selected podium lectures with informal conversations. Its design encourages comfortable, extended contact with the exhibitors, giving surgeons the chance to inspect and assess the latest surgical implants and equipment without the distraction of aggressive marketing. After a 2-year pandemic interruption, this on-site CSS Scientific Conference will be the first opportunity for the Canadian spine fraternity to meet, mingle and learn.

ABSTRACTS FOR PRESENTATION

CPSS-1
Abstract ID 108

Radiographic reporting in adolescent idiopathic scoliosis: Is there a discrepancy between radiologists' reports and surgeons' assessments? ***Manjot Birk, Kara Sidhu, Marina Rosa Filezio, Vishwajeet Singh, Fabio Ferri-de-Barros.* From the Department of Orthopaedic Surgery, University of Calgary, Calgary, Alta.**

Background: Cobb angle measurement is a standard method for quantification of scoliosis in patients with adolescent idiopathic scoliosis (AIS). Clinicians rely on Cobb angle measurements to guide treatment decisions. Timely and accurate diagnosis at the primary care level is required to screen patients eligible for time-sensitive brace treatment, which is typically delivered in the tertiary care setting. Therefore, accurate and reliable measurement of Cobb angle at the community level is crucial. This study investigated the agreement in Cobb angle measurement between radiologist and the treating spine surgeon. **Methods:** A retrospective audit of radiographs for patients with AIS was performed. A random sample of 80 patients was selected and radiographic reports (Cobb angle, Risser stage and end vertebrae) by radiologists and spine surgeons were compared. To assess interrater reliability, interclass correlation coefficients (ICC) with 95% confidence intervals (CIs) were computed. Interclass correlation coefficients < 0.70, 0.70–0.79, 0.80–89, and 0.9–0.99 were considered poor, fair, good and excellent reliability, respectively. All radiographs were assessed for quality. **Results:** The agreement of Cobb angle between spine surgeons was excellent (ICC 0.96, 95% CI 0.94 to 0.97). The agreement between spine surgeons and radiologists was poor (ICC 0.65, 95% CI 0.13 to 0.97). The ICC between spine surgeons and community radiologists and pediatric radiologists was poor (ICC 0.45, 95% CI 0.17 to 0.66) and good (ICC 0.87, 95% CI –0.46 to 0.96), respectively. However, 35 out of 80 radiographs performed did not meet the standard criteria. Risser stage was not reported in 56 of the 80 radiology reports. Interclass correlation coefficients between spine surgeons and radiologists for Risser stage was poor (ICC 0.625, 95% CI 0.325 to 0.794). For end vertebrae identification, there was absolute agreement of end vertebrae identification in 23 of the 80 scans. **Conclusion:** This study demonstrated a significant disagreement in Cobb angle measurement between radiologists and spine surgeons, which may negatively affect referral wait times and timely treatment for AIS. Quality improvement initiatives, such as continuing medical education, to improve Cobb angle measurement among community radiologists is required to improve scoliosis screening at the primary care level.

CPSS-2
Abstract ID 21

Pediatric posterior spinal deformity correction: 30-day postoperative infection rate and risk factors. ***Vivien Chan,[1,2] Geoffrey Shumilak,[1,3] Andrew Nataraj,[1] Holly Langston.*[2] From the [1]Division of Neurosurgery, University of Alberta, Edmonton, Alta.; [2]UCLA Health, Los Angeles, Calif.; the [3]Division of Neurosurgery, University of Saskatchewan, Saskatoon, Sask.**

Background: Our objective was to investigate risk factors associated with 30-day postoperative infection in pediatric patients who have received posterior spinal deformity correction. **Methods:** The National Surgical Quality Improvement Program pediatric database for years 2016–2020 was used for this study. Patients were included if they received posterior deformity correction (CPT 22800, 22802, 22804). Anterior approaches and combined anterior–posterior approaches were excluded. The outcome of interest was 30-day postoperative infection, which included superficial incisional surgical site infection, deep incisional surgical site infection, deep wound disruption or dehiscence, and surgical space infection. Patient demographics

and outcomes were analyzed using descriptive statistics. Multivariable logistic regression analysis using likelihood ratio backward selection method was used to identify significant risk factors for 30-day infection. **Results:** In total, 24768 patients were included in the study. The mean age was 13.8 years and 68.7% were female. The 30-day infection rate was 2.2%. The reoperation rate in patients who had a postoperative infection was 59.4%. Patients who had postoperative infection had a higher likelihood of nonhome discharge ($\chi^2 = 124.8$, $p < 0.001$). In our multivariable regression analysis, increasing body mass index (BMI) (B = 1.01, $p < 0.001$), presence of open wound (B = 3.18, $p < 0.001$), presence of ostomy (B = 1.51, $p < 0.001$), neuromuscular etiology (B = 1.56, $p = 0.009$), previous operation (B = 1.74, $p < 0.001$), increasing American Society of Anesthesiologists (ASA) class (B = 1.43, $p < 0.001$), increasing operation time in hours (B = 1.11, $p < 0.001$), and use of only minimally invasive techniques (B = 4.26, $p < 0.001$) were associated with increased risk of 30-day postoperative infection. Idiopathic etiology (B = 0.53, $p < 0.001$) and intraoperative antibiotics (B = 0.71, $p = 0.003$) were associated with reduced risk of 30-day postoperative infection. **Conclusion:** Postoperative infection is associated with significantly increased risk of reoperation and nonhome discharge. High-risk factors include BMI, ASA class, presence of open wound, presence of ostomy, neuromuscular etiology, previous operation, operation time and use of minimally invasive techniques only.

CPSS-3
Abstract ID 17

"Ultra-low dose" computed tomography without sedation is feasible and should be considered as part of the preoperative optimization pathway in paediatric patients with neuromuscular scoliosis. ***Nicholas J. Yee,[1,2] Carlo Iorio,[2] Nicholas Shkumat,[2] Brett Rocos,[2] Birgit Ertl-Wagner,[2] David Lebel,[1,2] Mark W. Camp.[1,2]*** **From the [1]Division of Orthopaedic Surgery, University of Toronto, Toronto, Ont.; the [2]Hospital for Sick Children, Toronto, Ont.**

Background: A major contributor to blood loss and surgical time in neuromuscular scoliosis is the insertion of instrumentation, which can be challenging owing to the abnormal anatomy. Radiographs provide minimal information regarding pedicle diameter, length, blocks to pedicle entry, or iliac crest orientation. Therefore, we developed an "ultra-low dose" computed tomography (ULD CT) protocol without sedation for patients with neuromuscular scoliosis. Our prospective quality improvement study aimed to determine the feasibility, radiation dose and image quality of this protocol. **Methods:** Fifteen nonambulatory surgical patients with neuromuscular scoliosis received the standard spine x-rays and an ULD CT. The CT protocol was a high-speed, high-pitch, tube-current modulated acquisition at a fixed tube voltage. Adaptive statistical iterative reconstruction was applied to soft tissue and bone kernels to mitigate noise. Radiation dose was quantified using reported dose indices (computed tomography dose index [CTDIvol]) and dose-length product (DLP) and effective dose (E), calculated through Monte Carlo simulation. Statistical analysis was completed using a paired Student *t* test ($\alpha = 0.05$). Computed tomography image quality was assessed for its use in preoperative planning and intraoperative navigation. **Results:** Eight males and 7 females were included. Average age (14 ± 2 yr), preoperative Cobb angle (95° ± 21°), and kyphosis (60° ± 18°) were recorded. One patient was unable to undergo the ULD CT protocol without sedation because of a codiagnosis of severe autism. The average x-ray radiation dose was 0.5 ± 0.3 mSv. Associated CT radiation metrics were CTDIvol = 0.46 ± 0.14 mGy, DLP = 26.2 ± 8.1 mGy.cm and E = 0.6 ± 0.2 mSv. The radiation dose differences between radiographic and CT imaging were not statistically significant. All CT scans had adequate quality for preoperative assessment of pedicle diameter and orientation, obstacles impeding pedicle entry, sacral alar iliac screw orientation and intraoperative navigation. **Conclusion:** Ultra-low dose CT scans without sedation were feasible. The effective dose was similar to standard preoperative spine radiographs. Ultra-low dose CT scans allowed for accurate assessment of the anatomy, aided in preoperative planning and allowed for intraoperative navigation despite the movement disorders in this patient population.

CPSS-4
Abstract ID 20

SeeSpine: a novel surface topography smartphone application for monitoring curve progression in adolescent idiopathic scoliosis. ***Evan Dimentberg,[1] Neil Saran,[2] Melissa Laflamme,[1] Jean A. Ouellet.[2]*** **From the [1]Faculty of Medicine, Université Laval, Québec, Que.; the [2]Division of Orthopaedic Surgery, McGill University, Montréal, Que.**

Background: Adolescent idiopathic scoliosis (AIS) is the most prevalent spinal deformity in children. Traditional AIS management, consisting of biannual visits with anterior–posterior and lateral radiographs, contributes to an increased risk of breast cancer over the course of their treatment. Radiation-free alternatives should replace x-rays whenever possible, to decrease the risks associated with current follow-up practices. **Methods:** A simulated modifiable scoliotic Styrofoam mannequin was moulded and scanned via a novel SeeSpine 3D imaging mobile application. Two topographic analysis methods (volumetric and depth map) in a standing and simulated Adam's forward bend position were tested to evaluate the ability of the software to detect and quantify topographic changes associated with scoliotic deformity, mimicking spinal deformity progression. **Results:** The volumetric and depth map techniques demonstrated high accuracy for deformity detection, with correlates of 0.85 and 0.99, respectively. The 2 techniques also reported standard errors of 5.5 and 2.0° of rotational deformity. Reliability analyses revealed high intra- and interobserver reliabilities of 0.97 and 0.97 for the volumetric analysis, 0.99 and 0.99 for the depth map. Data acquisition and 3D model generation failed in 2 out of 42 (4.7%) scans secondary to lighting issues. **Conclusion:** The SeeSpine mobile app generates an accurate 3D model to quantify and detect changes in spinal deformities. This radiation-free technology, designed for at-home use, could remotely monitor scoliotic deformity progression to avoid serial x-rays in AIS management. Furthermore, SeeSpine could be used for widespread screening. Further clinical validation in human trials is under way.

CPSS-5
Abstract ID 78

Pilot study: a machine learning algorithm for the detection of adolescent idiopathic scoliosis from images taken with modern smartphone technology. ***Jessica Wenghofer,[1] Holly Livock,[2] Luke Beaton,[2] Andrew Tice,[2] Kevin Smit,[2] Ryan Graham.[1]*** **From the [1]Health Science Department, University of Ottawa, Ottawa, Ont.; the [2]Children's Hospital of Eastern Ontario, Ottawa, Ont.**

Background: Early detection of adolescent idiopathic scoliosis (AIS) is critical, as early treatment can alter the natural history of progression. Routine screening for AIS has been eliminated, leaving its detection mainly to untrained parents. This has resulted in patients presenting with larger spinal curvatures upon first referral to a specialist. Therefore, there is a need for the development of a universally available, effective and easy-to-use tool or device to screen for scoliosis. The purpose of this research project was to create a simple and effective machine learning (ML) algorithm that can be used to detect AIS using images taken with a smartphone. **Methods:** Preliminary results were obtained from a subset of 33 participants (28 AIS; 5 control), who were recruited from the Children's Hospital of Eastern Ontario. Images were taken of the exposed back of participants in both an upright standing and a forward bending position, with a smartphone containing a time-of-flight camera. Participant images were randomly divided into a train and test data set with an 80:20 split. A convolutional neural network–backed decision tree algorithm was developed and trained using 3 different data streams: red green blue–depth (RGB-D), colourized depth map, and RGB. In total, 6 different models were trained. The performance of the ML algorithm was assessed by calculating an accuracy metric along with sensitivity, specificity, and positive and negative predictive values. **Results:** It was found that the model with the best performance was trained with the colourized overhead bending images. An accuracy of 93% was achieved, with a specificity of 75% and a sensitivity of 99%. All other trained models had accuracies ranging from 70% to 93%. **Conclusion:** The developed algorithm has a higher sensitivity than many traditional screening methods, such as the Adam's forward bend test; therefore, there is the potential to use the developed ML algorithm to screen for AIS. However, the data set is small, and while this study provides a proof of concept, data collection is ongoing.

CPSS-6
Abstract ID 101

Preoperative parameters influencing vertebral body tethering outcomes: patient characteristics play an important role in determining the outcomes at 2 years after surgery. ***Matias Pereira Duarte,[1,2] Marjolaine Roy-Beaudry,[1] Isabelle Turgeon,[1] Julie Joncas,[1] Jean-Marc Mac-Thiong,[1,2] Hubert Labelle,[1,2] Soraya Barchi,[1] Stefan Parent.[1,2]*** **From the [1]Centre hospitalier universitaire Sainte-Justine, Montréal, Que.; the [2]Division of Orthopaedic Surgery, Université de Montréal, Montréal, Que.**

Background: Predicting postoperative success of vertebral body tethering (VBT) remains challenging, and identifying patients' characteristics predictive of acceptable radiographic outcomes is of critical importance. The deformity angular ratio (DAR) has been proposed as a severity measurement for spinal deformity. The aim of this study was to determine preoperative predictors of good radiographic outcomes in patients who underwent VBT at 2-year follow-up. **Methods:** From a single-centre data set, we reviewed patients who underwent VBT from January 2014 to November 2018. Data analysis included age, gender, Risser stage and biometric data. Radiographically, maximum Cobb angle, DAR, and apical vertebral and disc wedging were measured before surgery and at 2-year follow-up. Patients were divided into 2 cohorts, following 2 different outcome measures: 1) vertebral growth modulation: those patients who growth-modulated or corrected by ≥ 5° or more and those who did not; and 2) maximum Cobb angle at 2 years, < and ≥ 40°. Student t and χ^2 test were used for comparison. **Results:** In total, 79 patients were recruited; 26 (33%) did growth-modulate their spine at 2-year follow-up. These patients were significantly younger, more skeletally immature with less height, weight (38 kg v. 45 kg) and body mass index (BMI) ($p < 0.05$) than those who did not growth-modulate. At 2-year follow-up, 67 patients (85%) had a maximum Cobb angle of < 40°. These patients were also younger and skeletally immature. We found significant differences in outcome 2 regarding the average (± standard deviation) preoperative maximum Cobb angle (48.5° ± 9.5° v. 59.1° ± 10°), average DAR (7 ± 1.5 v. 8.5 ± 2.1), average apical vertebral wedging (6.5° v. 8.3°), average vertebral and disc wedging ratio (1.5 v. 2.4) and the average immediate postoperative Cobb angle (25° v. 38°). **Conclusion:** Curve severity as determined by a DAR of ≤ 7, preoperative Cobb angles of ≤ 55°, and immediate postoperative Cobb angle of < 30° are significantly related to curves of < 40° at 2-year follow-up, while the potential to growth-modulate the spine is more dependent on skeletal maturity, lower body weight and lower BMI. These patients' characteristics should be considered preoperatively.

CPSS-7
Abstract ID 63

Preoperative bending radiographs are the best predictor of scoliosis correction on the first erect radiograph in vertebral body tethering: a single-centre retrospective study. ***Tara Gholamian,[1,2] Holly Livock,[3] Andrew Tice,[3] Kevin Smit.[2,3]*** **From the [1]Faculty of Medicine, University of Ottawa, Ottawa, Ont.; the [2]Children's Hospital of Eastern Ontario Research Institute, Ottawa, Ont.; the [3]Department of Orthopaedic Surgery, Children's Hospital of Eastern Ontario, Ottawa, Ont.**

Background: Scoliosis is a complex 3-dimensional curvature of the spine, and adolescent idiopathic scoliosis (AIS) is the most common type of pediatric scoliosis, affecting 1%–4% of adolescents. Skeletally immature patients with larger curves are at significant risk of curve progression. Vertebral body tethering (VBT) is a newer, less-invasive surgical technique designed to halt curve progression and correct the deformity as the child grows. The amount of initial curve correction has

been shown to affect the overall outcomes of VBT surgery. The aim of this study is to determine radiographic factors that can be used to best predict curve correction on the first erect postoperative spine radiograph after VBT. **Methods:** This was a single-centre retrospective chart review of 38 patients who underwent VBT surgery at the Children's Hospital of Eastern Ontario. We measured the major thoracic Cobb angle on the preoperative posteroanterior and supine bending radiographs, as well as the intraoperative post-tensioning fluoroscopic image. The major thoracic Cobb angles were then compared with the postoperative first erect radiograph after VBT surgery, to determine which measurement most correlated with postoperative curve correction. **Results:** Preoperative major thoracic Cobb angle (± standard deviation) was 53.4° ± 1.6°. Major thoracic Cobb angle on bending film was 24.6° ± 2.5°, while intraoperative thoracic Cobb on film showed a correction of 15.7° ± 2.1°. The first postoperative erect thoracic Cobb angle measured 29.6° ± 3.1°, representing a correction of 44.9% compared with the preoperative radiograph. At the first erect radiograph, the mean difference between the thoracic Cobb angle was 5.0° ± 3.5° for the bending films and 13.9° ± 2.5° for the intraoperative radiographs. This suggests that preoperative bending films better predict first erect correction. **Conclusion:** For patients with AIS undergoing VBT, preoperative bending radiographs are useful in predicting the major thoracic Cobb correction. This may help surgeons with patient selection for this newer type of surgery. Additionally, the results of this study could help surgeons achieve appropriate intraoperative correction.

CPSS-8
Abstract ID 18

Adverse events after zoledronate infusion in medically complex patients with neuromuscular scoliosis. ***Samuel Yoon,[1,2] Amna Zulfiqar,[2] Brett Rocos,[2] Anne Murphy,[2] Natasha Bath,[2] Stanley Moll,[2] Julia Sorbara,[2] David Lebel,[1,2] Mark W. Camp.[2,1]*** **From the [1]Division of Orthopaedic Surgery, University of Toronto, Toronto, Ont.; the [2]Hospital for Sick Children, Toronto, Ont.**

Background: To mitigate the intraoperative challenges of poor bone quality, we offered preoperative zoledronate infusions to medically complex patients with neuromuscular scoliosis. The aim of this project was to determine the adverse events after zoledronate infusion in this patient population. **Methods:** Patients underwent pre-infusion blood work to rule out renal disease and to ensure that their vitamin D levels were sufficient. Patients received infusions in a supervised medical day unit. The protocol included 3 infusions with an initial quarter dose (0.0125 mg/kg/dose), a three-quarter dose (0.0375 mg/kg/dose) at 6 weeks, and a full dose (0.05 mg/kg/dose) at 6 months. Surgery was scheduled no sooner than 6 weeks after infusion. Patient demographics, comorbidities, medications, laboratory investigations, infusion protocol and adverse events were collected. **Results:** Thirty-seven patients received at least 1 preoperative zoledronate infusion. Of these, 48% completed the preoperative optimization, receiving 3 infusions of zoledronate. The most common presenting etiology was cerebral palsy (54%), followed by Rett syndrome (14%) and congenital myopathy (8%). Six minor adverse events were noted, including 2 episodes of postinfusion hypocalcemia, 2 episodes of self-limited flu-like symptoms, 1 episode of nephrolithiasis and 1 episode of unspecified hypotension. There were no major adverse events requiring hospital admission or emergency department presentation related to zoledronate infusions. **Conclusion:** No major adverse events were noted after preoperative zoledronate infusions. The minor adverse events noted were self-resolving or resolved with outpatient treatment. Zoledronate can safely be included as part of a preoperative optimization pathway in medically complex patients with neuromuscular scoliosis. Further research is required to optimize patient selection and dose, and to determine the impact on screw pull-out and long-term complications.

CPSS-9
Abstract ID 5

Sequential rod rolling for surgical correction of Lenke type 2 adolescent idiopathic scoliosis: a 3D analysis. ***Jérémie Arthur Nallet,[1] Brett Rocos,[2] David Eduard Lebel,[2] Reinhard Zeller.[2]*** **From the [1]Centre hospitalier universitaire de Jean Minjoz, Besançon, Doubs, France; the [2]Hospital for Sick Children, Toronto, Ont.**

Background: Many options have been described to restore balance and create fusion in patients with adolescent idiopathic scoliosis (AIS), including preoperative gravity halo traction, posterior vertebral column resection and three-column osteotomies. Unfortunately, each of these comes with risks (e.g., bleeding, neurological injury). The aim of this investigation is to describe the sequential rod rolling (SRR) technique, its indications, the rotational correction achieved and the complications observed when it is used in the treatment of pediatric AIS. **Methods:** A retrospective study was carried out to include all patients treated with SRR to manage a Lenke 2 curve between 2006 and 2018 in whom a 3D EOS reconstruction was available. The primary objective of this study was to measure the derotation of the apical vertebra of the proximal thoracic curve (PT) achieved by the sequential rod technique. The secondary objectives include defining the morbidity and complications observed. **Results:** Sixteen patients with a mean age of 15 years were included. The mean preoperative coronal angular deformity was 53° for the PT and 76 for the main thoracic curve (MT). The mean postoperative coronal angular deformity was 19° for the PT, 22° for the MT. The mean rotation preoperatively was 10° for the apical vertebra of the PT and 23° for the MT. The mean rotation postoperatively was 3° for the apical vertebra of the PT and 8° for the MT. Twelve patients had a 2-year postoperative follow-up. No proximal junctional kyphosis or complications were reported at 2-year follow-up. **Conclusion:** These data show that SRR achieves a mean coronal PT correction of 66%, and 72% for the MT curve. The average derotation is 7° for the PT and 15° for the MT. No complications were encountered. The SRR technique for Lenke 2 type AIS is a safe and effective technique.

CPSS-10
Abstract ID 123

A comparative study of protocols for spinal casting as a surgical delay strategy in severe early-onset scoliosis. ***Jennifer A. Dermott, Dorothy J. Kim, Alison Anthony, Reinhard Zeller, David E. Lebel.* From the Hospital for Sick Children, Toronto, Ont.**

Background: Despite spinal casting being a widely accepted conservative management strategy, there is no consensus on the most appropriate protocol related to the number and frequency of casts. The objective of this study was to compare the outcomes of intermittent versus continuous spinal cast protocols. **Methods:** This was a retrospective review of all 24 patients whose initial management was spinal casting, between July 2014 and November 2020. The same health care provider cast all patients. Intermittent casting (3 casts over 6 months, then alternated with bracing) was used before November 2018. More recently, casting has been continuous, each worn 12–16 weeks for a minimum of 1.5 years. Comparative analyses considered control of curve magnitude over time, in and out of cast. Delay time to surgery was recorded. **Results:** In total, 13 patients underwent intermittent (10 female, 5 idiopathic) and 11 continuous casting (6 female, 5 idiopathic). At baseline, both groups were similar in age (± standard deviation) (3.2 ± 1.0 yr v. 2.7 ± 1.3 yr; $p = 0.28$) and Cobb angle (64.5° v. 70.6°; $p = 0.38$). The groups differed on average follow-up from first cast (6.6 v. 2.9 yr; $p < 0.01$), number of casts (4.5 v. 8.4; $p < 0.01$), frequency of casts (0.7 v. 3.0 casts/yr; $p < 0.01$), and delay time to initiating brace wear (0.6 v. 2.6 yr; $p < 0.01$). Percent correction achieved in first cast was similar (54.3% v. 42.5%; $p = 0.03$), but curve magnitude in the most recent cast, compared with first cast, was greater in the intermittent cohort (5.8° v. –41.7°; $p < 0.001$). Average Cobb angle at most recent follow-up was similar (55.9° v. 52.0°; $p = 0.36$), with both groups showing overall improvement from index imaging (18% v. 25%; $p = 0.6$). Surgical intervention was initiated in 4 of 13 patients in the intermittent group, ranging from 3.2 to 7.5 years after initial cast (mean 5.3 yr). In the continuous group, 1 of 11 underwent surgery, 2.0 years after first cast. **Conclusion:** Continuous casting allows for ongoing improvement of in-cast Cobb angle compared with an intermittent protocol. However, short-term results do not demonstrate a clear out-of-cast advantage. Both protocols effectively delay surgery in severe early-onset scoliosis.

A-11
Abstract ID 50

Does the type of pelvic fixation affect pelvic incidence after adult spinal deformity surgery? A retrospective analysis. ***Zhi Wang, Jesse Shen, Youssef Kamel, Jia Liu, Daniel Shedid, Fidaa Al-Shakfa, Sung-Joo Yuh, Ghassan Boubez, Maroun Rizkallah*. From the Centre hospitalier de l'Université de Montréal, Montréal, Que.**

Background: Recent studies suggest that changes occur to the previously assumed fixed pelvic incidence (PI) after sacropelvic fusion. However, the differential impact of the type of pelvic fixation, S2-alar-iliac screws (S2AI) versus iliac screws (IS), on the PI and on the remaining pelvic parameters and sagittal balance has never been evaluated, to our knowledge. **Methods:** This was a case series of patients undergoing adult spinal deformity (ASD) surgery with surgical correction and instrumentation to the pelvis. Standing EOS imaging was performed preoperatively and within 3 months postoperatively for all patients. Pre- and postoperative PI, lumbar lordosis (LL), pelvic tilt (PT), sacral slope (SS), PI-LL mismatch and sagittal vertical axis (SVA) were analyzed. A significant PI change was established a priori at 6° or more. Patients were categorized based on the type of pelvic fixation. **Results:** We included 142 patients with a mean (± standard deviation) age of 67.18 ± 11 years. Of these patients, 48% had a greater than 6° change in their PI after surgery. Of the patients with high preoperative PI (> 60°), 62% had a significant PI change compared with 37% patients with normal and low preoperative PI (< 60°) ($p = 0.01$). Patients in the S2AI group ($n = 99$) and those in the IS group ($n = 43$) were comparable at baseline. In the S2AI group, 46% of patients had a greater than 6° change in their PI compared with 53% of patients in the IS group ($p = 0.65$). In both groups, patients with high preoperative PI were more prone to significant postoperative change ($p = 0.02$ in IS, $p = 0.01$ in S2AI). Pre- to postoperative changes in LL, SS, PT and PI-LL mismatch were comparable between both groups. **Conclusion:** This study suggests that PI could change significantly in as many as 50% of patients after lumbo-pelvic fixation for ASD, especially in those with high preoperative PI. The type of pelvic fixation was not found to affect postoperative pelvic parameters nor sagittal balance, despite changes in PI. Spine surgeons should keep in mind the possible postoperative significant PI change while planning the ideal LL for their patients preoperatively, as this affects the postoperative PI-LL mismatch.

A-12
Abstract ID 51

How does pelvic fixation affect the compensatory mechanisms after adult spinal deformity surgery? A retrospective analysis. ***Maroun Rizkallah, Jesse Shen, Ghassan Boubez, Youssef Kamel, Jia Liu, Daniel Shedid, Fidaa Al-Shakfa, Frederic Lavoie, Sung-Joo Yug, Zhi Wang*. From the Centre Hospitalier de l'Université de Montréal, Montréal, Que.**

Background: The reciprocal changes of the body's sagittal profile after spinopelvic fusion in patients with adult spine deformity (ASD) remains poorly defined. This study aims to compare the postoperative changes in the compensatory mechanisms of the sagittal balance according to the type of pelvic fixation: S2-alar-iliac screws (S2AI) versus iliac screws (IS). **Methods:** This study included patients with ASD who underwent spinopelvic fixation and remained with a pelvic incidence–lumbar lordosis (PI-LL) mismatch of > 10° postoperatively. Standing EOS imaging was performed preoperatively and at 6 months postoperatively. Pre- and postoperative PI, LL, pelvic tilt (PT), sacral slope (SS), thoracic kyphosis (TK), femur obliquity angle (FOA), knee flexion angle (KFA) and ankle flexion angle (AFA) were analyzed. Patients were categorized based on the type of pelvic fixation (S2AI v. IS), and the preoperative to postoperative changes in the compensatory mechanisms were compared between both

groups. **Results:** A total of 79 patients were included. Mean (± standard deviation) PI-LL decreased from 23.8° ± 14° preoperatively to 19.44° ± 10° postoperatively. Patients with S2AI (n = 53) and those with IS (n = 26) were comparable at baseline, mainly for PI (57.90 v. 58.20; p = 0.93) and PI-LL (27.10 v. 28.10; p = 0.56). The preoperative to postoperative change in SS averaged 7.2° in the S2AI group compared with 9.9° in the IS group (p = 0.001), whereas the KFA preoperative to postoperative change reached 6.1° in the S2AI group as opposed to 3.5° in the IS group (p = 0.02). No significant differences were recorded in the preoperative to postoperative changes in LL, TK, FOA and AFA between groups. **Conclusion:** This study suggests that the type of pelvic fixation significantly affects the compensatory mechanisms of the body's sagittal profile. Patients with S2AI screws are more likely to compensate for their postoperative PI-LL mismatch through their knees and less likely through their pelvis. This could be explained by a lower resistance of the iliac connectors to the junctional mechanical stresses, allowing for sacroiliac joint motion in patients with IS, as opposed to the rigid sacroiliac fixation offered by the S2AI constructs.

A-13
Abstract ID 44

Development of a biomechanical model to identify risk factors in sagittal alignment contributing to proximal junctional kyphosis. ***Fatemeh Alavi, Christopher Nielsen, Raja Rampersaud, Stephen Lewis, Angela M. Cheung.* From the University Health Network, Toronto, Ont.**

Background: Our objective was to identify the most effective sagittal alignment parameter that accounts for the risk of proximal junctional kyphosis (PJK) development by increased vertebral loading. **Methods:** Nineteen patients with upper instrumented vertebrae (UIV) of T10 fused to pelvis, with no previous fusion surgery, were retrospectively reviewed. A thoracolumbar full-body musculoskeletal model, consisting of bones, muscles and joints, was used to calculate compression and shear forces at UIV and UIV+1. Scaled models were created corresponding to sex, height and weight. Custom MATLAB scripts were developed to identify location and orientation of intervertebral discs from preoperative EOS images and used to adjust orientation of vertebral bodies in the model accordingly. Simulation of alignments based on Roussouly, age-adjusted and global alignment and proportion classifications were completed using a Bézier curve fitted to preoperative EOS image and optimized by changing Bézier control points to match alignment parameters. After constructing patient-specific preplanning and pre- and postoperative models, musculoskeletal analysis was performed using OpenSim software in the upright standing position to calculate vertebral loading. **Results:** Proximal junctional kyphosis developed in 9 out of 19 patients. Average shear forces at UIV + 1 in patients with and without PJK were 151 N and 60 N, respectively, with no significant difference between average compression forces between the 2 groups. Comparison of different sagittal radiographic parameters in PJK and non-PJK groups was performed. In 6 out of 9 patients with PJK, the UIV+1 orientation and T1_UIV+1 line with respect to vertical line passing through UIV+1 pointed anteriorly; however, the opposite direction was observed in 8 out of 10 patients without PJK who experienced low shear. Moreover, vertebral loading of preplanning alignments suggested by different classifications was compared and the same direction was obtained for alignments that resulted in low shear at proximal junction. **Conclusion:** This study introduced UIV+1 orientation as a crucial risk factor for increase in shear loading and PJK development accordingly. The presented approach has the potential to aid spine surgeons in planning fusion surgery that can mitigate PJK occurrence.

A-14
Abstract ID 32

Biomechanical characterization of semirigid constructs and the potential effect on proximal junctional kyphosis. ***Chloe Cadieux,*[1,2] *Renan Fernandes,*[1,2] *Pawel Brzozowski,*[1] *Radovan Zdero,*[2] *Chris Bailey,*[1,2] *Parham Rasoulinejad.*[1,2] **From the [1]London Health Sciences Centre, London, Ont.; the [2]Department of Orthopaedic Surgery, Western University, London, Ont.**

Background: Semirigid constructs were developed to provide a gradual transition in motion at the junction between the instrumented and noninstrumented spine in long posterior spinal fusions. The objective of this study was to investigate whether there is a biomechanical advantage between several commonly used semirigid constructs and the standard all-pedicle screw construct. **Methods:** Nine fresh-frozen human cadaveric spine segments (T1–T12) were subjected to ex-vivo pure moment loading up to 5 Nm in flexion–extension, lateral bending and axial rotation. Each specimen was initially tested in the native condition and then instrumented with a standard pedicle screw and rod (APS) construct from T6 to T9. Semirigid constructs were sequentially instrumented at T5 using the following constructs: sublaminar bands (SB), supralaminar hooks (SLH), transverse process hooks (TPH) and short pedicle screws (SS). Three testing cycles were conducted for each condition. All data were normalized to the native condition. Statistical significance was established at $p < 0.05$. **Results:** There were no significant differences between APS and SB. In contrast, SLH, TPH and SS significantly reduced range of motion (ROM) at the level of T5–T6 as compared with APS, in all directions of motion. Additionally, SLH led to a significant reduction in motion at T4–T5. However, SLH was found to have a high degree of stiffness and led to an abrupt increase in motion at the level of T3–T4. Linear regression analysis demonstrated TPH had the most linear correlation between ROM and vertebral levels. **Conclusion:** A gradual change in motion across the junction between the instrumented and noninstrumented spine is thought to decrease the risk of proximal junctional kyphosis. In this study, SLH substantially decreased motion at the junctional levels; however, it led to an abrupt change in motion several levels above the construct. In contrast, a more linear change in motion across junctional levels was found with TPH. Overall, this study provides a direct biomechanical comparison of commonly used semirigid constructs and suggests that TPH is best able to provide a smooth transition in motion.

A-15
Abstract ID 65

Early adjacent disc characteristics are not associated with reoperation in short-segment lumbar fusions. ***Ahmed Cherry, Ragavan Manoharan, Mark Xu, Nisaharan Srikandarajah, Carlo Iorio, Aditya Raj, Christopher Nielsen, Raja Rampersaud, Stephen Lewis.*** **From the Toronto Western Hospital, Toronto, Ont.**

Background: Adjacent segment pathology (ASP) is an important mechanism of delayed morbidity in patients undergoing elective spinal fusions for degenerative conditions. In this study, we aimed to assess whether adjacent disc characteristics at 6–12 or 52 weeks were associated with reoperation for symptomatic ASP. **Methods:** We performed a review of retrospectively compiled data of 335 consecutive patients who had short-segment (1–3 levels) lumbar fusions between 2006 and 2017. Data collected included cohort demographics, reoperation rates for ASP and baseline, postoperative and 1-year radiographic adjacent disc characteristics, including disc lordosis, anterior disc height and presence or absence of antero- or retrolisthesis. Descriptive statistics, analysis of variance (ANOVA) and *t* test confirmation were performed using SPSS software. **Results:** Complete data were available for 307 of 335 patients. The majority of patients had single-level (67%) or 2-level (31%) fusions. Average age was 56 years; 44% were male and 56% female. The mean adjacent disc lordosis was 9.4° preoperatively, 7.8° postoperatively and 10.3° at 1 year ($p < 0.001$ between each pair of consecutive time points). The mean adjacent anterior disc height remained consistent across all time points (10.4 mm, 10.8 mm, 10.8 mm). No significant change in disc height was identified. A new listhesis was present in 21 patients (7%). Reoperation for symptomatic ASP was performed in 54/307 patients (18%) at a mean of 78 months postoperatively. There was no significant difference in the mean pre- to postoperative change in height or lordotic angle between subgroups. Multivariate statistical analysis did not identify any correlation between reoperation and preoperative or short-term adjacent disc height, angle or new listhesis. **Conclusion:** Our study demonstrates that there are statistically significant variations in the lordotic angle of the adjacent disc in the first year after spinal fusion. However, this did not demonstrate any correlation between long-term reoperation for ASP and preoperative adjacent disc angle, short-term postoperative adjacent disc angle or change in adjacent disc angle. Future analyses will aim to evaluate these disc metrics longitudinally over a longer time frame in those with and without reoperation.

A-16
Abstract ID 39

Concurrent validation of a novel inertial measurement unit–based method to evaluate spinal motion in clinical settings. ***Kristen Beange,[1,2] Ryan Graham,[2,3] Holly Livock,[4] Kevin Smit.[4]*** **From the [1]Department of Systems and Computer Engineering, Carleton University, Ottawa, Ont.; the [2]Ottawa-Carleton Institute for Biomedical Engineering, Ottawa, Ont.; the [3]School of Human Kinetics, University of Ottawa, Ottawa, Ont.; the [4]Division of Orthopedic Surgery, Children's Hospital of Eastern Ontario, Ottawa, Ont.**

Background: Recent pilot work evaluated spine range of motion (ROM) in postsurgical adolescent idiopathic scoliosis (AIS) patients having undergone 2 types of corrective surgery (i.e., vertebral body tethering and posterior spinal fusion and instrumentation) using laboratory-based optical motion capture. Preliminary results showed that spine motion may be preserved after vertebral body tethering in the transverse plane (i.e., rotation); however, data collection was time-consuming (3 h), confined to an off-site laboratory space and required specific expertise to operate. Inertial measurement units (IMUs) can enable objective assessment of spinal motion in clinic, but validity must be demonstrated before clinical acceptance. **Methods:** Four healthy control patients performed spine forward flexion, lateral bending, axial rotation and circumduction. Data were simultaneously collected from optical motion capture equipment (Vicon, Oxford, UK) and 3 IMUs (Xsens DOT; Xsens, Enschede, Netherlands) placed superficial to C7, T12 and S1 vertebrae. Range of motion in the sagittal, frontal and transverse planes were compared for each task, and mean absolute error (MAE) was calculated between systems. **Results:** Overall MAE (± standard deviation) was 0.53° ± 0.45 across all movements, sensors and planes. Results were similar for primary- and off-axis ROM during uniplanar movements (MAE primary 0.47° ± 0.48; MAE nonprimary 0.46° ± 0.40). All measurement differences were ≤ 1.71° (Table 1; accuracy ≤ 5° is viewed as clinically acceptable). **Conclusion:** Inertial measurement units can accurately capture spine ROM and have enabled efficient (i.e., 20-minute) data collection to occur in clinic. This makes participation more accessible for patients and families, and provides a foundation for potential multisite research studies in the future.

A-17
Abstract ID 68

Distal lordosis is associated with reoperation for adjacent segment disease in patients with degenerative lumbar fusion. ***Ragavan Manoharan, Ahmed Cherry, Nisaharan***

Table 1. Primary plane range of motion for individual inertial measurement unit (IMU) sensors and optical motion capture local coordinate systems during uniplanar movements

	Forward flexion		Right lateral bending		Left lateral bending		Right axial rotation		Left axial rotation	
Vertebra	IMU	Optical	IMU	Optical	IMU	Optical	IMU	Optical	IMU	Optical
C7	125.7	125.4	70.12	71.30	67.52	67.64	88.21	89.40	81.75	83.00
T12	92.80	92.85	28.17	28.63	27.47	27.33	36.27	36.51	30.49	30.44
S1	39.81	40.00	7.90	7.91	7.21	7.20	38.58	39.53	29.63	30.61

Srikandarajah, Aditya Raj, Mark Xu, Carlo Iorio, Christopher J. Nielsen, Y. Raja Rampersaud, Stephen J. Lewis. **From the Toronto Western Hospital, Toronto, Ont.**

Background: Adjacent segment disease (ASD) requiring reoperation has been reported in up to 15% of patients within 5 years of a lumbar fusion. Recent studies have suggested that distal lordosis (L4–S1) remains constant across all pelvic incidence (PI) subgroups while proximal lordosis (L1–L4) varies. We sought to investigate the impact of distal lordosis on ASD reoperation in patients undergoing lumbar fusion for degenerative conditions. **Methods:** A retrospective review of patients undergoing 1- to 3- level lumbar fusions for degenerative conditions with the 2 senior authors from 2007 to 2016 was performed. Demographic and radiographic information was recorded. Binary logistic regression models were used to assess the relationship between demographic and radiographic variables, and reoperation for ASD. **Results:** In total, 335 patients were identified and included in the final analysis. Most patients had single-level (67%) or 2-level (31%) fusions. The mean follow-up was 64 months. Fifty-seven patients (17%) underwent reoperation owing to ASD at an average of 78 months postoperatively (rASD group). There was no significant difference between the rASD and no reoperation for ASD (nrASD) groups in terms of age, sex, number of levels fused, minimally invasive or open surgery, baseline distal lordosis, or adjacent disc lordosis. The rASD group had a significantly lower mean postoperative distal lordosis (27° v. 31°; $p < 0.001$) and mean pelvic incidence (56° v. 59°; $p < 0.05$) than the nrASD group. On univariate analysis, patients with a postoperative distal lordosis of < 35° had higher odds of reoperation for ASD than those with a postoperative distal lordosis of 35° or higher (odds ratio 2.7, $p = 0.016$). In the multivariate model, postoperative distal lordosis, low or average PI, and spondylolisthesis were all significantly associated with reoperation for ASD. **Conclusion:** This study provides preliminary support for an association between postoperative distal lumbar lordosis and risk of reoperation for ASD. This risk may be amplified in patients with a low or average PI. Further prospective study is needed to confirm this association and identify its impact on long-term patient outcomes.

A-18
Abstract ID 69

Automatic extraction of spinopelvic parameters using artificial intelligence methods and a review on the effects of spine stiffness, spinal fusion and spinopelvic parameters on lower limb motion and total hip arthroplasty outcomes. ***AliAsghar MohammadiNasrabadi,[1] Gemah Moammer,[2,3] John McPhee.[1]*** **From the [1]Department of Systems Design Engineering, University of Waterloo, Waterloo, Ont.; [2]Grand River Hospital, Waterloo, Ont.; the [3]Department of Orthopaedic Surgery, McMaster University, Hamilton, Ont.**

Background: Increased rates of dissatisfaction after total hip arthroplasty (THA) surgery indicate that relying on the traditional Lewinnek safe zone is not practical for all patients. Several factors, such as spinopelvic parameters and spine stiffness, should be considered for optimal surgical outcomes. In this article, we introduce an artificial intelligence (AI) method to extract spinopelvic parameters (lumbar lordosis [LL], pelvic tilt [PT], pelvic incidence, sacral slope, sagittal vertical axis) and review research on the effects of different spinopelvic parameters and spine stiffness on lower limb motion and the risk of hip joint dislocation after THA. **Methods:** Research in 2 categories forms the focus of the article: spinopelvic parameters, and spinal fusion surgery. Spine stiffness resulting from fusion surgery can affect lower limb motion and change hip joint motion. To provide insights into dynamic motion and the literature, 2 case-study experiments were performed. First, to evaluate some hypotheses in the literature with the same method that surgeons rely on primarily, we analyzed x-ray images from 87 patients with different spinopelvic mobilities. We introduced a new method for measuring spinopelvic parameters using an AI algorithm based on YOLOv5 (object detection). Static x-ray analysis provides insights only into spinopelvic parameters in standing or sitting posture, not in the transition between the two. Therefore, the second experiment was a dynamic motion analysis using motion-capture data. **Results:** In a comparison of patients' spinopelvic parameters, patients with restricted pelvic motion are found to have more limited spine mobility. The results show that not only is PT restricted in a patient with a stiffer spine, but the trajectory of PT and LL has smaller amplitude during motion. Dynamic motion analysis identifies a potentially critical point when a patient is at the highest risk for a possible implant impingement or dislocation. **Conclusion:** Spine stiffness (restricted LL) is identified as the key contributor to a behavioural change in lower limb motion. Considering dynamic motion analysis in surgical planning is recommended to identify the actual critical point with the highest risk of dislocation.

A-19
Abstract ID 38

Gender differences in fusion rates in the treatment of degenerative lumbar spondylolisthesis: analysis from the CSORN prospective degenerative lumbar spondylolisthesis study. ***Taryn Walker,[1] Jennifer C. Urquhart,[1] R. Andrew Glennie,[2] Y. Raja Rampersaud,[3] Charles G. Fisher,[4] Chris S. Bailey.[1]*** **From the [1]London Health Sciences Centre Combined Neurosurgical and Orthpaedic Spine Program, Schulich School of Medicine, Western University, London, Ont.; the [2]Departments of Orthopedics and Neurosurgery, Dalhousie University, Halifax, N.S.; the [3]Department of Surgery, University of Toronto, Toronto, Ont.; the [4]Department of Surgery, University of British Columbia, Vancouver, B.C.**

Background: Female patients with degenerative lumbar spondylolisthesis (DLS) have poorer preoperative and postoperative patient-reported outcome measures (PROMs) after surgical intervention. Recently, there have been conflicting reports about noninferiority comparing decompression alone versus decompression and fusion. The objective of this study was to assess differences in the fusion rate between female and male participants, and to determine if existing indications for fusion justify any observed differences in fusion rates found between male and female groups. **Methods:** This study is a retrospective cohort analysis of patients enrolled in the Canadian Spine Outcomes and Research Network (CSORN) DLS prospective

study. Patient characteristics, preoperative PROMs and radiographic measures were compared between patients who self-reported gender as female and those who self-reported gender as male, using the Student *t* test for continuous parametric variables. Comparisons for categorical variables were made using the χ^2 test or the Fisher exact test. A p value < 0.05 was considered to indicate statistical significance. All the analyses were performed using SPSS software, version 27. **Results:** Female participants were more likely to undergo decompression and fusion than the male participants. This difference was explained by a significantly higher proportion of indicators for fusion for potential instability in the female cohort, including kyphotic disc angle, higher spondylolisthesis grade, increased slip percentage, higher degenerative spondylolisthesis instability classification grade, and patient-reported back pain. Indirect considerations for fusion, including facet effusion and facet distraction, were not different between groups, while magnetic resonance imaging facet angle was greater in the female group. **Conclusion:** Despite lack of consensus for fusion as a surgical treatment for DLS, female patients are fused at a higher rate than their male counterparts. This difference may be largely explained by the well-established radiographic and patient-reported indicators for fusion.

A-20
Abstract ID 29

L3–4 hyperlordosis after a reduction in lower lumbar lordosis with L4–L5 fusion surgery is common in patients requiring L3–4 revision surgery for adjacent segment disease. ***Brandon J. Herrington,[1,2] Renan R. Fernandes,[1,2] Jennifer C. Urquhart,[1,3] Parham Rasoulinejad,[1–3] Fawaz Siddiqi,[1–3] Christopher S. Bailey.[1–3]*** **From the [1]London Health Sciences Centre combined Neurosurgical and Orthopaedic spine program, London, Ont.; the [2]Schulich School of Medicine and Dentistry, Department of Surgery, Western University, London, Ont.; the [3]Lawson Health Research Institute, London Health Sciences Centre, London, Ont.**

Background: Revision surgery after L4–L5 spine fusion is common, with the most frequent reason for reoperation being adjacent segment disease at L3–L4. Decreased preoperative and postoperative L1–S1 global lumbar lordosis (GLL) is a known risk factor for adjacent segment disease. L4–S1 lower lumbar lordosis (LLL) accounts for the majority of GLL and is modifiable during fusion surgery. We hypothesize that a reduction in LLL leads to an increase in the adjacent L3–L4 focal lumbar lordosis (L3–L4 FLL). **Methods:** We reviewed the records of a prospective cohort with lumbar spinal stenosis who underwent L4–L5 or L4–L5–S1 fusion between 2006 and 2012. Radiographic parameters — GLL, LLL, L3–L4 FLL, upper lumbar lordosis (L1–L4), lordosis distribution index (LLL/GLL x 100), pelvic tilt and pelvic incidence — were extracted from preoperative and early postoperative lumbar spine radiographs. Statistical comparisons were made between those who required revision surgery for adjacent segment disease at L3–L4 (REVISION) and those who did not (NO REVISION) using an unpaired *t* test analysis ($\alpha = 0.05$). **Results:** Inclusion criteria were met by 104 patients. The REVISION cohort included 19 individuals. No significant differences in baseline demographic characteristics and operative details were found between the groups. The REVISION cohort had a preoperative decreased GLL and LLL, but similar L3–L4 FLL compared with the NO REVISION group. Postoperatively, the REVISION cohort compared with the NO REVISION cohort had a decrease in LLL (–2.6° v. +1.5°; $p = 0.011$) and lordosis distribution index (–5.1% v. +1.3%; $p = 0.039$), and a reciprocal increase in the L3–L4 FLL (+2.6° v. –0.6°; $p = 0.001$). There were no between-group differences in the magnitude of change in postoperative GLL between groups (+0.8° v. +2.1°; $p = 0.575$). **Conclusion:** A reduction in LLL and compensatory increase in L3–L4 FLL after initial lower lumbar fusion surgery resulted in increased incidence of adjacent segment disease and reoperation at the rostral L3–L4 segment.

B-21
Abstract ID 40

Predictors of dynamic instability in the decision to fuse in degenerative lumbar spondylolisthesis: results from the Canadian Spine Outcomes and Research Network prospective degenerative lumbar spondylolisthesisstudy. ***Jennifer Urquhart,[1] Renan R. Fernandes,[1] R. Andrew Glennie,[2] Y. Raja Rampersaud,[3] Charles G. Fisher,[4] Chris S. Bailey.[1]*** **From the [1]London Health Sciences Centre Combined Neurosurgical and Orthopaedic Spine Program, Schulich School of Medicine, Western University, London, Ont.; the [2]Departments of Orthopedics and Neurosurgery, Dalhousie University, Halifax, N.S.; the [3]Department of Surgery, University of Toronto, Toronto, Ont.; the [4]Department of Surgery, University of British Columbia, Vancouver, B.C.**

Background: Instability, defined as 3 mm of translation at the listhetic level, is recognized as an indication for fusion in degenerative lumbar spondylolisthesis (DLS). The objective of this study was to evaluate which radiographic factors best correlate with dynamic spondylolisthesis and to determine whether they have a cumulative effect in predicting dynamic instability. **Methods:** The Canadian Spine Outcomes and Research Network (CSORN) multicentre prospective study on the assessment and management of DLS was retrospectively reviewed to identify patients enrolled between 2015 and 2021 who had single-level spondylolisthesis. Demographic factors, patient-reported outcome measures (PROMs) and imaging factors from plain radiographs, computed tomography and magnetic resonance imaging (MRI) were compared between those who had dynamic instability and those who did not. Multivariate backward logistic regression analysis identified the best combination of predictors of dynamic instability. **Results:** There were 424 eligible patients enrolled at 8 sites, of whom 107 (25%) were unstable. Patients who had dynamic instability were younger (64 v. 67 yr), more overweight (31 v. 29 kg/m^2), had a larger disc height at the level above (8.2 mm v. 7.6 mm), were more likely to have grade II or III spondylolisthesis, facet effusion and facet joint distraction, and were less likely to have a Pfirrmann grade V MRI at the operative level ($p < 0.05$ for all comparisons). Preoperative PROMs were similar between the 2 groups. The multivariate analysis revealed that the odds of having dynamic instability

increased by at least 2 times for each of the following factors: grade spondylolisthesis II or III, joint distraction, age younger than 55 years, and spondylolisthesis level Pfirrmann MRI grade I, II, III compared with IV or V. The likelihood of instability is 70% when all 4 factors are present, 50% when 3 factors are present, and 8% when no factors are present. **Conclusion:** The decision to fuse in DLS is multifactorial. This study suggests that younger age, facet joint distraction, grade II or III spondylolisthesis, and less disc degeneration on MRI have a cumulative effect in predicting dynamic instability.

B-22
Abstract ID 49

Impact of preoperative insomnia on poor postoperative pain control after elective spine surgery and the Modified Calgary Postoperative Pain After Spine Surgery score. ***Michael M.H. Yang,[1,2] Jay Riva-Cambrin,[1] Jonathan Cunningham,[1] Steven Casha.[1]*** **From the [1]Department of Clinical Neurosciences, University of Calgary, Calgary, Alta.; the [2]O'Brien Institute of Public Health, Calgary, Alta.**

Background: Poor pain control after spine surgery is common. The Calgary Postoperative Pain after Spine Surgery (CAPPS) score was developed to identify this subset of patients to allow for optimization of care. Insomnia is prevalent, but its impact on postoperative pain is unknown. The objectives of this study were to examine the association between preoperative insomnia and poor postoperative pain control and to update the CAPPS score to improve the prediction of pain. **Methods:** In this prospective cohort study, poor postoperative pain control was defined as the mean numeric rating scale (NRS) for pain > 4 at rest in the first 24 hours after surgery. Patients were scored using the CAPPS score, which included 7 prognostic factors: age younger than 70 years; female sex; daily use of opioid medication; preoperative axial neck or low back pain > 7 on NRS; Patient Health Questionnaire-9 (PHQ-9) depression score at ≥ 10; ≥ 3 motion segment surgery; and fusion surgery. A multivariable model was created to investigate the association between Insomnia Severity Index (ISI) and poor pain control after adjusting for the CAPPS score. The model was then transformed to create the Modified CAPPS score. **Results:** Of 219 patients, 49.7% experienced poorly controlled pain. The prevalence of clinical insomnia (ISI ≥ 15) was 26.9%. Preoperative ISI was independently associated with poor pain control (odds ratio [OR] 1.09, p = 0.004) after adjusting for the CAPPS score (OR 1.61, $p < 0.001$). The model was discriminative (area under the receiving operating characteristic curve [AUC] 0.80) and calibrated (Hosmer–Lemeshow p = 0.35). The Modified CAPPS score retained discrimination (AUC 0.78) and calibration (Hosmer–Lemeshow p = 0.57). Low-, high- and extreme-risk groups stratified by the Modified CAPPS score had 17.3%, 49.1% and 80.7% predicted probability of experiencing poorly controlled pain compared with 32.0%, 64.0% and 85.1% in the original CAPPS score. **Conclusion:** Preoperative insomnia is common and is a novel modifiable risk factor for poor pain control after spine surgery. Preoperative detection and optimization of insomnia may lead to improved pain outcomes.

B-23
Abstract ID 115

Influence of high pelvic incidence on operative difficulty in patients treated surgically for degenerative lumbar spondylolisthesis. ***Chloe N. Cadieux,[1] Jennifer Urquhart,[1] Renan Fernandes,[1] Andrew Glennie,[2] Charles Fisher,[3] Raja Rampersaud.[4]*** **From the [1]Division of Orthopaedic Surgery, Western University, London, Ont.; the [2]Department of Surgery, Dalhousie University, Halifax, N.S.; the [3]Combined Neurosurgical and Orthopaedic Spine Program, University of British Columbia, Vancouver, B.C.; the [4]Division of Orthopaedic Surgery, University of Toronto, Toronto, Ont.**

Background: The objective of this study was to determine whether the degree of pelvic incidence (PI) influenced the difficulty of surgery in patients undergoing treatment for degenerative lumbar spondylolisthesis (DLS). **Methods:** This is a retrospective cohort study of patients enrolled between 2015 and 2021 in the Canadian Spine Outcomes and Research Network (CSORN) multicentre prospective study on the assessment and management of DLS, who underwent decompression or decompression and fusion and who had baseline radiographic measures. Patients were divided into 2 groups based on a preoperative pelvic incidence (PI) of ≥ 60°, or < 60°. Baseline demographic, clinical, radiographic and procedural factors were compared between the groups stratified by procedure type (decompression v. decompression and fusion). **Results:** Of the patients who had a decompression alone, 85 had PI < 60° and 43 had PI of ≥ 60°. Demographic factors, chief complaint, grade of spondylolisthesis and preoperative patient-reported outcome measures (PROMs) were similar between groups. Blood loss was similar in both groups, but patients with a high PI had significantly longer operative times (96 min. v. 82 min.). Of the patients who had a decompression and fusion, 193 had PI < 60° and 142 had PI ≥ 60°. Demographics and preoperative PROMs were similar between the groups, except that more females were in the high PI group (71% v. 60%). Patients in the high PI group were also more likely to have grade II spondylolisthesis (41% v. 26%) and less likely to have minimally invasive surgery (16% v. 29%). Operating time was similar between groups; however, blood loss was significantly increased in the patients who had a high PI (M = 400 v. 300 mL). Intraoperative complications and length of stay were not different between groups, regardless of procedure. **Conclusion:** Overall, this study demonstrates that high PI is associated with increased operative time and blood loss, indicating there may be unique challenges with this population. Technical difficulties may arise as a result of the larger exposures required and challenging angles seen in patients with a high PI. Thus, operative difficulties should be anticipated when treating patients with a PI ≥ 60°.

B-24
Abstract ID 45

Reoperation rates for adjacent segment disease in degenerative lumbar fusion surgery: a comparison between minimally invasive versus open surgical approaches. ***Mark Xu, Ragavan Manoharan, Ahmed Cherry, Aditya Raj, Nish***

Srikandarajah, Carlo Iorio, Christopher Nielsen, Stephen Lewis, Raja Rampersaud. **From the Division of Orthopaedic Surgery, University of Toronto, Toronto, Ont.**

Background: The primary objective of this study was to compare reoperation rates for adjacent segment disease (ASD) between minimally invasive (MIS) and open surgical approaches in degenerative lumbar fusion surgery. Secondary objectives were to compare MIS and open postoperative changes in lumbosacral sagittal alignment parameters that may predispose to adjacent segment pathology (ASP) and reoperation. **Methods:** This was a retrospective review of consecutive patients undergoing 1- to 3-level degenerative lumbar spinal fusions from 2007 to 2016. Patients were categorized into MIS versus open surgery groups. Both groups were compared for baseline demographic data, reoperation rates (for ASD v. other indication), time to reoperation, and pre- and postoperative radiographic sagittal alignment parameters, including distal lordosis (L4–S1) and adjacent disc lordosis. Binary logistic regression models were utilized for group comparison. **Results:** In total, 335 patients were included (mean follow-up 64 months). Of these, 173 (52%) underwent MIS and 162 (48%) open approaches. There was no difference in demographic data and number of levels fused between groups. The overall reoperation rate for all causes was 25.6% (n = 86/335) with an incidence of 20.8% (n = 36/173) in the MIS group and 30.8% (n = 50/162) in the open group. The overall reoperation rate for ASP was 17% (n = 57/335), with an incidence of 14% (n = 24/173) for MIS and 20% (n = 33/162) for the open group. Mean time to reoperation was 76 months (MIS) and 79 months (open). The lower reoperation for MIS was not statistically significant. At a mean of 64 months after surgery, mean MIS versus open radiographic parameters were L1–S1 (51° v. 48°), L4–S1 (29° v. 27°), and adjacent disc lordosis (10° v. 10°), with no difference in the mean change before and after surgery. **Conclusion:** Most reoperations after degenerative lumbar fusion surgery were a result of ASD. Our study found no significant difference in reoperation rates for adjacent segment disease when comparing MIS with open approaches. Furthermore, there was no difference in postoperative lumbar sagittal alignment parameters between MIS and open approaches. Future studies will evaluate clinical outcome scores between the groups.

B-25
Abstract ID 118

Assessment of changes in opioid utilization 1 year after elective spine surgery: a Canadian Spine Outcomes and Research Network study. ***Ahmed Cherry,[1] Aditya Raj,[1] Greg McIntosh,[2] Ragavan Manoharan,[1] Jean-Christophe Murray,[3] Christopher Nielsen,[1] Mark Xu,[4] Nisaharan Srikandarajah,[4] Carlo Iorio,[1] Anthony Perruccio,[4] Mayilee Canizares,[4] Raja Rampersaud.[1]*** **From the [1]Toronto Western Hospital, Toronto, Ont.; the [2]Canadian Spine Outcomes and Research Network, Markdale, Ont.; the [3]Centre hospitalier universitaire de Québec, Québec, Que.; the [4]Krembil Research Institute Arthritis Institute, Toronto, Ont.**

Background: Chronic opioid use has been associated with negative individual and societal consequences. Our primary objective was to identify perioperative changes in opioid use among patients undergoing elective spinal surgery. Our secondary objective was to assess baseline and perioperative factors associated with positive or negative change in opioid use 1 year after surgery. **Methods:** A retrospective review of Canadian Spine Outcomes and Research Network (CSORN) data (patient-reported measures, sociodemographic factors, lifestyle factors and perioperative procedural information) was performed. Multivariable logistic regression models were used to examine the associations between these factors and change in opioid use. **Results:** Our data included 5059 patients (2628 [51.9%] nonusers and 2431 [48.1%] users) with opioid change data, of whom 52.7% were male. At 1 year after surgery, 77.5% of patients were not using opioids. Patients were stratified into the following subgroups based on change in baseline opioid use status: a) nonusers-no-change (47.4%), b) users-no-change (17.9%), c) nonuser-changed-to-user (4.5%), and d) user-changed-to-nonuser (30.1%). In other words, 62.7% of baseline users became nonusers and 8.7% of nonusers became users at 1 year. The following baseline factors were independently associated with 1) opioid users who became nonusers: lower body mass index (BMI), fewer comorbidities, nonsmoker, not living alone, no insurance claims, routinely exercising, shorter operations, spondylolisthesis diagnosis; 2) opioid users who remained users: higher BMI, more comorbidities, cervical spine location, smoking, married, living alone, compensation claims, not working, no routine exercise, higher Patient Health Questionnaire-9 (PHQ-9) score, longer operating time, no spondylolisthesis; and 3) nonusers who became users: more comorbidities, longer symptom duration, higher PHQ-9 score, longer length of stay, no spondylolisthesis diagnosis. **Conclusion:** The majority of spine surgery patients are not taking opioids at 1 year after surgery. This includes two-thirds of those who were taking opioids before surgery. Further study of the 1 in 5 patients who are persistent or new users at follow-up is required to identify possible modifiable baseline risk factors and develop targeted mitigation strategies in the perioperative period.

B-26
Abstract ID 93

Preoperative neuroleptic and opioid use effects on postoperative pain and disability after spinal surgery for lumbar radiculopathy. ***Dana El-Mughayyar,[1–4] Erin Bigney,[1–3] Eden Richardson,[1,5] Neil Manson,[1,4,6] Edward Abraham,[1,4,6] Najmedden Attabib,[1,3,4] Chris Small,[1,4,6] George Kolyvas,[1,3,4] Andre LeRoux,[1,3,4] Canadian Spine Outcomes and Research Network Investigators,[5] Jeff Hebert.[2]*** **From the [1]Canada East Spine Centre, Saint John, N.B.; the [2]Department of Kinesiology, University of New Brunswick, Fredericton, N.B.; the [3]Horizon Health Network, Saint John, N.B.; [4]Dalhousie Medicine New Brunswick, Saint John, N.B.; the [5]Canadian Spine Outcomes and Research Network, Markdale, Ont.; the [6]Saint John Orthopaedics, Saint John, N.B.**

Background: Our objective was to estimate the effect of preoperative neuroleptics and narcotics on postoperative pain and disability. **Methods:** This retrospective cohort study included patients from the Canadian Spine Outcomes and Research Network who underwent decompressive spine surgery, with or without fusion, for lumbar radiculopathy. Patients reported their preoperative use of neuroleptics and narcotics as none, intermittent or daily. Study outcomes were leg pain and back pain intensity measured with 0–10 numeric rating scales, and disability measured with the 0–100 Oswestry Disability Index (ODI) at 3, 12 and 24 months after surgery. We constructed propensity score models using inverse probability weights and regression adjustment to account for confounding due to age, sex, education level, smoking status, depression risk, and baseline pain or disability. **Results:** We included data from 3991 patients (mean age 55.5 [standard deviation 15.3] years; 49.7% female). There were no effects of preoperative medication use on 3-month outcomes and no effects of preoperative neuroleptic use on any outcome. At 12 months, patients who had consumed narcotics daily before surgery had higher back pain intensity scores (mean difference [MD] 0.46, 95% confidence interval (CI) 0.22–0.70) and ODI scores (MD 2.36, 95% CI 0.55–4.17) than nonusers. Similarly, intermittent narcotic users had higher ODI scores than nonusers (MD 2.98, 95% CI 1.02–4.95]). Preoperative narcotic use also affected 24-month outcomes, with intermittent (MD 0.42, 95% CI 0.12–0.73]) and daily (MD 0.55, 95% CI 0.27–0.83) users reporting greater back pain intensity than nonusers. Compared with nonusers, patients who intermittently consumed narcotic medications also reported less leg pain at 24 months (MD 0.36, 95% CI 0.02–0.71). Patients who consumed preoperative narcotic drugs intermittently (MD 3.26, 95% CI 1.07–5.45) or daily (MD 3.51, 95% CI 1.46–5.56) also reported lower ODI scores. All other comparisons were nonsignificant. **Conclusion:** Preoperative narcotics adversely affected intermediate- and long-term clinical outcomes after lumbar spine surgery for radiculopathy. This information may help to guide therapeutic decision-making for surgical candidates with lumbar radiculopathy.

B-27
Abstract ID 52

The importance of lower extremity compensation mechanisms in lumbar degenerative pathology: a retrospective analysis. ***Victor Baisamy,[1] Maroun Rizkallah,[2] Jesse Shen,[2] Thierry Cresson,[1] Carlos Vazquez,[1] Zhi Wang,[2] Ghassan Boubez.[2]*** **From [1]l'École de Technologie Supérieure, Montréal, Que.; the [2]Centre hospitalier de l'Université de Montréal, Montréal, Que.**

Background: Compensation mechanisms such as pelvic retroversion or knee flexion for an unbalanced spine have been well described in the literature. However, how these mechanisms evolve after lumbar spine fusion has been poorly quantified, especially those of the lower extremities. This work aims to define knee flexion in relation to global and regional sagittal spinal parameters in lumbar degenerative disease. **Methods:** This study included patients undergoing lumbar spine fusion for degenerative pathology. All patients included had pre- and postoperative full-body EOS imaging. Patients had a minimum of 6 months of postoperative follow-up. Exclusion criteria are patients with previous spine surgery or total knee arthroplasty. Thirty-two radiographic parameters, including knee flexion and spinopelvic, were measured using SterEOS software. Student *t* tests and linear regression analysis was performed using MATLAB. **Results:** In total, 113 patients were analyzed. Knee flexion was moderately correlated with global sagittal angle (r^2 = 0.645) and ankle angle (r^2 = 0.768). There was no correlation between lumbar lordosis (LL) and knee flexion (r^2 = 0.1). Patients with greater preoperative knee flexion (n = 65) had significantly greater pelvic incidence (± standard deviation) LL (10.6 ± 11.3 v. 1.8 ± 14.7) mismatch and C7 sagittal vertical axis (5.7 ± 4.3 cm v. 2.7 ± 4.6 cm) than the lower knee flexion group (n = 48). Patients with > 10° of PI-LL mismatch (n = 43) had significantly greater knee flexion preoperatively (14.3 ± 7.6 v. 10.7 ± 6.9) than the matched group (n = 70). Patients with > 10° of PI-LL mismatch preoperatively, with exacerbated mismatch postoperatively, have significantly (p = 0.02) increased knee flexion after surgery. **Conclusion:** This work suggests that the relationship between lower extremity alignment and sagittal spinopelvic parameters can be quantified using full-body imaging. Knee flexion angle may help to quantify the compensation of the lower extremities in relation to spinopelvic mismatch in patients with lumbar degenerative pathologies. Surgeons should include full-body imaging in lumbar degenerative pathology in surgical planning.

B-28
Abstract ID 107

Persistent poor sleep is associated with worse pain and quality of life in patients with degenerative thoracolumbar conditions undergoing surgery: a retrospective cohort study. ***Tiffany Lung,[1] Mayilee Canizares,[2] Anthony Perruccio,[2] Raja Rampersaud.[1,2]*** **From the [1]Division of Orthopaedic Surgery, Department of Surgery, Faculty of Medicine, University of Toronto, Toronto, Ont.; the [2]Schroeder Arthritis Institute, Krembil Research Institute, University Health Network, Toronto, Ont.**

Background: Limited studies have demonstrated the relationship between sleep disturbance in surgical patients and worse patient-reported outcomes. The purpose of this study was to evaluate the relationship between pain-related sleep disturbance and postoperative outcomes in patients undergoing surgery for degenerative thoracolumbar conditions. **Methods:** This was a retrospective cohort study using the Canadian Spine Outcomes and Research Network database. There were 4145 included patients. We divided patients based on their change in sleep disturbance as reported on the Oswestry Disability Index (ODI) sleep question, from baseline to their first postoperative follow-up. The primary outcomes were the odds of attaining clinically important improvements (CII) in the numeric pain rating scale (NRS) for back pain, leg pain, EuroQoL-5 Dimension Questionnaire (EQ-5D) and 12-item Short-Form Health Survey (SF-12). Multivariable logistic regression (adjusting for age, sex, education, comorbidities, opioid use, symptoms and relevant baseline patient-reported outcome measure score) was used.

Results: There was a higher proportion of patients with no sleep disturbance among those with a baseline chief complaint of claudication compared with back- or leg-dominant pain (26% v. 14% and 15%). Patients with ongoing severe and/or worsening sleep disturbance had significantly reduced odds of achieving postoperative CII in the physical (PCS) and mental component summary (MCS) scores of SF-12 (odds ratio [OR] 0.51–0.62, 95% confidence interval [CI] 0.32–0.95), back and/or leg pain (OR 0.44–0.54, 95% CI 0.28–0.84), and EQ-5D (OR 0.42–0.46, 95% CI 0.26–0.73). Patients with improvements in sleep were more likely to achieve CII in MCS scores (OR 1.54, 95% CI 1.06–2.23). Severe baseline sleep disturbance alone was not associated with postoperative outcomes. **Conclusion:** To our knowledge, this is the first study using the ODI sleep subsection to demonstrate that persistent severe or worsening sleep disturbance at the first postoperative visit is independently associated with reduced odds of achieving CII for quality of life and pain outcomes at 1 year in patients who have undergone thoracolumbar surgery. Improving perioperative sleep could be a targeted intervention to optimize surgical outcomes.

B-29
Abstract ID 126

Opioid use in low back pain is associated with increased utilization of health care services and likelihood of work absenteeism. ***Eric J. Crawford,[1] Robert A. Ravinsky,[2] Anthony V. Perruccio,[1,3] Y. Raja Rampersaud,[3,4] Peter C. Coyte.[1]*** **From the [1]Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, Ont.; the [2]Department of Orthopaedics & Physical Medicine, Medical University of South Carolina, Charleston, S.C.; the [3]Schroeder Arthritis Institute, University Health Network, Toronto, Ont.; the [4]Division of Orthopaedic Surgery, Toronto Western Hospital, University Health Network & University of Toronto, Toronto, Ont.**

Background: Opioid use has been found to be associated with worse treatment outcomes in patients with low back pain (LBP). The objective of this study was to determine whether opioid use is associated with increased health care service utilization, costs and reported work absenteeism in adults with LBP in a primary care setting. **Methods:** A retrospective review was performed of the Inter-professional Spine Assessment and Education Clinics (ISAEC) program database, which contains prospective outcome data and retrospectively reported data on health care service utilization. Health care utilization and work absenteeism data were captured from the Ambulatory and Home Care Record, a self-report measure based on the previous 6-month period. Health care utilization included physician visits, investigations (imaging, electromyogram and nerve conduction studies) and procedures (injections). Costs were reported from the perspective of the Ministry of Health and Long-term Care (MOHLTC). **Results:** A review of the ISAEC database identified 503 patients with LBP, with 83 (16.5%) reporting opioid use. Multivariable logistic regression analyses identified that patients with reported opioid use were more likely to report family physician (odds ratio [OR] 4.13, 95% confidence interval [CI] 1.29–14.0) and emergency room (ER) (OR 2.69, 95% CI 1.25–5.83) visits for their LBP. A Poisson regression analysis found that there was a trend toward increased total physician visits for patients with reported opioid use ($p = 0.063$). A log-transformed multivariable regression analysis found that health care costs were associated with a previous history of LBP ($p = 0.014$), in addition to patient-reported disability measured with the Oswestry Disability Index ($p = 0.028$), but opioid use (0.674) was not. A multivariable logistic regression analysis found that patients with reported opioid use were more likely to report time off work (OR 2.0, 95% CI 1.1–3.65) owing to their LBP. **Conclusion:** Opioid use is associated with increased odds of family physician and ER visits for LBP and increased odds of reporting time off work. Health care costs, from the perspective of the MOHLTC, were not associated with opioid use. Future research should adopt a wide perspective to capture further potential economic impacts of opioid use in this population.

B-30
Abstract ID 53

Wait times for degenerative lumbar spine consultation and surgery: a repeated cross-sectional analysis of the Canadian Spine Outcomes and Research Network. ***Michael Bond,[1] John Street,[2] Charles Fisher,[2] Raphaele Charest-Morin,[2] Jason M. Sutherland.[1]*** **From the [1]Centre for Health Services and Policy Research, University of British Columbia, Vancouver, B.C.; the [2]Combined Neurosurgical and Orthopaedic Spine Program, Vancouver General Hospital, Vancouver, B.C.**

Background: Wait times for specialist care in Canada are a significant problem for patients and providers. The Canadian Institute for Health Information has established benchmarks for surgical management of orthopedic conditions to be less than 6 months. This study aimed to compare contemporaneous wait times for spinal surgical consultation across Canada and evaluate the proportion of patients receiving treatment within a 6-month goal. **Methods:** This observational study was based on data prospectively collected by the Canadian Spine Outcomes and Research Network between 2015 and 2020. Wait times for spinal surgical care were defined as the wait from primary care referral to specialist consultation (Wait 1), the wait from surgical booking to date of surgery (Wait 2) and the cumulative wait time (CWT) from referral to surgical intervention. Median wait times were compared between provinces, diagnoses and year. Linear regression was used to determine the average change in wait time per year. The percentage of patients meeting Wait 2 targets for surgical intervention was calculated yearly using a 6-month benchmark (< 182 days). **Results:** There were 4253 surgical patients included. The median Wait 1 time was 93 days (interquartile range [IQR] 35–221), Wait 2 time was 93 days (IQR 42–168) and CWT was 280 days (IQR 138–492). The CWT demonstrated a gradual increase over the course of 5 years with an average increase of 30 days per year (regression coefficient 30.6, $p < 0.001$). The percentage of participants who did not meet the wait-time benchmark was almost 40% of patients in 2020. **Conclusion:** Operative spinal care patients waited for much longer periods when the time from primary care referral to surgical management was considered. Consideration should be taken for the CWT when evaluating access to care for lumbar degenerative pathology. Evidence-based strategies should be implemented by provinces to reduce wait times and improve access to care.

C-31
Abstract ID 33

Patients with radicular pain improve more than those with axial pain alone after treatment for metastatic spine disease. ***Arthur R. Bartolozzi,[1] Ori Barzilai,[2] Dean Chou,[2] Ilya Laufer,[2] Jorrit-Jan Verlaan,[2] Arjun Sahgal,[2] Laurence D. Rhines,[2] Daniel M. Scuibba,[2] Aron Lazary,[2] Michael H. Weber,[2] James M. Schuster,[2] Stefano Boriani,[2] Chetan Bettegowda,[2] Paul M. Arnold,[2] Michelle J. Clarke,[2] Michael G. Feblings,[2] Jeremy J. Reynolds,[2] Ziya L. Gokaslan,[2] Charles G. Fisher,[2] Nicolas Dea.[1,3]*** **From the [1]Combined Neurological and Orthopedic Spine Program, University of British Columbia, Vancouver, B.C.; the [2]AO Spine Knowledge Forum Tumor, Davos, Graubünden, Switzerland; the [3]AO Foundation, Davos, Graubünden, Switzerland.**

Background: Mechanical axial pain generally improves with surgical and radiation-based interventions for metastatic spine disease. We sought to delineate how radicular pain specifically responds to cancer treatment. **Methods:** Patients treated with surgery and/or radiotherapy for spine metastases were identified from the Epidemiology, Process, and Outcomes of Spine Oncology (EPOSO) international multicentre prospective observational study. The primary outcome was the numeric pain rating scale (NRS) at 3 months after treatment, referring to an overall pain magnitude rather than to a specific location or type. **Results:** Of 284 patients, 129 (45%) had radicular pain with or without axial pain and 155 (55%) had axial pain alone. Age, comorbidities, cancer type, epidural compression, tumour location, Spinal Instability Neoplastic Score or treatment did not differ ($p > 0.05$). Of these, 202 (71%) patients had surgery with or without radiotherapy and 82 (29%) had radiotherapy alone. Patients with radicular pain reported a higher preoperative NRS than patients with axial pain only ($p = 0.028$). The mean baseline score of patients with radicular pain was 6.7 (95% confidence interval [CI] 6.2–7.1) and improved by 3.2 points (95% CI 2.5–4.0) at 3 months ($p < 0.001$). Patients with isolated axial pain had a preoperative mean score of 5.8 points (95% CI 5.5–6.2), which improved by 2.2 points (95% CI 1.5–2.9) ($p < 0.001$). Improvement magnitude was significantly higher for patients with radicular pain than those with only axial pain ($p = 0.041$). However, the net pain score at 3 months was similar ($p = 0.97$). Patients with radicular pain undergoing surgery with or without radiotherapy ($n = 95$) had a higher pretreatment pain (mean 7.0, 95% CI 6.5–7.5) than radiotherapy alone ($n = 34$, mean 5.6, 95% CI 4.8–6.5; $p = 0.027$). Surgical patients with radicular pain improved more (mean 3.8, 95% CI 2.9–4.7) than with radiotherapy alone (1.8, 95% CI 0.3–3.2; $p = 0.015$). Patients with isolated biological radicular pain showed improvement similar to those with isolated mechanical radicular pain ($p = 0.993$). **Conclusion:** After surgery and radiotherapy for metastatic spine disease, patients with radicular pain improve more than those with axial pain alone. Surgery is associated with a larger improvement in pain scores than radiotherapy alone. No differences were identified based on mechanical or biological pain etiology.

C-32
Abstract ID 46

Association between nutritional status and survival in patients requiring treatment for spinal metastases. ***Anne L. Versteeg,[1] Raphaele Charest-Morin,[2] Ilya Laufer,[3] William Teixeira,[4] Ori Barzilai,[5] Alessandro Gasbarrini,[6] Michael G. Feblings,[7] Dean Chou,[8] Michael G. Johnson,[9] Ziya L. Gokaslan,[10] Nicolas Dea,[11] Jorrit-Jan Verlaan,[12] Tony Goldschlager,[13] John H. Shin,[14] John E. O'Toole,[15] Daniel M. Sciubba,[16] Chetan Bettegowda,[17] Michelle J. Clarke,[18] Michael H. Weber,[19] Addisu Mesfin,[20] Norio Kawahara,[21] Rory Goodwin,[22] Alexander Disch,[23] Aron Lazary,[24] Stefano Boriani,[25] Arjun Sahgal,[26] Laurence Rhines,[27] Charles G. Fisher.[11]*** **From the [1]Division of Surgery, University of Toronto, Toronto, Ont.; the [2]Spine Surgery Institute, Vancouver General Hospital, University of British Columbia, Vancouver, B.C.; the [3]Department of Neurosurgery, New York University Langone Health, New York, N.Y.; the [4]Department of Orthopedic, Spine Surgery Division, Instituto do Câncer do Estado de São Paulo, São Paulo, Brazil; the [5]Department of Neurosurgery, Memorial Sloan Kettering Cancer Center, New York, N.Y.; the [6]Instituto Ortopedico Rizzoli, Bologna, Emilia-Romagna, Italy; the [7]Division of Neurosurgery and Spine Program, Department of Surgery, University of Toronto, Toronto, Ont.; the [8]Department of Neurosurgery, Division of Spine Surgery, Columbia University Vagelos College of Physicians and Surgeons, New York, N.Y.; the [9]Department of Orthopaedics, University of Manitoba, Winnipeg, Man.; the [10]Department of Neurosurgery, The Warren Alpert Medical School of Brown University, Providence, R.I.; the [11]Spine Surgery Institute, Vancouver General Hospital, University of British Columbia, Vancouver, B.C.; the [12]University Medical Center Utrecht, Utrecht, Netherlands; the [13]Department of Neurosurgery, Monash Health, Melbourne, Victoria, Australia; the [14]Department of Neurosurgery, Massachusetts General Hospital, Harvard University, Boston, Mass.; the [15]Department of Neurosurgery, Rush University, Chicago, Ill.; the [16]Department of Neurosurgery, Zucker School of Medicine at Hofstra, Long Island Jewish Medical Center and North Shore University Hospital, Northwell Health, Manhasset, N.Y.; the [17]Department of Neurosurgery, Johns Hopkins University School of Medicine, Baltimore, Md.; the [18]Department of Neurosurgery, Mayo Clinic, Rochester, Minn.; the [19]Spine Surgery Program, Department of Surgery, Montréal General Hospital, McGill University Health Centre, Montréal, Que.; the [20]Department of Orthopaedics, University of Rochester Medical Center, Rochester, N.Y.; the [21]Department of Orthopaedic Surgery, Kanazawa Medical University, Kahoku, Ishikawa, Japan; the [22]Department of Neurosurgery, Spine Division, Duke University, Durham, N.C.; the [23]Department of Orthopaedics, University Hospital Carl Gustav Carus at the TU Dresden, Dresden, Saxony, Germany; the [24]National Center for Spinal Disorders, Budapest, Hungary; the [25]Istituto Ortopedico Galeazzi, Milan, Milan, Italy; the [26]Department of Radiation Oncology, University of Toronto, Sunnybrook Health Sciences Centre, Toronto, Ont.; the [27]Department of Neurosurgery, Division of Surgery, The University of Texas MD Anderson Cancer Centre, Houston, Tex.**

Background: Malnutrition is common among patients with cancer and has been associated with profound consequences, such as increased morbidity, mortality, risk of complications, length of stay and decreased patient-reported treatment outcomes. The Patient-Generated Subjective Global Assessment (PG-SGA) is a standardized tool for assessing malnutrition in patients with cancer. The aim of this study was to assess the impact of preoperative nutritional status as measured by PG-SGA on survival for patients requiring surgical intervention and/or radiotherapy for spinal metastases. **Methods:** Patients with spinal metastases who underwent surgery and/or radiation therapy for symptomatic spinal metastatic disease were enrolled in the AO Spine Metastatic Tumor Research and Outcome Network (MTRON), a prospective international multicentre research registry, between September 2017 and August 2022. Nutritional status is classified into 3 categories: well nourished (A), moderately malnourished (B) and severely malnourished (C). **Results:** Of the 1825 patients enrolled in MTRON, 569 met the inclusion criteria; 453 underwent surgery with or without radiation therapy and 116 were treated with radiotherapy alone. Of these, 348 (61%, PG-SGA A) were classified as well nourished, 155 were moderately malnourished (27%, PG-SGA B), and 66 were severely malnourished (12%, PG-SGA C). The median survival for patients in category A was 475 days, 321 days in category B, and 110 days in category C after treatment. Patients who required surgical intervention and were malnourished (PG-SGA C) had a significantly increased risk of mortality (hazard ratio 2.7; $p < 0.01$) compared with those who were well nourished (PG-SGA A). **Conclusion:** The prevalence of malnutrition among surgically treated patients with spinal metastases is high. Malnutrition as measured by the PG-SGA was demonstrated to be significantly and independently associated with postoperative survival. The PG-SGA is a simple tool to identify patients with spinal metastases who are at risk for early postoperative mortality and should be included in the preoperative evaluation of these patients.

C-33
Abstract ID 47

Introduction of the new Patient Expectations in Spinal Oncology questionnaire. ***Anne L. Versteeg,[1,2] Roxanne Gal,[2] Leilani Reich,[3] Angela Tsang,[3] Allan Aludino,[3] Arjun Sahgal,[4] Jorrit-Jan Verlaan,[5] Charles G. Fisher,[3] Lenny Verkooijen.[2]***
From the [1]Division of Surgery, Department of Orthopaedic Surgery, University of Toronto, Toronto, Ont.; the [2]Division of Imaging and Cancer, University Medical Center Utrecht, Utrecht, Netherlands; the [3]Division of Spine, Department of Orthopaedics, University of British Columbia and Vancouver General Hospital, Vancouver, B.C.; the [4]Department of Radiation Oncology, University of Toronto, Sunnybrook Health Sciences Centre, Toronto, Ont.; the [5]Department of Orthopaedic Surgery, University Medical Center Utrecht, Utrecht, Netherlands.

Background: Surgery and radiation therapy have been shown to be effective treatments to improve pain and health-related quality of life in patients with spinal metastatic disease. Yet, a significant portion of patients report dissatisfaction with the outcomes of their treatment. It is thought that a discrepancy between pretreatment expectations and perceived outcomes of treatment is a significant source of dissatisfaction. Currently, no clinical tools exist to assess expectations among patients undergoing treatment for spinal metastases. The purpose of this study was to develop a questionnaire to evaluate expectations among patients with spinal metastatic disease. **Methods:** The new Patient Expectations in Spinal Oncology (PEPSO) questionnaire was developed through an international quality study. The study was conducted in 3 phases. In the first phase, semistructured interviews were conducted with patients with spinal metastatic disease, patients' relatives and physicians involved in the care of patients with spinal metastatic disease. In the second phase, the interviews were analyzed and a preliminary version of the questionnaire was developed with an extensive item pool. In phase 3, the preliminary version of the questionnaire was tested for language, content and structure with a select group of patients. **Results:** A total of 22 items were retained in the final version of the new PEPSO questionnaire. The questionnaire is divided into 3 sections. Section A covers the patient expectations regarding the outcomes of surgery and/or radiation therapy, including physical functioning, pain and social activities, and requirements of analgesia. Section B covers expectations regarding goals of treatment and life expectancy. Section C covers patient understanding of the consultation with the physician. **Conclusion:** The new PEPSO questionnaire was developed to evaluate patient expectations regarding outcomes after treatment for spinal metastases. This new questionnaire will allow physicians to systematically assess patient expectations and will help physicians counsel patients toward realistic expectations. A follow-up study is planned to further evaluate the reliability and construct validity of the questionnaire.

C-34
Abstract ID 74

Medium-term follow-up outcomes in palliative transpedicular corpectomy with cement-based anterior vertebral reconstruction performed for patients with spinal metastasis. ***Maroun Rizkallah, Zhi Wang, Sung-Joo Yuh, Daniel Shedid, Jesse Shen, Fidaa Al-Shakfa, Céline Belguendouz, Rayan AlKafi, Ghassan Boubez.*** **From the Centre hospitalier de l'Université de Montréal, Montréal, Que.**

Background: Multiple reconstruction techniques provide anterior column support after posterior transpedicular corpectomy in patients with spine metastasis. Cage reconstruction is known as the gold standard, but cement-based stabilization would offer good structure with reduced cost in patients with a shorter life expectancy. To our knowledge, this is the first article to assess the medium-term outcomes related to cement-based anterior reconstruction. **Methods:** This was a retrospective monocentric study in which consecutive metastatic patients who underwent posterior spine decompression with transpedicular corpectomy and cement-based anterior reconstruction, with a minimum 6 months follow-up, were included. Ambulatory status and pain were evaluated at every checkpoint. Preoperative and postoperative spine x-rays were performed and repeated on follow-up. Local sagittal angle (LSA) was defined as the Cobb angle between the lower end plate of the underlying vertebra and the upper end plate of the over-lying vertebra, adjacent to the targeted metastatic level.

Results: In total, 142 patients were included, with a mean follow-up of 11.06 months (6–60). Of these, 115 (81%) died during their follow-up (mean survival 13.2 months). Preoperatively, 45% of patients were ambulatory, 27% were ambulating with assistive device and 27% were nonambulant. At the last follow-up, 49% were ambulatory, 37% were ambulating with assistive device and 9% were nonambulant ($p = 0.02$). Pain analogue score was reduced from 8.2 preoperatively to 4.3 at the latest follow-up ($p = 0.003$). Mean (± standard deviation) LSA went from 19.63° ± 13° postoperatively to 18.86° ± 12.5° at the latest follow-up ($p = 0.86$). Subsidence of the cement into the adjacent end plates was observed in 12% of patients, whereas 88% maintained their cement in its initial position. A proximal adjacent vertebral fracture occurred in 2 patients (1.4%), but no surgical revisions were needed. **Conclusion:** The mechanical stability offered by the cement-based anterior reconstruction is maintained during the lifespan of patients operated on for spinal metastasis. Satisfying functional and radiologic outcomes observed at the last follow-up show that this cost-sparing, relatively simple reconstruction technique is a valid alternative for the costly and more complicated cage-based reconstruction.

C-35
Abstract ID 10

Perception of frailty in spinal metastatic disease: international survey of the AO Spine Community. ***Mark A. MacLean*[1], *Miltiadis Georgiopoulos*[2], *Raphaele Charest-Morin*[3], *Niccole Germscheid*[4], *C. Rory Goodwin*[5], *Michael Weber*[2], *AO Spine International*[4]** **From the [1]Department of Surgery, Dalhousie University, Halifax, N.S.; the [2]Combined Neurological and Orthopedic Spine Program, McGill University, Montréal, Que.; the [3]Division of Orthopaedic Spine Surgery, University of British Columbia, Vancouver, B.C.; [4]AO Spine, Davos, Graubunden, Switzerland; [5]Duke University Medical Center, Duke University, Durham, N.C.**

Background: Frailty is increasingly recognized in the surgical spine literature as having an association with adverse events, mortality and hospital discharge disposition. Despite this, frailty has not been clearly defined in the context of spinal metastatic disease (SMD). The purpose of this study was to better understand how members of the AO Spine community conceptualize, define and assess frailty in the context of SMD. **Methods:** The AO Spine Knowledge Forum Tumor conducted an international, self-administered, cross-sectional survey of the AO Spine community. The 33-question survey was developed using a modified Delphi technique. The survey was designed to capture preoperative surrogate markers of frailty and relevant postoperative clinical outcomes in the context of SMD, respectively. Responses were ranked using weighted averages. Consensus was defined as agreement of 70% or higher among respondents. A subgroup analysis was performed, stratifying responses based on respondents' subjective perceived level of knowledge regarding frailty in SMD. **Results:** Results were analyzed for 312 respondents. Most respondents were orthopedic (61.2%) or neurosurgical spine surgeons (35.6%). Study participants represented 71 countries. In the clinical setting, most respondents informally assess frailty and cognition in patients with SMD by forming a general perception based on clinical condition and patient history. Consensus was attained regarding the association between 14 preoperative clinical variables and frailty. Severe comorbidities, extensive systemic disease burden and poor performance status were most associated with frailty. Severe comorbidities associated with frailty included high-risk cardiopulmonary disease, renal failure, liver failure and malnutrition. The most clinically relevant outcomes were major complications, neurological recovery and change in performance status. **Conclusion:** This study represents a first step toward defining the multidimensional nature of frailty in SMD. Respondents recognized that frailty is important but commonly evaluate it based on general clinical impressions rather than using existing frailty tools. We identified numerous preoperative surrogate markers of frailty and postoperative clinical outcomes perceived as most relevant in this population. These results may guide the development of an objective tool for assessing frailty in patients with SMD.

C-36
Abstract ID 73

COVID-19: Were we able to get back to the prepandemic level of spine surgery activity? An experience from a tertiary referral centre in Quebec. ***Maroun Rizkallah*, *Ghassan Boubez*, *Hao Zhang*, *Fidaa Al-Shakfa*, *Pamela Brindamour*, *Danielle Boule*, *Jesse Shen*, *Daniel Shedid*, *Sung-Joo Yuh*, *Zhi Wang*.** **From the Centre hospitalier de l'université de Montréal, Montréal, Que.**

Background: The COVID-19 pandemic severely affected operating room schedules and reduced spine-related surgical activity around the world. With wide diffusion of vaccination and gradual release of restrictions in Canada, the health care system recently resumed normal functioning. However, to our knowledge, no articles have assessed the postrestrictions level of spine-related surgical activity. **Methods:** This retrospective study focused on spine surgery activity at a tertiary referral hospital in Quebec. Three periods were defined: Period 1 (P1) extended from March 2018 to February 2020 (prepandemic); Period 2 (P2) spanned from March 2020 to June 2021 (pandemic and restrictions); Period 3 (P3) covered July 2021 to September 2022 (postrestrictions). The numbers and types of surgeries (scheduled v. emergency), mean preoperative waiting times, complications rates, and 30-day mortality rates were compared between all 3 periods. **Results:** A total of 1776 surgeries were performed during the inclusion period. Around 34.6 surgeries per month were carried out in P1. This dropped to 32.5 surgeries per month in P2 and went back to 37.7 surgeries per month in P3. Of these surgeries, 31% were unscheduled emergencies in P1, 52% in P2 and 35% in P3 ($p = 0.003$). The complication rate went from 10.1% in P1 to 5.6% in P2, then to 10.6% in P3 ($p < 0.001$). Mean preoperative waiting time averaged 131.3 days in P1 compared with 118.4 days in P2 and 178.75 days in P3 ($p < 0.001$). In all 3 periods, 30-day mortality averaged 0.1%. **Conclusion:** According to this study, there was minimal reduction of surgical activity during the height of pandemic restrictions. This is a result of an increase in emergency spine surgeries, as more cases were referred from surrounding shut-down hospitals. The complication rate decreased during the restrictions, likely

because of the reduced complexity of emergency surgeries compared with adult spine deformity surgery commonly performed in our centre. Strict COVID-19 prevention rules were applied during P2, as witnessed by the stable 30-day mortality rate. With prepandemic levels of spine surgery activity successfully restored, efforts should be targeted toward reducing the increased waiting time witnessed in P3 as a result of the elective surgery rate reduction in P2.

C-37
Abstract ID 114

Provider confidence with virtual spine exams 2 years after COVID-19 lockdown restrictions. ***Marcia Rebecca Correale,[1,2] Leslie Jayne Soever,[1,2] Raja Rampersaud.[1,3,4]*** **From the [1]University Health Network, Toronto Western Hospital, Schroeder Arthritis Institute, Toronto, Ont.; the [2]Department of Physical Therapy, University of Toronto, Toronto, Ont.; the [3]Department of Surgery, University of Toronto, Toronto, Ont.; the [4]Krembil Research Institute, Toronto, Ont.**

Background: Standardized virtual care was expeditiously implemented during the COVID-19 lockdowns by clinicians in the Ontario network of Rapid Access Clinics for Low Back Pain (RAC-LBP). The objectives of our quality improvement initiative were to understand clinician confidence with virtual spine examination and determine preference regarding the care delivery method for spine. **Methods:** A 26-item questionnaire was administered by email to 133 RAC-LBP clinicians for voluntary completion. Responses were scored using a 5-point Likert scale with the following descriptors: not confident (1), a little confident (2), somewhat confident (3), confident (4) and very confident (5). Three open-ended questions yielded qualitative findings. **Results:** Ninety questionnaires were completed by 35 physiotherapists and 55 chiropractors (response rate 68%). Seventy-seven clinicians had 10 or more years' experience assessing spine. Confidence scores were as follows: subjective assessment (86.37% confident or very confident); assessing location of dominant pain (80.0% confident or very confident); assessing gait (70.46% confident or very confident); myotome assessment using functional movements (34.83% confident or very confident); hip screening with modified Flexion, Abduction and External Rotation (FABER) test (56.67% confident or very confident); assessing Active Straight Leg Raise (aSLR) test in sitting (63.34% confident or very confident); administering DOWN (4 questions to assess whether patients are Dropping things, are Off-balance, or feel Weakness or Numbness) myelopathy screening questionnaire (53.94% confident or very confident); assessing finger escape sign (41.58% confident or very confident); patient education (81.11% confident or very confident); and overall confidence in delivering virtual care (67.42% confident or very confident). When in-person and video appointments were clinically appropriate and available, clinicians preferred in-person appointments for both initial (94%) and follow-up (68%) assessments. Descriptive semi-qualitative analysis revealed that overall clinician confidence and preference for spine assessment delivery was influenced by comfort with and reliability of technology, and the potential limitations of virtual physical examinations. **Conclusion:** Overall, clinicians were more confident with the subjective components of virtual spine examination than objective. Clinicians preferred in-person assessment for initial appointments when a comprehensive examination was required. Future directions include in-depth qualitative clinician interviews informed by our survey results and evaluating the virtual compared with hands-on objective assessment.

C-38
Abstract ID 76

The impact of nasal decontamination by photodisinfection in spine surgery: a feasibility pilot study. ***Claudia Cristina Malic, Melanie Dubreuil, Kate Duke, Stephen P. Kingwell, Zihan Lin.*** **From The Ottawa Hospital, Ottawa, Ont.**

Background: Surgical site infection (SSI) after spinal surgery is a major source of postoperative morbidity. The Ottawa Hospital has been part of the National Surgical Quality Improvement Program (NSQIP) since 2010; despite implementing an SSI bundle, the SSI rate has continued to range between 4% and 6%. Previous studies that investigated the impact of nasal decontamination on SSI rate in spine surgery did not indicate big successes. A novel technology using photodisinfection was considered in a pilot stage for addition to the current SSI prevention bundle. The aim of our study is to identify whether the addition of nasal photodisinfection as the only changing factor will affect the SSI rate, use of antibiotics up to 30 days and length of stay (LOS). **Methods:** Nasal photodisinfection was implemented in all spine surgeries as part of a quality initiative (January 2022–December 2022). No other changes were made to the standard of care. A comparison cohort was represented by spine surgeries performed between October 2020 and October 2021. The variables of interest were unadjusted SSI rate, LOS, readmission rates, return to emergency departments (ED) and percentage of antibiotics used within 72 hours after surgery and up to 30 days. Bivariate analysis was performed to compare the 2 cohorts. **Results:** A total of 722 spine surgeries were performed from January to September 2022 and the cohort was compared with 1192 cases performed between October 2020 and October 2021. The use of antibiotics from 72 hours to 30 days after surgery was reduced by 3.7% ($p = 0.040$), the postoperative LOS decreased from 7.34 to 6.36 days ($p = 0.053$), return to the ED reduced by 3.5% ($p = 0.009$), return to operating room within 30 days reduced with 1.9%, and the readmission rate halved (3.5%). **Conclusion:** Preliminary results indicate that nasal decontamination by photodisinfection technology has an impact on SSI rate, LOS and readmission rates.

C-39
Abstract ID 116

Exploring the bacterial hypothesis of low back pain: a prospective cohort study. ***Mark A. MacLean, Lisa C. Julien, Glenn Patriquin, Jason LeBlanc, Ryan Green, Jacob Alant, Sean Barry, R. Andrew Glennie, William Oxney, Sean D. Christie.*** **From the Division of Neurosurgery, Dalhousie University, Halifax, N.S.**

Background: Occult bacterial infection is a proposed etiology of low back pain (LBP). However, 2 controversial double-blind randomized controlled trials of antibiotic therapy for chronic LBP in the setting of lumbar disc herniation (LDH) came to disparate conclusions. A causative link between LBP and bacteria remains unconfirmed. Herein, we determined the incidence of occult discitis in patients receiving surgery for LDH. **Methods:** A prospective cohort study was conducted of consecutive adult patients undergoing discectomy for symptomatic LDH. Exclusion criteria included previous epidural steroid use, previous spinal surgery and recent antibiotic use (< 2 wk since surgery). Four nuclear tissue and ligamentum flavum (control) samples were obtained per patient using stringent aseptic protocol. All samples underwent 16S polymerase chain reaction (PCR) testing and culturing, as per routine laboratory practices. Surgeons and patients were blinded to microbiological data unless species were deemed virulent and warranting treatment, as determined by independent infectious disease specialists. Health Scale (HS) and Oswestry Disability Index (ODI) scores were recorded before surgery and at 6–12 weeks, 6- and 12-month follow-up. **Results:** Eighty-one patients were enrolled (mean ± standard deviation age 43.3 ± 13.3 yr; body mass index [BMI] 28.7 ± 5.3 kg/m^2). Of these, 51% were smokers. For the overall cohort, 100% of tissue samples were negative by 16S PCR and no virulent species were detected. Nuclear and ligament cultures were both negative in 51 (62.9%) cases. Cultures were positive for nuclear tissue only, ligament only, or both in 14.8%, 12.3% and 9.9% of cases, respectively. Fifteen of 20 (75%) disc positive samples grew a single colony of an indolent species. There were no differences in age, sex, BMI, baseline HS, baseline ODI, or surgeon specialty between patients with positive and negative disc cultures. Ligament cultures were positive in 8.7% of neurosurgical and 27.6% of orthopedic cases (p = 0.055). **Conclusion:** The findings of this prospective cohort study of consecutive patients receiving surgery for lumbar disc herniation do not support the theory of occult discitis. All samples were 16S-PCR negative, and most cultures were negative or grew a single colony, suggestive of contamination.

C-40
Abstract ID 7

Management of deep surgical site infections of the spine: a Canadian survey. ***Mohamed Sarraj,[1] Abdullah Alqahtani,[1] Patrick Thornley,[2] Frank Koziarz,[1] Christopher S. Bailey,[3] Millaray Freire-Archer,[1] Kunal Bhanot,[4] Edward Kachur,[1] Mohit Bhandari,[1] Colby Oitment.[1]*** **From the [1]Division of Orthopaedic Surgery, McMaster University, Hamilton, Ont.; the [2]Division of Orthopaedic Surgery, Western University, London, Ont.; the [3]London Health Sciences Centre, London, Ont.; the [4]Grand River Hospital, Kitchener, Ont.**

Background: Given the lack of evidence or guidelines on the variety of procedural options in the management of deep spine surgical site infections, the purpose of this survey was to document and investigate the use of these techniques across Canada. **Methods:** A 34-question survey evaluating surgical techniques for irrigation and debridement in postoperative thoracolumbar infection was distributed to Canadian adult spine surgeons. Results were analyzed qualitatively, and comparisons by specialty, years of training and number of cases were completed using Fisher exact tests. We defined consensus as a higher than 70% agreement. **Results:** We received 53 responses (62% response rate) from a comprehensive sample of Canadian adult spine surgeons. There was a consensus to retain hardware (80%) and interbody implants (93%) in acute infection, to retain interbody implants in chronic or recurrent infection (71%), and to apply topical antibiotics in recurrent infection (85%). There was consensus on the use of absorbable suture to close fascia in acute (83%) and chronic (87%) infection. Eighty-five percent of surgeons used nonabsorbable materials such as nylon or staples for skin closure in chronic infection, but there was no consensus in acute infection. Surgeons varied significantly in opinion on type, volume and pressure of fluids, adjuvant solvents, graft management, use of topical antibiotics acutely and the use of negative pressure wound therapy. Partial hardware exchange was controversial. Additionally, specialty or surgeon experience had no impact on management strategy. **Conclusion:** This survey demonstrates significant heterogeneity among Canadian adult spine surgeons regarding key steps in the surgical management of deep instrumented spine infection, concordant with scarce literature on the topic.

D-41
Abstract ID 26

Earlier tracheostomy reduces complications in complete cervical spinal cord injury in real-world practice: analysis of a multicentre cohort of 2001 patients. ***Armaan K. Malhotra,[1,2] Michael Balas,[1] Blessing N.R. Jaja,[1] Erin M. Harrington,[1] Johann Hofereiter,[1] Rachael H. Jaffe,[1,2] Yingshi He,[1] James P. Byrne,[3] Jefferson R. Wilson,[1,2] Christopher D. Witiw.[1,2]*** **From the [1]Division of Neurosurgery, Department of Surgery, St. Michael's Hospital, University of Toronto, Toronto, Ont.; the [2]Institute for Health Policy, Management and Evaluation, University of Toronto, Toronto, Ont.; the [3]Department of Surgery, Johns Hopkins Hospital, Baltimore, Md.**

Background: Patients with traumatic cervical spinal cord injury (SCI) typically experience severe respiratory complications necessitating prolonged ventilatory support. Tracheostomy is frequently employed in these circumstances, although there is currently no consensus on the optimal timing. This study aimed to assess whether early tracheostomy (< 7 days) is beneficial in adult patients with traumatic complete cervical SCI. **Methods:** We conducted an observational cohort study using data from the American College of Surgeons Trauma Quality Improvement Program database from 2010 to 2018. Patients were stratified into those receiving early tracheostomy (at or before 7 days) and those receiving delayed tracheostomy. Propensity score matching was used to assess the association between delayed tracheostomy and the risk of in-hospital adverse events, including mortality, major complications and immobility-related complications. Risk-adjusted variability in tracheostomy timing across trauma centres was also investigated using mixed-effects regression. **Results:** Median time to tracheostomy was 9.2 days (interquartile range [IQR] 6.1–13.1 days), with 654 patients (32.7%) undergoing

early tracheostomy. After matching, the odds of a major complication were significantly lower for patients who had an early tracheostomy (odds ratio [OR] 0.90, 95% confidence interval [CI] 0.88 to 0.98). Patients were also significantly less likely to experience an immobility-related complication (OR 0.90, 95% CI 0.88 to 0.98). Patients in the early group spent 8.2 fewer days in the critical care unit (95% CI –10.2 to –6.61) and 6.7 fewer days ventilated (95% CI –9.44 to –5.23). There was significant variability in tracheostomy timeliness between trauma centres with a median odds ratio of 12.2 (95% CI 9.7 to 13.7) that was not explained by case-mix and hospital-level characteristics. **Conclusion:** A 7-day threshold to implement tracheostomy appears to be associated with reduced in-hospital complications, time in the critical care unit and time on mechanical ventilation. Notably, there is substantial unexplained variability in tracheostomy timing between centres.

D-42
Abstract ID 87

Neuroprotection after traumatic spinal cord injury through mitochondrial calcium uniporter inhibition. ***Kennedy C.M. Brittain, Sean Christie, Saranyan Pillai.* From the Division of Neurosurgery, Dalhousie University, Halifax, N.S.**

Background: A common final pathway of secondary spinal cord injury is glutamate excitotoxicity, manifested by calcium overloading of the neuron. Mitochondria are damaged by excessive intake of cytoplasmic Ca^{2+} through the mitochondrial calcium uniporter (MCU). When this occurs, the mitochondria become overwhelmed, collapse and trigger neuronal cell death. We hypothesized that MCU inhibition by Ru265 will improve recovery after traumatic spinal cord injury (tSCI) by preserving mitochondrial integrity and function essential for axonal survival and repair. **Methods:** We demonstrated that intraperitoneal (IP) delivery at a dose previously shown to be neuroprotective in a stroke model (3 mg/kg) promotes seizure activity in mice, prompting us to investigate localized methods of drug delivery and a lower total dose. We compared single epidural and IP doses of Ru265 (1 mg/kg; non-seizure-inducing dose, determined empirically), in mice after tSCI. Mice were sampled 4, 8 and 24 hours afterward and Ru265 within the spinal parenchyma, forebrain and whole blood determined using mass spectrometry. **Results:** Mass spectrometry data support that Ru265 reached higher concentrations in the spinal parenchyma with epidural application, than via IP injection. This effect was also time dependent, with the drug concentration increasing with time. Epidural application was determined to be a feasible and effective method of Ru265 delivery. After this, mitochondrial integrity of Ru265-treated and control mice was evaluated with transmission electron microscopy. Evaluation of the structural integrity of mitochondria after tSCI revealed that there were significantly more healthy mitochondria ($p < 0.0001$) and significantly fewer damaged mitochondria ($p < 0.0001$) in the Ru265-treated sections. To determine if this increase in mitochondrial preservation translated to improved neuronal survival, Fluoro-Jade C, a fluorescent label for degenerating neurons, was used. Samples treated with Ru265 had significantly fewer degenerating neurons than controls ($p = 0.009$). **Conclusion:** These findings support that Ru265 provides mitoprotection and, as a likely result, neuroprotection after tSCI. To our knowledge, this is the first study demonstrating the benefits of MCU inhibition in the context of SCI.

D-43
Abstract ID 16

The impact of specialized versus nonspecialized acute hospital care on survival among patients with acute incomplete traumatic spinal cord injuries: a population-based observational study from British Columbia, Canada. ***Marcel F. Dvorak,[1] Nathan Evaniew,[2] Melody Chen,[3] Zeina Waheed,[3] Naama Rotem-Kohavi,[3] Nader Fallah,[3] Vanessa K. Noonan,[3] Charles G. Fisher,[1] Raphaële Charest-Morin,[1] Nicolas Dea,[1] Tamir Ailon,[1] John Street,[1] Brian K. Kwon.[1]* From the [1]Combined Neurosurgical and Orthopedic Spine Program, University of British Columbia, Vancouver, B.C.; the [2]Division of Orthopaedic Surgery, University of Calgary, Calgary, Alta.; the [3]Praxis Institute, Vancouver, B.C.**

Background: Given the complexity of care required after a patient suffers an acute traumatic spinal cord injury (tSCI), it seems intuitively beneficial for such care to be delivered at hospitals with specialized SCI expertise. However, demonstrating these benefits is not straightforward. We sought to determine whether specialized acute hospital care influenced the most fundamental outcome after SCI: mortality within the first year of injury. **Methods:** We compared survival among patients with incomplete tSCI admitted to a single quaternary-level trauma hospital with a specialized acute SCI program compared with those admitted to trauma hospitals without specialized acute SCI care. We performed a population-based retrospective observational cohort study using administrative and clinical data linked from multiple sources in British Columbia (B.C.) from 2001 to 2017. **Results:** Among a cohort of 1920 patients, there were 193 deaths within 1 year. We failed to identify a significant overall benefit for survival after adjusting for potential confounders, and the confidence intervals (CIs) were compatible with both benefit and harm (odds ratio [OR] 1.01, 95% CI 0.17–6.11; $p = 0.99$). Significant associations were observed with age > 65 years (OR 4.92, 95% CI 1.66–14.57), Charlson Comorbidity Index (OR 1.61, 95% CI 1.42–1.83; $p < 0.01$), Injury Severity Score (OR 1.08, 95% CI 1.06–1.11; $p < 0.01$), and traumatic brain injury (OR 2.21, 95% CI 1.32–3.41; $p < 0.01$). **Conclusion:** Among patients with acute tSCI, admission to a hospital with specialized acute SCI care was not associated with improved 1-year survival. Subgroup analyses suggested heterogeneity of benefit, with little benefit for older patients with less polytrauma and substantial benefit for younger patients with greater polytrauma.

D-44
Abstract ID 59

Stem cells from human spinal cord exhibit reduced oligodendrogenesis compared with rodent stem cells. ***Ryan V. Sandarage,[1,2] Ahmad Galuta,[1] Diana Ghinda,[2] Jason C.S. Kwan,[1] Eve C. Tsai.[1,2]* From the [1]Neurosurgery Division, University of Ottawa, Ottawa, Ont.; [2]The Ottawa Hospital, Ottawa, Ont.**

Background: In preclinical rodent models, endogenous neural stem/progenitor cells (NSPCs) in the spinal cord represent a promising target to stimulate oligodendrocyte regeneration. It is unclear whether human spinal cord NSPCs possess the same potential to differentiate into oligodendrocytes as rat NSPCs do. We directly compared the functional and transcriptional profiles of primary spinal cord NSPCs from adult humans and rats to determine whether human NSPCs possess the same potential for oligodendrogenesis. **Methods:** Spinal cord tissue from adult human organ donors and female rats were harvested and primary NSPCs were cultured using the neurosphere assay. To induce spontaneous differentiation, primary-derived NSPCs (pdNSPCs) were treated with 1% fetal bovine serum (n = 15 humans, n = 10 rats). To promote oligodendrocyte differentiation, pdNSPCs were treated with 40 ng/μL or 100 ng/μL of platelet-derived growth factor AA (PDGF-AA) (n = 3 humans, n = 3 rats). pdNSPCs were treated for 1 or 2 weeks and characterized by immunocytochemistry. To compare transcriptomes, human (n = 6) and rat pdNSPCs (n = 3) had their RNA extracted and sequenced using the NextSeq platform. Differentially expressed (DE) genes and gene sets were analyzed using DESeq and Gene Set Enrichment Analysis, respectively. **Results:** Upon spontaneous differentiation, human NSPCs (± standard deviation) generated fewer oligodendrocytes (0.013% ± 0.01% and 0.029% ± 0.01% O4+ after 1 and 2 weeks, respectively) compared with rat NSPCs (4.9% ± 0.4% and 6.3% ± 0.6% O4+ after 1 and 2 weeks, respectively). Oligodendrocyte differentiation of rat NSPCs but not human NSPCs could be further enhanced with PDGF-AA treatment, which was most effective at a concentration of 40 ng/μL applied for 1 week (8.5 ± 1.4-fold increase in O4+). Rat NSPCs were enriched in the transcripts OLIG1/2, SOX10 and CNP. **Conclusion:** We directly compared the potential for oligodendrogenesis between primary human and rat spinal cord NSPCs. Human NSPCs bear little potential for oligodendrogenesis at a functional and transcriptional level, which may affect the successful translation of myelinating strategies.

D-45
Abstract ID 122

Harnessing the endogenous stem cell response after spinal cord injury. ***Laureen D. Hachem,[1,2] James Hong,[2] Alexander Velumian,[1,2] Andrea J. Mothe,[2] Charles H. Tator,[1,2] Michael G. Fehlings.[1,2]*** **From the [1]Division of Neurosurgery, Department of Surgery, University of Toronto, Toronto, Ont.; the [2]Krembil Research Institute, University Health Network, Toronto, Ont.**

Background: The adult spinal cord contains a population of ependymal-derived neural stem/progenitor cells (epNSPCs), which are normally quiescent but are acutely activated after spinal cord injury (SCI). Once activated, epNSPCs serve as critical players in promoting endogenous regeneration and baseline functional recovery. However, activation of epNSPCs remains limited to the acute injury period and, thus, strategies that harness their regenerative potential after subacute or chronic SCI hold promise in enhancing endogenous repair or regeneration. A major barrier to unlocking the therapeutic benefits of epNSPCs has been a limited understanding of the mechanisms that regulate their activation after SCI. Recently, we discovered that excitotoxic levels of glutamate, a hallmark in the pathophysiology of acute SCI, promote epNSPC proliferation and survival in vitro. In this study, we characterized the downstream signalling pathways involved in this response and targeted this mechanism in vivo to enhance the endogenous regenerative capacity of the injured spinal cord. **Methods:** epNSPCs isolated from the central canal region of the adult spinal cord were treated with glutamate in the presence or absence of pharmacologic inhibitors of glutamate receptors in vitro. Pathway analysis was conducted using immunohistochemistry, RNAseq and Western Blot. In vivo, cervical SCI was induced in adult rats. One week after SCI, the animals (n = 7/group) were randomized to receive CX546 (a positive AMPA receptor [AMPAR] modulator) or vehicle control. Animals underwent weekly behavioural testing and spinal cords were extracted for histologic analysis. **Results:** Glutamate leads to calcium influx in epNSPCs via AMPARs and this change in calcium, in concert with Notch signalling, serves to increase the proliferation of epNSPCs via pCREB and induce astrocytic fate specification through Hes1 upregulation. Positive modulation of AMPARs subacutely after SCI significantly enhances epNSPC proliferation, astrogliogenesis and neurotrophic factor production, and promotes neuronal survival and functional recovery. **Conclusion:** We uncovered an important mechanism by which glutamatergic signalling via AMPARs alters the proliferation and phenotype of spinal cord epNSPCs. Pharmacologic modulation of AMPAR signalling offers a novel, translational strategy to regulate the fate of epNSPCs and harness their regenerative potential after SCI.

D-46
Abstract ID 62

Comparison of age and 5-Item Modified Frailty Index as predictors of in-hospital mortality for patients with complete traumatic cervical spinal cord injury. ***Husain Shakil,[1,2] Blessing N.R. Jaja,[2] Peng Zhang,[2] Rachael Jaffe,[1,2] Armaan K. Malhotra,[1,2] Jefferson R. Wilson,[1,2] Christopher D. Witiw.[1,2]*** **From the [1]Department of Surgery, Neurosurgery Division, University of Toronto, Toronto, Ont.; [2]Unity Health Toronto, Toronto, Ont.**

Background: Increased clinical frailty, as measured by the 5-item Modified Frailty Index (mFI-5), and older age have been found to be associated with increased mortality in the setting of traumatic spinal cord injury (SCI). However, a comparison of the predictive power of each measure has not been completed. Therefore, in this study we aimed to discern which patient factor is superior in a mortality predication model. **Methods:** Using the 2010–2018 Trauma Quality Improvement Program (TQIP) database, we identified a cohort of adult (age ≥ 16 yr) patients who sustained complete traumatic cervical SCI. We developed a regression model of mortality that included either age and mFI-5, or the composite of age with mFI-5 adjusted for additional clinical covariates of interest. We conducted receiver operating characteristic (ROC) analysis and decision curve analysis (DCA) to compare models. Subgroup analysis was done by restricting the cohort to patients older than 65 years. **Results:** We identified 4814 patients with a mean age of 49 years, 63% with an mFI of 0, 22% with an mFI of 1, and 15% with an mFI of 2 or higher. We found the area under the ROC curve (AUROC) for a model of age with mFI-5 (0.81, 95% CI 0.79–0.84) compared with a model

with age alone (0.81, 95% CI 0.79–0.83) to be comparable (p = 0.57). When compared with a predictive model with mFI-5 alone (0.75, 95% CI 0.72–0.77), both models were superior ($p < 0.05$). Decision curve analysis also determined that a predictive model with age or the composite of age with frailty has more clinical utility than mFI-5 alone. In an older age subgroup, ROC analysis and DCA also determined that a model with age and mFI-5 or age alone were similar (p = 0.22), and superior to mFI-5 alone ($p < 0.05$). **Conclusion:** In the setting of adult complete traumatic cervical SCI, our analysis suggests that age provides more predictive power in a statistical model for mortality than mFI-5.

D-47
Abstract ID 109

Unplanned readmissions after traumatic spinal cord injury: perspective from the British Columbian population. ***Naama Rotem-Kohavi,[1] Marcel F. Dvorak,[2] Nicolas Dea,[2] Nathan Evaniew,[3] Melody Chen,[1] Zeina Waheed,[1] Jijie Xu,[1] Nader Fallah,[1] Vanessa Noonan,[1] Brian Kwon.[2]*** **From the [1]Praxis Spinal Cord Institute, Vancouver, B.C.; the [2]Combined Neurosurgical and Orthopedic Spine Program, University of British Columbia, Vancouver, B.C.; the [3]Division of Orthopaedic Surgery, University of Calgary, Calgary, Alta.**

Background: Unplanned readmissions (UR) in patients with traumatic spinal cord injury (tSCI) after discharge pose an economic burden and reflect quality of care. An understanding of the causes and rates of readmissions after inpatient discharge can inform targeted interventions that will improve care and reduce costs. The objective of this study is to characterize UR after tSCI in British Columbia (B.C.) within 30 days and 1 year post-discharge (PD). **Methods:** This is a population-based study using B.C. administrative and Rick Hansen SCI Registry (RHSCIR) clinical data, linked from multiple sources from 2001 to 2017. Patients with incomplete tSCI were identified using *International Classification of Diseases*, *10th Edition* codes. We conducted a descriptive analysis (χ^2 and Kruskal–Wallis) to characterize patients with UR, and the causes and factors associated with UR. **Results:** In total, 1920 patients met the inclusion criteria. Within 30 days PD, 80 patients had had hospital UR at least once, for a total of 88 UR. These patients had higher levels of comorbidities ($p < 0.0001$), more UR before injury ($p < 0.0001$) and delayed admission to acute care after the injury ($p < 0.0001$) than patients without UR. Within 1 year PD, 320 patients had had hospital UR at least once, for a total of 541 UR. These patients were older (p = 0.0002), had higher levels of comorbidities ($p < 0.0001$), longer acute and rehab stay ($p < 0.0001$) and delayed admission to acute hospital ($p < 0.0001$) than patients without UR. Causes for UR within 30 days and 1 year PD were mostly related to procedure complications and injuries (e.g, implant or device complications): 36% and 21%, respectively. **Conclusion:** Our preliminary results suggest that within 1 year PD, 17% of patients with incomplete tSCI have at least 1 UR. Close to 5% of patients are readmitted as early as within 30 days PD. These UR are mostly a result of procedure complications and injuries. This preliminary analysis highlights the benefit of early admission to acute care for reducing UR. Further analyses are currently under way to examine the effect of being admitted to specialized care versus nonspecialized care on UR.

D-48
Abstract ID 9

The radiographic characteristics that lead surgeons to agree and disagree on making treatment recommendations in thoracolumbar burst fractures without neurologic deficits. ***Charlotte Dandurand,[1] Sander Muijs,[2] Marcel Dvorak,[1] Klaus Schnake,[3] Cumhur Öner.[2]*** **The [1]Combined Neurosurgical and Orthopedic Spine Program, University of British Columbia, Vancouver, B.C; the [2]University Medical Center Utrecht, Utrecht, Netherlands; the [3]Malteser Waldkrankenhaus Erlangen, Erlangen, Bavaria, Germany.**

Background: After using equipoise methodology to determine inclusion, the next step is to use the methodology to better understand what radiographic characteristics lead surgeons to agree or disagree on optimal management of thoracolumbar (TL) burst fractures without neurological deficits. We aimed to assess the association of agreement and equipoise with fracture classification, the degree of certainty of posterior ligamentous complex (PLC) injury, the use of the M1 modifier and the degree of body comminution. **Methods:** A panel of 22 AO Spine Knowledge Forum Trauma experts reviewed 183 TL fracture cases and were asked to 1) classify the fracture, 2) assess degree of certainty of PLC disruption, 3) assess degree of comminution and 4) make a treatment recommendation. Two groups were created: agreement versus equipoise. The threshold of equipoise used was 86% (86:14 distribution of uncertainty, or 19 v. 3 experts). **Results:** Twenty-four cases (13.1%) were included in the agreement group and 159 cases (86.9%) were included in the equipoise group. The intraclass correlation for fracture classification was excellent for both groups. A3 and A4 fractures were more common in the equipoise group (90.6% v. 73.0%; $p < 0.001$). The agreement group had a trend toward a higher degree of certainty of PLC disruption (45.7% ± standard deviation 37.9 v. 29.05 ± 29.0; p = 0.1). The use of the M1 modifier was more common in the agreement group (53.2% v. 39.1%; $p < 0.001$). Overall, the degree of comminution was similar in both groups (50.6 ± 25.0 v. 46.3 ± 21.3; p = 0.69]. **Conclusion:** The agreement group had a trend toward a higher degree of certainty of PLC injury, and the more common use of the M1 modifier explained the presence of more type B fractures. The equipoise group had more A3 and A4 type fractures. Future studies are required to identify the role of comminution in decision-making, as degree of comminution was similar between the agreement and equipoise group.

D-49
Abstract ID 19

The effect of Enhanced Recovery After Surgery protocols for elective cervical and lumbar spine procedures on hospital length of stay: a systematic review and meta-analysis. ***Ryan Greene,[1,2] Bradley Furlong,[2] Jenna Smith-Forrester,[1] Michelle Swab,[2] Sean D. Christie,[1] Amanda Hall.[2]*** **From the [1]Division of Neurosurgery, Dalhousie University, Halifax, N.S.; the [2]Neurosurgery Division, Memorial University of Newfoundland, St. John's, N.L.**

Background: Enhanced Recovery After Surgery (ERAS) protocols are well established in many surgical fields but are relatively novel in spine surgery, with the efficacy of these programs being unclear for spine. Enhanced recovery interventions aim to reduce patient length of stay (LOS) by improving delivery of care at the pre-, peri- and postoperative phases of a patient's surgical journey. Existing systematic reviews for ERAS and spine have heterogeneous populations, including surgery for deformity, tumour and degenerative disease. The aim of this study was to determine the efficacy of ERAS protocols for degenerative pathologies of the spine. **Methods:** A systematic review and meta-analysis was performed according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) and Peer Review of Electronic Search Strategies (PRESS) guidelines. Inclusion criteria were patients aged 18 years and older, who had had surgery for stenosis, disc herniation, spondylolisthesis or cervical myelopathy. Studies were excluded if the patient had surgery for deformity or oncologic spine or did not utilize a full ERAS pathway. Pediatric populations were also excluded. Risk of bias was assessed using Risk of Bias in Non-Randomised Studies–of Interventions (ROBINS-I), and a random effects model was used for the meta-analysis. The quality of evidence was assessed using the Grading of Recommendations, Assessment, Development, and Evaluations (GRADE) approach. **Results:** Twelve studies were included in the review. All were uncontrolled before-and-after studies and showed moderate (n = 1) or serious (n = 11) risk of bias. The meta-analysis showed low-quality evidence that implementing ERAS protocols for elective spine procedures may reduce LOS by 1.03 days (95% confidence interval [CI] –1.36 to –0.70; $p < 0.001$; $I^2 = 93\%$). The meta-analysis also observed no significant difference in readmission to hospital at 30-, 60- and 90-day follow-up. **Conclusion:** This study observed that implementing ERAS protocols for spine procedures may reduce LOS without increasing readmission to hospital. Existing studies are subject to significant risk of bias. Currently, spine ERAS research is in its infancy, and more rigorously conducted studies are necessary in the future.

D-50
Abstract ID 23

Exploring end-of-life decision-making and perspectives on medical assistance in dying through the eyes of individuals living with cervical spinal cord injuries in Nova Scotia. ***Erika Leck*, *Emily Marshall*, *Sean Christie*. From the Division of Neurosurgery, Dalhousie University, Halifax, N.S.**

Background: Individuals with spinal cord injuries (SCI) are invariably faced with decisions regarding management of their injury, from escalation of care to life-prolonging or palliating interventions. End-of-life decision-making includes decisions about the breadth of options that exist and, more recently, has come to include conversations on medical assistance in dying (MAiD), as legislation changes have expanded access by repealing criteria that death must be reasonably foreseeable. The intersection between SCI and MAiD, and other end-of-life decision-making, has yet to be explored in the literature, and through this study we sought to discuss the awareness of options that exist with respect to end of life, and participant perspectives on MAiD and end-of-life decision-making. **Methods:** We conducted hour-long semistructured interviews with 15 individuals living with cervical SCI. Interviews took place over the telephone or virtually via Microsoft Teams. Interview transcripts were then analyzed using an iterative coding process and thematic analysis (NVivo). **Results:** Overall, very few conversations were had between participants and their health care teams during the upfront stage when they were admitted to hospital, with a similar lack of awareness of options that exist for end-of-life decision-making. As people spent time in the hospital and at rehab, they were able to take on a more independent role in decision-making. People generally had an awareness of MAiD, but variable understanding of whom the legislation applies to. The way that someone with an SCI could interact with MAiD legislation brought forth interesting discussions about body autonomy and self-determination, with often immediate affective reactions, which quickly changed to openness. Some voiced their own desire initially for MAiD, while others vacillated or were more strongly opposed, yet gave caveats that could justify someone's decision to pursue it. **Conclusion:** This study emphasizes the importance of engaging with these difficult conversations, and trying to strike the balance of respecting autonomy and self-determination, while understanding the constraints of each individual's situation.

E-51
Abstract ID 88

Neurologically intact thoracolumbar burst fractures (AO Spine A3, A4) improve on Oswestry Disability Index equally when treated surgically versus nonoperatively. ***Marcel F. Dvorak*,[1] *Cumhur F. Öner*,[2] *Alexander R. Vaccaro*,[3] *Lorin M. Benneker*,[4] *Shanmuganathan Rajasekaran*,[5] *Mohammad El-Sharkawi*,[6] *Eugen Cezar Popescu*,[7] *Jin Wee Tee*,[8] *Jerome Paquet*,[9] *John C. France*,[10] *Richard Allen*,[11] *William F. Lavelle*,[12] *Miguel Hirschfeld*,[13] *Spyros Pneumaticos*.[14] From the [1]Combined Neurosurgical and Orthopedic Spine Program, University of British Columbia, Vancouver, B.C.; the [2]University Medical Centre Utrecht, Utrecht, Netherlands; the [3]Thomas Jefferson University, Philadelphia, Pa.; the [4]Orthopedic Department, University of Bern, Bern, Switzerland; the [5]Ganga Hospital, Coimbatore, Tamil Nadu, India; the [6]Assiut University, Assiut, Egypt; the [7]Dr N Oblu Emergency Hospital, Iasi, Moldova, Romania; the [8]Alfred Hospital, Melbourne, Victoria, Australia; the [9]Surgery Department, Université Laval, Québec, Que.; the [10]Orthopedics, West Virginia University, Morgantown, W.V.; the [11]Department of Orthopaedic Surgery, University of California at San Diego, San Diego, Calif.; the [12]Orthopedic Surgery, SUNY Upstate Medical University, Syracuse, N.Y.; [13]Marbella, Malaga, Spain; the [14]KAT Hospital, Kifisia, Attica, Greece.**

Background: We sought to compare the rate of clinically relevant improvement in disability with surgical as compared with nonsurgical treatments in acute thoracolumbar burst fractures with no neurological injury. **Methods:** This global observational multicentre cohort study included patients between the ages of 18 and 65 years with acute AO type A3 and A4 fractures between T10 and L2 on a computed tomography scan. Patients with suspected posterior ligamentous injury were included. Generalizability was enhanced by distributing the 14 participating sites across

North America, Europe, India, Africa and Australia. Sample size was calculated to be 208 with a 2:1 ratio between surgical and nonsurgical. Nonsurgical treatment included pain management and mobilization either with or without external brace or cast immobilization, whereas surgical treatment included open or percutaneous posterior instrumentation, with or without anterior instrumentation. **Results:** Of 213 patients, 130 were treated surgically and 83 nonsurgically. A significantly lower level of disability (Oswestry Disability Index [ODI]) was evident in the surgically treated patients at discharge. Median time to achieve a 12.8% improvement in ODI from baseline was 28.0 days (95% confidence interval [CI] 15.0–28.0) in the surgical group and 25.5 days (95% CI 17.0–31.0) in the nonsurgical group. Neither the log rank test (p = 0.961) nor the adjusted Cox regression analysis (surgical v. nonsurgical group (hazard ratio [HR] 1.10, 95% CI 0.77–1.58]) showed any statistically significant differences between the 2 groups. When an exploratory analysis considered the time to achieve an ODI of less than 20 (minimal disability) from the date of injury, the adjusted HR was 1.32 (95% CI 0.96–1.82). At discharge, 91% of surgical and 81% of nonsurgical patients reported being satisfied with treatment. Of all patients, 85% were extremely or very satisfied at 2-year follow-up. Surgical patients returned to work at a mean (± standard deviation) of 90.8 ± 69.7 days, while nonsurgical patients returned to work at 116.5 ± 132.7 days. **Conclusion:** Surgically and nonsurgically treated patients with thoracolumbar burst fractures without neurological injury do not differ in achieving improvements in outcomes, as assessed by ODI. Surgery may shorten the time to achieve minimal disability.

E-52
Abstract ID 28

Predictive algorithm for surgery recommendation in thoracolumbar burst fractures without neurological deficits. ***Charlotte Dandurand*[1], *Cumbur Öner*[2], *Sander Muijs*[2], *Klaus Schnake*[3], *Marcel Dvorak*[1]. From the [1]Combined Neurosurgical and Orthopedic Spine Program, University of British Columbia, Vancouver, B.C.; the [2]University Medical Center Utrecht, Utrecht, Netherlands; the [3]Malteser Waldkrankenhaus Erlangen, Erlangen, Bavaria, Germany.**

Background: Predictive modelling and artificial intelligence constitute emerging fields and have not previously been used to guide treatment decision-making in thoracolumbar burst fractures. Building such a model is crucial in reducing the variability in decision-making. The goal of this study was to build a mathematical prediction rule to guide treatment consensus. This new model could define a new scoring system to aid decision-making. **Methods:** Twenty-two expert surgeons from the AO Knowledge Forum Trauma reviewed 183 cases from the AO Spine Thoracolumbar Burst Fractures Study Comparing Surgical Versus Nonsurgical Treatment prospective study (classification, degree of certainty of posterior ligamentous complex [PLC] injury, degree of comminution, treatment recommendation). Reviewer regions were classified as Europe, North and South America, and Asia. Classification and regression trees were used to create predictive models. We applied the decision tree model, which accounts for the possibility of non-normal distributions of data. Several cross-validation techniques were used to validate the multivariate analyses. **Results:** Variables included in the algorithm were certainty of PLC injury (%), degree of comminution (%), the use of M1 modifier, and regions. The algorithm suggested that a patient with a certainty of PLC injury > 57.5% had a 97.0% chance of receiving surgery. If certainty of PLC injury was < 57.5% and comminution was > 37.5%, a patient had a 74.2% chance of receiving surgery in Europe and Asia, versus a 22.7% chance in North and South America. A patient had an 87.5% chance of being treated nonoperatively if certainty of PLC injury was < 57.5%, comminution was < 37.5% and the M1 modifier was not used. **Conclusion:** This study presents a predictive analytic algorithm to guide decision-making in the treatment of thoracolumbar burst fractures without neurological deficits. The model identified cut-off points. Notably, a certainty of PLC injury > 57.5% was highly predictive of receiving surgery (97.0%). With a degree of comminution > 37.5%, being treated in Europe or Asia was highly predictive of receiving surgery (74.2%), compared with North and South America (22.7%). This new knowledge will be key for the creation of a new scoring system and guidelines.

E-53
Abstract ID 36

A randomized trial of cervical orthosis versus no orthosis after multilevel posterior cervical fusion. ***Renan Rodrigues Fernandes*, *Patrick Thornley*, *Jennifer Urquhart*, *Sean Kelly*, *Nasser Alenezi*, *Abdulmajeed Alahmari*, *Fawaz Siddiqi*, *Supriya Singh*, *Parham Rasoulinejad*, *Christopher Bailey*. From the London Health Sciences Centre, London, Ont.**

Background: Postoperative immobilization with cervical orthosis (CO) is commonly used after posterior cervical fusion (PCF). The biomechanical advantage of modern instrumentation means that the additional stabilization from an external CO is no longer required. Therefore, the primary indication for CO is likely a reduction in postoperative pain. Potential disadvantages may include discomfort, functional limitation and costs. Given the lack of evidence, our study aimed to determine whether postoperative neck pain after multilevel PCF with CO is equivalent to multilevel PCF without CO. **Methods:** In a single-centre, prospective, randomized equivalence trial, patients requiring multilevel PCF extending no further than T2 were enrolled and randomly assigned to postoperative orthosis (collar) for 6 weeks or no orthosis (no-collar). Randomization was stratified based on 1) trauma versus degenerative indication, and 2) preoperative opioid use. The primary outcome measure was neck pain intensity during the first 4 weeks after surgery, using the numeric pain rating scale (NRS). The equivalence margin was set at δ = 2 points. Secondary outcomes included Neck Disability Index (NDI) score, 12-Item Short-Form Health Survey (SF-12) score, arm pain, range of motion (ROM), and comparison of procedural details and complications. A mixed longitudinal regression model for repeated measures was used to analyze the primary outcome, accounting for the correlation among the outcome score on the same patient at 2 days, 2 weeks and 4 weeks. **Results:** In total, 62 patients were enrolled in the study, 31 in each group. At baseline, the collar group had more neck pain

(5.3 v. 3.2, p = 0.013). Baseline characteristics and procedural details were similar. For primary outcome, the NRS pain score (± standard deviation) was 4.6 ± 0.3 for the collar group versus 4.9 ± 0.3 for the no-collar group. The 95% confidence interval (–1.4 to 0.2) was within the predetermined equivalence margin. No differences were found between groups for NDI or SF-12. The collar group had reduced ROM at 6 weeks, but no difference after 12 weeks. No differences in complications or adverse events were observed. **Conclusion:** Patients treated with or without CO maintain similar pain scores during the early postoperative period without increasing the risk for adverse events.

E-54
Abstract ID 11

Deterioration after surgery for degenerative cervical myelopathy: an observational study from the Canadian Spine Outcomes and Research Network. ***Nathan Evaniew*,[1] *Lukas D. Burger*,[1] *Nicolas Dea*,[2] *David W. Cadotte*,[1] *Greg McIntosh*,[3] *Bradley Jacobs*.[1] From the [1]Spine Program, University of Calgary, Calgary, Alta.; the [2]Combined Neurosurgical and Orthopedic Spine Program, University of British Columbia, Vancouver, B.C.; the [3]Canadian Spine Outcomes and Research Network, Markdale, Ont.**

Background: Postoperative neurological deterioration is one of the most undesirable complications that can occur after surgery for degenerative cervical myelopathy (DCM). Our primary objective was to investigate the incidence, etiology and outcomes of patients who experience this problem. **Methods:** We analyzed data from the Canadian Spine Outcomes and Research Network (CSORN) DCM prospective cohort study. We defined postoperative neurological deterioration as a decrease in modified Japanese Orthopaedic Association (mJOA) score by at least 1 point from baseline to 3 months after surgery. Adverse events were collected using the Spinal Adverse Events Severity System (SAVES) protocol with additional validation. Secondary outcomes included patient-reported pain, disability and health-related quality of life. **Results:** Among a study cohort of 428 patients, 50 (12%) deteriorated by at least 1 point on the mJOA after surgery for DCM (21 by 1 point, 15 by 2 points, and 14 by ≥ 3 points). Significant risk factors after adjusting for potential confounders included older age, female sex and milder preoperative disease. Among those who deteriorated, 13 (n = 428; 3%) experienced contributing intra- or postoperative adverse events, 6 (1%) had alternative non-DCM diagnoses and 31 (7%) did not have an identifiable etiology. Patients who deteriorated had significantly lower mJOA scores at 1 year after surgery (13.5 ± standard deviation 2.7 versus 15.2 ± 2.2; $p < 0.01$) and those with larger deteriorations were less likely to recover their mJOA to at least their preoperative baseline, but most secondary measures of pain, disability and health-related quality of life were unaffected. **Conclusion:** The incidence of mJOA deterioration after surgery for DCM was approximately 1 in 10, but many deteriorations were small, some were unrelated to actual spinal cord impairment, and most secondary outcomes were unaffected. These findings can inform patient and surgeon expectations during shared decision-making, and they demonstrate that interpretation of mJOA scores without clinical context can sometimes be misleading.

E-55
Abstract ID 66

Canadian cohort of older patients with cervical spinal cord injury: Do radiologic parameters correlate with initial neurological impairment? ***Loïc St-Laurent-Lebeux*, *Étienne Bourassa-Moreau*. From the Orthopedic Surgery Division, Université de Montréal, Montréal, Que.**

Background: The primary objective was to describe clinical and radiologic parameters of a population of older patients with traumatic cervical spinal cord injury (C-SCI) during the acute care trajectory. The secondary objective was to investigate the correlation between initial radiographic parameters and initial neurological impairment. **Methods:** A retrospective cohort study was performed over a period of 11 years in a quaternary spinal surgery centre. We included 128 patients older than 60 years who had sustained traumatic C-SCI and received surgical treatment. These patients were followed for 1 year after surgery. Twelve patients (9.4%) died within 1 year. Demographics and care trajectory (n = 128), preoperative American Spinal Cord Injury Association (ASIA) assessment (n = 124) and imaging studies (n = 112) were collected. **Results:** The mean age was 70.7 years and 82.0% were men. The most prevalent mechanism of injury was falling (78.1%) with a low energy pattern (70.3%). The mean Upper Extremity Motor Score (UEMS) at admission was 26, and 29 for lower extremities. At admission, 13.7% were graded A on the ASIA Impairment Scale (AIS), 8.9% B, 20.2% C and 57.3% D. Thirty percent were diagnosed with central cord syndrome. Forty-five patients (40.2%) presented with vertebral fractures, of whom 23 (20.6%) were unstable. Cerebrospinal fluid (CSF) effacement was present in 84.8% of patients. Level of maximal compression was mostly between C4–C5 (30.4%) and C5–C6 (30.4%). No correlation was observed between initial AIS grade and radiologic parameters, except for the presence of facets fractures or luxation (p = 0.009). No statistically significant correlation was observed between maximal spinal cord compromise (MSCC) and maximal canal compromise (MCC). Statistically significant correlations were observed between UEMS and number of levels with CSF effacement, MSCC, MCC, facets injury and midsagittal diameter of the spinal canal. **Conclusion:** To our knowledge, this is the first cohort study focusing on older C-SCI patients that acknowledges specific radiologic patterns in a population with ubiquitous degenerative changes. Although radiologic parameters poorly correlate with initial AIS grade, correlation was found with UEMS.

E-56
Abstract ID 6

Surgical complications or neurologic decline? A patient discrete-choice experiment for cervical myelopathy. ***Mohamed Sarraj*, *Meerab Majeed*, *Daipayan Guha*, *Markian Pahuta*. From the Orthopedic Surgery Division, McMaster University, Hamilton, Ont.**

Background: This study aimed to quantify and compare the relative importance of neurologic function, risk of future surgery and complications to patients with cervical stenosis. **Methods:** Patients with cervical stenosis presenting for surgical evaluation,

or patients who have had cervical decompression surgery, were recruited to participate. Demographic information — including modified Japanese Orthopaedic Association (mJOA) score, type of surgery and complications — were recorded and anonymized to the study ID. Patients then completed an online discrete-choice experiment survey. In a series of 10 questions, respondents chose between 2 hypothetical health states, defined in terms of 5 attributes, or "decision factors": upper extremity neurologic function, lower extremity neurologic function, risk of revision surgery, dysphagia and C5 palsy. Participants were asked to choose which "life" they preferred, and a regression model was used to quantify the importance of each decision factor. **Results:** Overall, 100 patients completed the survey. Of these, 55 had undergone surgery and 45 were either awaiting surgery or were not surgical candidates. Neurologic function was the factor with the greatest relative importance, and this was statistically significant. In all subgroups, lower extremity function was considered more important than upper extremity function. We also found that there was no statistically significant difference in the undesirability of neurologic decline and dysphagia. Differences in importance scores varied between patients who had undergone surgery and those who had not. The postoperative group considered revision surgery more important than a C5 palsy, while patients who had not had surgery valued the opposite. Additionally, when scaled to the least important attribute, patients who had not had surgery valued lower extremity function as 30 times more important than the least important attribute (revision surgery). In contrast, the surgical group only valued lower extremity function as 4 times more important than the least important attribute (C5 palsy). **Conclusion:** Although we found neurology to be the most important factor, it does not trump all other factors. Not all complications are equivalent, with dysphagia being as undesirable as neurologic deterioration. Additionally, the experience of surgery influences patients' values and preferences, and must be incorporated into the decision-making process.

E-57
Abstract ID 82

Laminectomy alone for cervical spondylotic myelopathy: a Canadian Spine Outcomes and Research Network Study. ***Mathieu Laflamme,[1] Greg McIntosh,[2] Nicolas Dea.[3]*** **From the [1]Centre hospitalier universitaire de Québec, Université Laval, Québec, Que.; the [2]Canadian Spine Outcomes and Research Network, Markdale, Ont.; the [3]Combined Neurosurgical and Orthopedic Spine Program, University of British Columbia, Vancouver, B.C.**

Background: Most posterior cervical decompression is supplemented by instrumentation and fusion in North America. However, laminectomy alone remains a common procedure globally. Our objectives were 1) to better define the cervical spondylotic myelopathy (CSM) population treated with a decompression alone in Canada, 2) to assess the outcomes of patients treated with decompression alone and 3) to compare these patients with a cohort of posterior decompression and fusion. **Methods:** The Canadian Spine Outcomes and Research Network (CSORN) is a multicentre national prospective registry. Patients with CSM who underwent laminectomy alone were identified. Clinical, surgical and radiologic data were extracted at baseline and postoperatively. The primary outcome was the Neck Disability Index (NDI) at 1 year postoperatively. Secondary outcomes were reoperation, the 36-Item Short-Form Health Survey (SF-36), postoperative cervical alignment, and neck and arm pain at 1 year. **Results:** From the 274 patients enrolled in the registry, 34 met inclusion criteria. The mean modified Japanese Orthopaedic Association (mJOA) score at baseline was 13.15 and the mean Cobb angle (C2–C7) was –7.70° (lordotic). These 2 baseline parameters were significantly different from the rest of the cohort (240 patients) who underwent posterior instrumentation with a mJOA of 11.82 and a Cobb angle of 2.57°. The number of levels involved (3.77 v. 2.06), the operative time (174 v. 102 min) and the estimated blood loss (330 v. 184 mL) were significantly higher in the instrumented group. At 12 months, there was no significant difference for NDI mean change between the laminectomy alone (–14.07) and the laminectomy with fusion (–11.90). There was no significant difference at 1 year in mJOA and SF-36. Multivariate analysis results are pending. **Conclusion:** In this population of patients who underwent posterior surgery for CSM in Canada, patients selected for a laminectomy alone had a better mJOA score and a greater lordotic alignment at baseline. Laminectomy alone involved fewer levels, shorter operative time and decreased blood loss. The improvement in mJOA and patient-reported outcomes was similar at 1 year postoperatively. In a carefully selected population, simple decompression is a good treatment alternative.

E-58
Abstract ID 95

The effect of surgical approach on patient outcomes of degenerative cervical myelopathy: a pooled analysis of individual patient data from 1031 cases. ***Alex B. Bak, Mohammed A. Alvi, Ali Moghaddamjou, Michael G. Fehlings.*** **From the Division of Neurosurgery, University of Toronto, Toronto, Ont.**

Background: Controversy exists regarding the optimal approach to surgically treat degenerative cervical myelopathy (DCM). Moreover, patients with mild DCM may be more sensitive to slight changes in physical function when treated using different surgical approaches. **Methods:** Individual data of patients who underwent surgery for DCM were identified from a pooled data set of the AO Spine North America Cervical Spondylotic Myelopathy Study (CSM-North America), CSM-International, and Efficacy of Riluzole in Surgical Treatment for Cervical Spondylotic Myelopathy (CSM-Protect) clinical studies. Primary outcomes were changes in 36-Item Short-Form Health Survey (SF-36) Physical Component Summary (PCS), minimal clinically important difference (MCID = 4) and modified Japanese Orthopedic Association (mJOA; MCID = 1) scores at 12 months. Two comparison cohorts were created: anterior and posterior surgery. One-stage mixed-effects meta-analysis was performed and reported with mean differences (MDs) and 95% confidence intervals (CIs). A subgroup analysis planned a priori in patients with mild DCM (mJOA 15–17) was performed. **Results:** From a total of 1047 patients with DCM, 979 met eligibility criteria, of whom 186 had mild disease. Patients who had anterior decompressive surgery did not experience greater improvements at 1 year of follow-up than those who underwent posterior decompressive surgery in SF-36 PCS score (adjusted MD 1.57, 95% CI

0.11 to 3.03; $p = 0.0348$); mJOA score (adjusted MD 0.24, 95% CI –0.09 to 0.57; $p = 0.1545$); Neck Disability Index (NDI) score (adjusted MD 3.32, 95% CI 0.58 to 6.05; $p = 0.0172$); or SF-36 mental component score (MCS; adjusted MD –0.27, 95% CI –2.13 to 1.60; $p = 0.7890$). In patients with mild DCM, those who underwent anterior decompressive surgery experienced greater improvements in SF-36 PCS score (adjusted MD 5.45, 95% CI 1.73 to 9.18; $p = 0.0042$) and mJOA score (adjusted MD 0.95, 95% CI 0.12 to 1.77; $p = 0.0238$; MCID = 1) than patients who underwent posterior surgery. Neck Disability Index score or SF-36 MCS scores were not significantly different. **Conclusion:** In general, anterior and posterior approaches for DCM result in similar gains in functional recovery or patient-reported physical functioning. However, in patients with mild DCM, when surgery is clinically indicated, anterior surgery is associated with clinically important benefits in functional recovery and patient-reported physical functioning when compared with posterior techniques.

E-59
Abstract ID 81

Occiput and upper cervical fusions: Does navigation matter? A Canadian Spine Outcomes and Research Network study.
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From the [1]Orthopaedic Surgery Division, Université de Sherbrooke, Sherbrooke, Que.; the [2]Canadian Spine Outcomes and Research Network, Markdale, Ont.; the [3]Neurosurgery Division, Université de Sherbrooke, Sherbrooke, Que.

Background: Intraoperative computed tomography navigation (IoCT) is useful to facilitate landmark identification for surgical spine instrumentation. Screw insertion in the upper cervical region (C0–C2) is often challenging, given the specific anatomy and biomechanical characteristics of the area. Although it is known that IoCT improves accuracy of screw placement, no study evaluates its perioperative clinical impact. We hypothesize that IoCT improves perioperative outcomes and revision rate. **Methods:** We conducted a retrospective, multicentre analysis of prospectively collected data on the Canadian Spine Outcomes and Research Network (CSORN) registry. We included patients with upper cervical pathology who underwent posterior instrumentation and fusion with or without IoCT guidance, between 2015 and 2021. We evaluated blood loss (BL), surgical time (ST), time to discharge (TD) and revision rate. A statistical analysis using χ^2, Student t and Fisher tests was conducted. **Results:** In total, 42 patients met the inclusion criteria. Of these, 15 (35.7%) were instrumented using IoCT and 27 (64.3%) using fluoroscopy or x-ray. Nineteen patients were fused to the occiput and 23 patients were fused solely from C1 to C2 or C3. No statistically significant differences in BL ($p < 0.642$), ST ($p < 0.723$) and TD ($p < 0.674$) were found between the navigated and non-navigated groups. Patients fused up to the occiput had longer ST ($p < 0.028$) and TD ($p < 0.017$) than patients in the nonocciput groups. There was 1 reoperation on the navigated group and 2 reoperations in the non-navigated group. **Conclusion:** Our results showed that the use of IoCT does not seem to influence perioperative outcomes compared with the use of classic intraoperative imaging modalities. The need to extend the fusion up to the occiput increases ST and TD without affecting BL. We found a similar revision rate at 1 year as in the literature in both the navigated and non-navigated groups. The very low revision rate in our cohort prevents us from stating categorically that IoCT could be related to mid- to long-term prevention of complications.

E-60
Abstract ID 89

Preoperative therapies improve postoperative disability in patients who undergo anterior cervical discectomy and fusion surgery for cervical radiculopathy.
Tyler Adams,[1,2] Erin Cunningham,[1,2] Dana El-Mughayyar,[1,2] Erin Bigney,[1,2] Amanda Vandewint,[2,3] Niel Manson,[2–4] Edward Abraham,[2–4] Chris Small,[2–4] Najmedden Attabib,[2–4] Eden Richardson,[2,4] Jeffery Hebert.[1]
From the [1]Faculty of Medicine, University of New Brunswick, Fredericton, N.B.; the [2]Canada East Spine Centre, Saint John, N.B.; the [3]Faculty of Medicine, Dalhousie University, Saint John, N.B.; the [4]Horizon Health Network, Saint John, N.B.

Background: We sought to estimate the effects of common preoperative therapies on postoperative trajectories of pain and disability after surgery for cervical radiculopathy. **Methods:** This was a multicentre, nationwide retrospective analysis of prospectively collected data. The study included patients enrolled in the Canadian Spine Outcomes and Research Network who underwent anterior cervical discectomy and fusion (ACDF) for radiculopathy. Preoperative therapies were anticonvulsant and opioid pain medications, spinal injections, physiotherapy and chiropractic treatment, and regular exercise. Study outcomes were neck and arm pain intensity and neck pain–related disability, measured preoperatively and 3, 12 and 24 months after surgery. Postoperative trajectories consistent with poor clinical outcomes were modelled with latent class growth analysis. The effects of preoperative therapies were estimated with robust Poisson models controlling for multiple sources of confounding. **Results:** We included data from 352 patients (43.8% female, mean [± standard deviation] age 50.9 ± 9.5 years). Depending on the outcome measure, 15.5%, 23.2% and 23.5% of patients experienced a poor postoperative outcome. Preoperative spinal injections (relative risk [RR] 0.46, 95% confidence interval [CI] 0.22–0.97), physiotherapy (RR 0.56, 95% CI 0.33–0.96), and regular exercise (RR 0.50, 95% CI 0.27– 0.90) reduced the risk of poor outcome for disability, but not neck or arm pain postoperatively. Other preoperative therapies had no effects on postoperative outcomes. Half of the patients in this study indicated that they did not exercise regularly (51%) and did not receive preoperative physiotherapy (50%). More than half of patients did not receive preoperative spinal injections (72%). **Conclusion:** Approximately 1 in 5 patients with cervical radiculopathy experienced a poor outcome after ACDF surgery. Preoperative spinal injections, physiotherapy and regular exercise reduced the risk of poor outcome for neck disability by 54%, 44% and 50%, respectively. Although the current study results and clinical guidelines support using nonoperative therapies for patients with radiculopathy, many patients did not receive these therapies before surgical intervention. Patients may improve their postoperative disability status by using these preoperative therapies.

F-61
Abstract ID 58

The influence of wait time on surgical outcomes in elective lumbar degenerative surgery: a Canadian Spine Outcomes and Research Network study. ***Michael Bond*[1] *John Street*[2] *Charles Fisher*[2] *Raphaele Charest-Morin*[2] *Jason M. Sutherland*[1] From the [1]Centre for Health Services and Policy Research, University of British Columbia, Vancouver, B.C.; the [2]Combined Neurosurgical and Orthopaedic Spine Program, Vancouver General Hospital, Vancouver, B.C.**

Background: Wait times for surgical management of lumbar degenerative conditions constitute a significant policy issue, and the impact of delayed access on outcomes remains unclear. Current research has focused on surgical wait-list time as opposed to the cumulative wait time (CWT) from initial referral to surgical management. The goal of this study was to evaluate the association between CWT and outcomes for elective lumbar degenerative pathology. **Methods:** This study is based on a retrospective analysis of participants from the Canadian Spine Outcomes and Research Network database who presented with degenerative lumbar conditions between 2015 and 2020. Wait times were calculated based on initial referral dates, surgical booking and date of surgical procedure. Demographic, clinical and patient-reported outcome data were summarized with simple summary statistics. Cumulative wait time was dichotomized at 6 months. Unadjusted and adjusted odds ratios (ORs) were calculated for patients who met the minimal clinically important difference (MCID) for the Oswestry Disability Index (ODI) at 12 months postoperatively, using logistic regression. Statistical significance was set at $p < 0.05$. **Results:** A total of 2754 participants were included; 1346 (48.0%) were female and average age was 57.5 years (± standard deviation 15.1). The median CWT was 226 days (interquartile range [IQR] 116–407) and 1156 (41.9%) patients had surgical intervention by 6 months. On average, there was improvement in ODI scores between baseline and 12-month follow-up (46.2 v. 24.7; $p < 0.001$). Patients who waited more than 6 months for surgery had worse postoperative ODI scores than those who waited less than 6 months (48.3 v. 44.6, $p < 0.05$). Patients were more likely to meet the MCID (> 12.8 improvement) for ODI if they had surgery within 6 months (unadjusted OR 1.5, 95% confidence interval [CI] 1.23–1.80; adjusted OR 1.32, 95% CI 1.10–1.60; $p < 0.05$). **Conclusion:** Patients who waited less than 6 months for surgery were more likely to meet the MCID for improvement in disability after adjustment for clinical and demographic variables. Interventions should be targeted to reduce wait times to improve patient outcomes of spine surgery.

F-62
Abstract ID 77

A cost consequence analysis comparing spinal fusion versus decompression alone for lumbar degenerative spondylolisthesis. ***Troy Hillier*[1] *Chris S. Bailey*[2] *Charles Fisher*[3] *Raja Rampersaud*[4] *Prosper Koto*[5] *R. Andrew Glennie*[6] From the [1]Faculty of Medicine, Dalhousie University, Halifax, N.S.; the [2]Orthopaedic Surgery Division, Western University, London, Ont.; the [3]Combined Neurosurgical and Orthopedic Spine Program, University of British Columbia, Vancouver, B.C.; the [4]Orthopaedic Surgery Division, University of Toronto, Toronto, Ont.; [5]Nova Scotia Health, Halifax, N.S.; the [6]Orthopaedic Surgery Division, Dalhousie University, Halifax, N.S.**

Background: The utility of spinal fusion in the treatment of degenerative spondylolisthesis has been questioned in recent trials and systematic reviews. Formal cost analyses comparing each treatment are lacking. A guide was developed to encourage surgeons to more selectively offer fusion to patients with more unstable spondylolisthesis. The purpose of the current project is to assess whether the current surgical treatment strategies of spondylolisthesis at participating academic centres in Canada are cost-effective. **Methods:** A cost consequence analysis using prospective, multicentred, observational cohort data was performed from a societal perspective. Cost-effectiveness of fusion was assessed by comparing the outcomes and costs associated within the cost-effectiveness plane at 1 year. Institutional costs were estimated from case-costing data from the site with greatest enrolment. Out-of-pocket expenses were estimated from case-costing diaries. Oswestry Disability Index (ODI), quality-adjusted life-years (QALYs) from the EuroQol EQ-5D-5L questionnaire, and the 12-Item Short-Form Health Survey (SF-12) index were the health outcomes. The potential effect of confounding variables on outcomes were controlled for using different techniques that included augmented inverse probability of treatment weighting (AIPW) and inverse probability of treatment weighting (IPTW). **Results:** There were 285 patients with full-cost data, with 68 (24%) undergoing decompression alone. Fusion ($12 227) was costly compared with decompression ($5651), with an adjusted cost difference of $6569 (95% CI $6242–$6896). There were no statistically significant differences in ODI, SF-12 and QALYs in either the unadjusted or the adjusted models. Both the incremental cost and QALYs are in the upper left quadrant of the cost-effectiveness plane; hence, fusion is a dominated strategy, with zero probability of being cost-effective at a willingness-to-pay threshold of $50 000. **Conclusion:** The current study demonstrates that the surgical strategy for treatment of degenerative spondylolisthesis at participating academic centres is not cost-effective. Higher fusion rates have continued despite limited agreement that it should be offered more selectively. This implies that either the surgical guide is ineffective at selecting patients for fusion, or that it is not being followed.

F-63
Abstract ID 96

Economic impact of wait time in degenerative lumbar stenosis surgery: association with time away from work, chronic persistent opioid use and patient satisfaction. ***Alex Soroceanu, Fred Nicholls, Ken Thomas, Nathan Evaniew, Peter Lewkonia, Jacques Bouchard, Brad Jacobs.* From the Department of Orthopaedic Surgery and Clinical Neurosciences, University of Calgary, Calgary, Alta.**

Background: Surgical wait times for elective surgery can be excessive in the single-payer Canadian system. We aimed to assess the economic impact of wait time for patients undergoing surgical intervention for lumbar stenosis and degenerative spondylolisthesis in the Canadian health care system. **Methods:** The

Canadian Spine Outcomes and Research Network (CSORN) prospective spine registry was used. Patients with a principal pathology of lumbar stenosis or degenerative spondylolisthesis, who underwent decompression with or without fusion and completed 1-year follow-up, were included. Patients with no reported date of referral were excluded. Wait time was defined as the time frame from referral to surgery, and categorized as < 6 months, 6 months to 1 year, 1–2 years, and > 2 years. Baseline demographics and surgical factors were compared using 1-way analysis of variance (ANOVA) or χ^2 tests. The impact of wait time on satisfaction, time away from work, chronic opioid use, and health-related quality of life (HRQoL) was analyzed using linear or logistic regression, accounting for confounders. **Results:** A total of 2237 patients met inclusion criteria. The average wait time was 451.75 days (< 6 mo: n = 767; 6–12 mo: n = 794; 1–2 yr: n = 756; > 2 yr: n = 444). There was no difference between groups with regard to baseline age, body mass index (BMI), smoking status, and surgical invasiveness ($p < 0.05$). The groups were different in terms of American Society of Anesthesiologists (ASA) classification (p = 0.005), sex (p = 0.004) and previous spine surgery (0.001); these differences were accounted for through multivariate analysis. Longer wait times were associated with increased time away from work (< 6 mo and > 2 yr 339.3 days' difference; p = 0.03), and with more frequent use of spinal injections (p = 0.02). Patients with longer wait times were more likely to experience chronic postoperative opioid use 1 year after surgery, despite similar preoperative use and similar complications (1–2 yr wait, odds ratio [OR] 1.27; > 2 yr wait, OR 1.61; p = 0.002). One year after surgery, longer wait times were also linked to decreased patient satisfaction (> 2 yr wait, OR 0.69; p = 0.03), and less improvement on HRQoL scores ($p < 0.001$ 12-Item Short-Form Health Survey, Oswestry Disability Index, Visual Analogue Scale). **Conclusion:** One in 5 patients waited longer than 2 years for access to elective lumbar surgery. Longer wait times were associated with increased time away from work, worse postoperative satisfaction and higher persistent opioid use.

F-64
Abstract ID 121

Optimal timing of surgery for symptomatic single-level lumbar disc herniation: a cost-effectiveness analysis. ***David Ben-Israel,[1] Eric J. Crawford,[2] Charles Fisher,[3] Nicolas Dea,[3] Eldon Spackman,[1] Raja Rampersaud,[2] Kenneth C. Thomas.[1]***
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Background: The most common management for radiculopathy associated with lumbar disc herniation (LDH) involves a trial of nonoperative management. This may include physical therapy, pharmacotherapy, interventional therapy and multiple care provider visits, including the emergency department, all of which contribute to increasing health care costs. However, as microdiscectomy has evolved to be less resource intensive, it is no longer clear whether nonoperative management is in the best interest of the patient or the health care system. The goal of this study was to determine, through decision analytic modelling, the optimal timing of surgical intervention for adults with a symptomatic single-level LDH, maximizing patient quality of life while making appropriate use of scarce health care resources. **Methods:** A probabilistic Markov model was constructed from the health care payer perspective, using 1-week cycle lengths for 520 total cycles (10 yr). Health care utilization and quality-of-life estimates during nonoperative treatment were calculated using data from the Interprofessional Spine Assessment and Education Clinics database. The timing of symptom resolution was estimated through meta-analysis, using all data available from previously published scientific literature. Clinical and quality-of-life outcomes for operative patients were calculated using the Canadian Spine Outcomes and Research Network database, with microcosting data provided by the Alberta provincial health service financial department. All costs were represented in 2021 CAD and all costs and quality-adjusted life-years (QALYs) were discounted at 3%. **Results:** The optimal timing for surgical intervention was found to be 10 weeks from symptom onset when using a threshold of $50 000 per QALY. Compared with performing surgery at 48 weeks, providing surgery at 10 weeks represented the dominant strategy, with an incremental cost-effectiveness ratio (ICER) of –$109.27 per QALY. Optimal surgical timing provided a net monetary benefit of $3590 (credible interval [CrI] 2823) and $6664 (CrI 3793) per patient, when considering the health care payer and societal perspectives, respectively. **Conclusion:** To provide optimal patient care while maintaining health care cost-effectiveness, patients with symptomatic single-level LDH should trial nonoperative management for 10 weeks before surgical intervention.

F-65
Abstract ID 67

Impact of scheduled spine surgery for degenerative spinal disorders on patient health-related quality of life compared with the general Canadian population. ***Nisabaran Srikandarajah,[1] Jean-Christophe Murray,[2] Christopher Nielsen,[1] Ragavan Manoharan,[1] Ahmed Cherry,[1] Aditiya Raj,[1] Mark Xu,[1] Carlo Iorio,[1] Chris Bailey,[3,4] Nicolas Dea,[4,5] Charles Fisher,[4,5] Hamilton Hall,[4,6] Neil Manson,[7,10] Kenneth Thomas,[4,8] Mayilee Canizares,[4,9] Yoga Raja Rampersaud.[1,4]***
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Background: The national impact of spinal disorders and spine surgery on health-related quality of life (HRQoL) has not been well characterized. Our objective was to compare baseline and 1-year HRQoL from the Canadian Spine Outcomes and Research Network (CSORN) registry to their age–sex matched estimations in the general population. **Methods:** A retrospective

review of patients on the CSORN registry with degenerative cervical or thoracolumbar pathology was performed. The outcomes were baseline and 1-year physical component (PCS) and mental component summary (MCS) scores from the 12-Item Short-Form Health Survey (SF-12). Age–sex specific means and standard deviation (SD) for PCS and MCS, baseline and 1 year after surgery, were calculated for the cohort and compared with their corresponding values from the Canadian general population (CGP). **Results:** In total, 5495 patients were analyzed. Baseline mean PCS was 50.5 ± 9 overall for the CGP, decreasing with each decade of age. Across all pathoanatomical diagnoses and chief clinical complaints, the mean PCS was 29.4 at baseline and 40.2 at 12 months postoperative in the CSORN group. Physical component summary improvement was greatest for lumbar disc herniation and radiculopathy (13.3 and 12) and least for cervical stenosis and myelopathy (6.7 and 6.1). The MCS for all diagnoses and chief complaints also substantially improved at 1 year; however, both baseline and 1-year scores were within 1 SD of the CGP values. **Conclusion:** In a surgical cohort, compared with the CGP, degenerative spinal disorders are associated with a dramatic reduction of HRQoL across all age and sex groups regardless of diagnosis or clinical presentation. In a representative national surgical cohort, spine intervention was impactful in restoring HRQoL to within 1 SD of the age–sex match CGP across all common degenerative diagnosis and symptom presentations. The relatively normative MCS scores of our entire surgical cohort reflect appropriate patient selection as it pertains to the negative surgical prognostic implication of poor mental health.

F-66
Abstract ID 84

Decompression and decompression and fusion and the influence of spinopelvic alignment in the outcome of patients with degenerative lumbar spondylolisthesis. ***Jennifer Urquhart,[1] Renan R. Fernandes,[1] R. Andrew Glennie,[2] Y. Raja Rampersaud,[3] Charles G. Fisher,[4] Chris Bailey.[1]*** **From the [1]London Health Sciences Centre Combined Neurosurgical and Orthopaedic Spine Program, Schulich School of Medicine, Western University, London, Ont.; the [2]Departments of Orthopedics and Neurosurgery, Dalhousie University, Halifax, N.S.; the [3]Department of Surgery, University of Toronto, Toronto, Ont.; the [4]Department of Surgery, University of British Columbia, Vancouver, B.C.**

Background: Preoperative spinopelvic alignment correlates with postoperative outcomes but is not routinely considered in the decision to fuse. A recent study reported that patients with pelvic incidence and lumbar lordosis difference (PI-LL) < 10° benefit more from decompression alone (DA), whereas patients with PI-LL > 10° benefit more from decompression and fusion (DF). This study aimed to confirm whether patient-reported outcome measures (PROMs) are affected by spinopelvic alignment in relation to surgical treatment. **Methods:** This is a retrospective study of patients enrolled in the Canadian Spine Outcomes and Research Network multicentre prospective study on the assessment and management of degenerative lumbar spondylolisthesis who underwent DA or DF between 2015 and 2021 for a single-level spondylolisthesis. Patients were stratified by surgery type and spinopelvic alignment (PI-LL < 10° or PI-LL ≥10°). PROMs were collected at 3 months, 1 year and 2 years after surgery and compared between alignment groups, using mixed-effects models accounting for baseline score, and age, gender, mental health and disability in an adjusted analysis. **Results:** In the PI-LL < 10° cohort, 60 patients had DA and 146 patients had DF. In the PI-LL ≥ 10° cohort, 58 patients had DA and 168 had DF. The majority had grade I spondylolisthesis. Operating time, blood loss and hospital stay was greatest in the patients who had a fusion. In the PI-LL < 10° cohort, demographics were similar between the DA and DF groups. Although patients in the fusion group had worse preoperative PROMs, postoperative PROMs were not different from those of patients who had DA. In the PI-LL ≥ 10° cohort, patients in the DF group were younger than those who had DA (66 v. 71 yr). Patients with DF had less leg pain at 1 year after surgery in adjusted analyses (3.4 v. 2.4; $p = 0.031$). **Conclusion:** In patients who have spinopelvic alignment (PI-LL < 10°), DF was not superior to DA with regard to PROMs to 2 years after surgery. In patients who had malalignment (PI-LL > 10°), fusion offered a better reduction in leg pain at 1 year after surgery.

F-67
Abstract ID 43

Association between poor postoperative pain control and surgical outcomes after elective spine surgery. ***Michael M.H. Yang,[1,2] Rena Far,[1] Tolulope Sajobi,[1] Jay Riva-Cambrin,[1] Steven Casha.[1]*** **From the [1]Department of Clinical Neurosciences, University of Calgary, Calgary, Alta.; the [2]O'Brien Institute of Public Health, Calgary, Alta.**

Background: Inadequate pain control after spine surgery is common and is associated with adverse outcomes. The impact of poor postoperative pain control on surgical outcomes has not been studied. Accordingly, the aim of this study was to investigate the association between poor postoperative pain control and surgical outcomes. **Methods:** Consecutive adult patients (aged ≥ 18 yr) undergoing elective cervical or thoracolumbar spine surgery were enrolled. Poor surgical outcome was defined as failure to achieve a minimal clinically important difference (MCID) of 30% improvement on the Oswestry Disability Index (ODI) or Neck Disability Index (NDI) at follow-up (3 mo, 1 yr and 2 yr). Poor pain control was defined as a mean numeric rating scale score higher than 4 during the first 24 hours after surgery. Univariable analyses, followed by a multivariable random effects model, were used to investigate the relationship between poor pain control and poor surgical outcome after adjusting for known risk factors that affect postoperative ODI and NDI. Age, sex and follow-up time were forced into the multivariable model. Secondarily, the Calgary Postoperative Pain After Spine Surgery (CAPPS) score was investigated for its ability to predict poor surgical outcome. **Results:** Overall, 42.8% of 1305 patients failed to achieve a minimal clinically important difference (MCID) at follow-up. The incidence of poor postoperative pain control after surgery was 56.9%. Multivariable analysis showed that poor pain control after spine surgery was independently associated with failure to achieve MCID (odds ratio [OR] 2.15, 95% confidence interval [CI] 1.42–3.25; $p < 0.001$) after adjusting for age ($p = 0.15$), sex ($p = 0.59$), Patient Health Questionnaire-9 (PHQ-9) depression

score (p = 0.030), American Society of Anesthesiologists (ASA) physical status > 2 (p < 0.001), ≥ 3 motion segment surgery (p = 0.003), revision surgery (p = 0.032), and follow-up time (p < 0.001). Notably, daily use of preoperative opioid medications was not associated with failure to achieve MCID. The CAPPS score was also found to be an independent risk factor for poor surgical outcome (OR 1.15, 95% CI 1.014–3.31; p = 0.03). **Conclusion:** Poor pain control 24 hours after elective spine surgery was an independent risk factor for poor surgical outcome. Perioperative treatment strategies to improve postoperative pain control may lead to improved surgical outcomes.

F-68
Abstract ID 56

Factors associated with shorter wait times for lumbar degenerative spinal surgery. ***Michael Bond*[1], *John Street*[2], *Charles Fisher*[2], *Raphaele Charest-Morin*[2], *Jason M. Sutherland*[1]** **The [1]Centre for Health Services and Policy Research, University of British Columbia, Vancouver, B.C.; the [2]Combined Neurosurgical and Orthopaedic Spine Program, Vancouver General Hospital, Vancouver, B.C.**

Background: Lumbar spine pathology (LSP) is a leading cause of pain and disability in adults. In Canada, there is a significant wait period associated with referral for surgical treatment. The goal of this study was to identify demographic and clinical factors that are associated with shorter wait times for surgical management of LSP. **Methods:** A retrospective analysis of participants from the Canadian Spine Outcomes and Research Network was conducted. Participants were included if they were adults (aged > 18 yr) and presented with LSP between 2014 and 2019. Baseline demographic, clinical and outcome variables were evaluated for all participants. Cumulative wait times (CWT) were calculated from initial primary care referral to surgical date. Cumulative wait time was compared between degenerative diagnoses, and surgical procedure type (fusion v. decompression) using a Kaplan–Meier survivor function. Factors associated with prolonged CWTs were identified with a Cox regression multivariable model. **Results:** A total of 4154 patients were included; 1801 (46.9%) were female and the average age was 57.9 years (± standard deviation 14.9). The median CWT was 228 days (interquartile range [IQR] 117–409). Participants with a diagnosis of disc herniation had the shortest CWT for surgery, compared with spinal stenosis, spondylolisthesis and degenerative disc disease (median 131 days, IQR 65–244; p < 0.001). Those who were treated with decompression without fusion had shorter CWT compared with fusion (median 178, IQR 97–307, v. median 233, IQR 122–387; p < 0.001). Factors associated with shorter CWT in multivariable analysis included a diagnosis of disc herniation (hazard ratio [HR] 1.42, 95% CI 1.27–1.59), decompression without fusion (HR 1.15, 95% CI 1.10–1.25), nonsmokers (HR 1.12, 95% CI 1.01–1.25), > high school education (1.11, 95% CI 1.03–1.20) and those with higher baseline Oswestry Disability Index score (HR 1.01, 95% CI 1.00–1.02). **Conclusion:** Several factors were identified that are associated with shorter CWT for spine surgical management. This study highlights the barriers to receiving timely care in spine surgery for LSP.

F-69
Abstract ID 25

Is navigation a game changer in single-level transforaminal lumbar interbody fusions? ***Yan Silva*, *Newton Godoy Pimenta*, *Bernard LaRue*, *Sonia Bedard*, *Sonia Cheng Oviedo*, *Julien Goulet*, *Jerome Couture*, *Jocelyn Blanchard*.** **From the Neurosurgery Division, Université de Sherbrooke, Sherbrooke, Que.**

Background: Intraoperative computed tomography navigation (IoCT) is used to facilitate the insertion of pedicle screws, with better accuracy. However, to our knowledge, no study has investigated medium-term clinical and intraoperative outcomes of navigation during single-level transforaminal lumbar interbody fusions (SL-TLIF). Our objective was to evaluate the role of IoCT in SL-TLIF and to identify the differences between fluoroscopy and IoCT for the variables of operative time and hospitalization, blood loss, and the number of surgical revisions up to 6 months postoperatively. **Methods:** We conducted a retrospective single-centre case–control study of SL-TLIF performed at Centre integré universitaire de santé et de services sociaux de l'Estrie–Centre hospitalier universitaire de Sherbrooke (CIUSSS de l'Estrie-CHUS). We included patients who had surgery between 2016 and 2020, either fluoroscopy guided (FG) or navigation guided (OG). We excluded traumatic, tumour, infectious, minimally invasive surgery, anterior and lateral cases, other than lumbar fusions, and all surgeries performed at more than 1 level. Demographic, clinical and surgical data were collected. χ^2, Fisher and Student t tests were used for statistical analysis. **Results:** In total, 176 patients were enrolled, of whom 54 (30.68%) were in the OG group and 122 (69.32%) in the FG group. A statistically significant difference in operating time (odds ratio) was reported (OG 185.93 v. FG 163.24; p = 0.003), with a mean operative time of 170 minutes. The revision rate was also statistically significant, with 8 revisions of surgery in the FG group and none in the OG group (6.6% of FG patients; p = 0.050). No statistically significant differences were found for blood loss (OG 270.83 mL v. 277.28 mL; p = 0.827) and length of hospital stay (days) (mean 4.55, 4.31 for OG v. 4.65 for FG). **Conclusion:** Despite increased operating time, O-Arm navigation does not imply an increase in blood loss or a longer hospital stay. We observed a lower rate of reoperation in the first 6 months postoperatively. The use of IoCT navigation is effective and might help to reduce revisions, even when used during SL-TLIF.

F-70
Abstract ID 34

Radiologic and clinical evaluation of posterolateral versus interbody fusion in degenerative lumbar spondylolisthesis. ***James McDonald*[1], *Fares Al-Jahdali*[2], *Jennifer Urquhart*[3], *Abdulmajeed Alahmari*[4], *Raja Rampersaud*[5], *Charles Fisher*[6], *Chris Bailey*[4], *Andrew Glennie*.[7]** **From the [1]Division of Orthopaedics, Department of Surgery, Memorial University of Newfoundland, St. John's, N.L.; the [2]Division of Orthopedics, Dalhousie University, Halifax, N.S.; the [3]Lawson Health Research Institute, London, Ont.; the [4]Division of Orthopaedics, Department of Surgery, Western University, London, Ont.; the**

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Background: The primary objective was to compare foraminal height (FH) and disc height (DH) differences in posterolateral (PLF) transforaminal interbody fusions (TLIF) and, secondarily, correlate these measurements with patient-reported outcomes (PROs). **Methods:** A retrospective review of a subset of patients from a prospective cohort from the Canadian Spine Outcomes and Research Network was undertaken. Radiographic assessment preoperatively and at 3 months and 1 year were completed, with standing lumbar spine radiographs. Foraminal height was measured from the inferior to the superior edge of the pedicle on the operated level and average DH was calculated from anterior and posterior disc measurements. Differences in FH/DH between groups were compared using linear mixed-effect models with adjustment for age, body mass index (BMI) and Patient Health Questionnaire-9 (PHQ-9) score at baseline, while correlations with PROs were assessed with Pearson correlation coefficient. **Results:** In total, 109 patients were included (23 PLF and 86 TLIF). At 3-month follow-up, the change in FH was greater in the TLIF group than in the PLF group (mean difference 2.3 mm, 95% confidence interval [CI] 0.8–3.5; $p = 0.002$). The change in FH remained significantly different at 12 months (mean difference 1.6 mm, 95% CI 0.2–3.0; $p = 0.028$). The change in DH was greater in the TLIF group, with a mean difference between groups of 4.1 mm (95% CI 2.5–5.7; $p < 0.001$) and 3.6 mm (95% CI 2.0–5.3; $p < 0.001$) at the same time points. A positive change in FH correlated with less back pain, less disability and improved physical function in the TLIF group ($p < 0.05$). There were no correlations between PROs and FH in the PLF group. **Conclusion:** Patients treated with PLF lost FH, although there was no effect on PROs at both follow-up points. Although patients in the TLIF group initially gained FH at 3 months, this decreased to baseline at 1 year, indicating cage subsidence with time. An increase in FH at 1 year was associated with improved function and less back pain in the TLIF group.

G-71
Abstract ID 15

Timing of recovery after surgery for patients with degenerative cervical myelopathy: an observational study from the Canadian Spine Outcomes and Research Network. ***Nathan Evaniew,[1] Matthew Coyle,[1] Y. Raja Rampersaud,[2] Christopher S. Bailey,[3] W. Bradley Jacobs,[1] David W. Cadotte,[1] Kenneth C. Thomas,[1] Najmedden Attabib,[4] Jérôme Paquet,[5] Andrew Nataraj,[6] Sean D. Christie,[7] Michael H. Weber,[8] Philippe Phan,[9] Raphaële Charest-Morin,[10] Charles G. Fisher,[10] Hamilton Hall,[2] Greg McIntosh,[11] Nicolas Dea.[10]***
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Background: The time course over which postoperative neurological recovery occurs after surgery for degenerative cervical myelopathy (DCM) is poorly understood. Our primary objective was to determine the time point at which patients experience significant neurological improvement. **Methods:** We reviewed data from an ongoing prospective multicentre cohort study. We measured neurological function at 3 months, 1 year and 2 years after surgery, using the modified Japanese Orthopaedic Association scale (mJOA) scale. We implemented minimal clinically important differences (MCIDs) to guide interpretation of mJOA scores, and we used 1-way analysis of variance to compare changes between follow-up intervals. **Results:** Among 330 patients, mean overall mJOA improved from 12.9 (± standard deviation 2.6) to 14.6 ± 2.4 at 3 months, 14.7 ± 2.4 at 1 year, and 14.8 ± 2.5 at 2 years. The difference in means was statistically significant ($p < 0.01$) at the interval from baseline to 3 months postoperatively, but not from 3 months to 1 year, or 1 year to 2 years. The MCID was reached by 161 patients at 3 months, 32 more at 1 year, and 15 more at 2 years, with a statistically significant difference only at 3 months. Patients with moderate or severe disease reached the MCID more frequently than those with mild disease. **Conclusion:** Among patients who underwent surgery for DCM, most significant neurological improvement occurred by 3 months after surgery. These findings will facilitate valid discussions about postoperative expectations during shared clinical decision-making between patients and their surgeons.

G-72
Abstract ID 30

Development of a patient-centred cervical myelopathy severity index: measurement property testing, item generation and item reduction. ***Armaan K. Malhotra,[1,2] Aileen M. Davis,[2] Yingshi He,[1] Erin M. Harrington,[1] Blessing N.R. Jaja,[1] Mary P. Zhu,[1] Husain Shakil,[1,2] Nicolas Dea,[3] W. Bradley Jacobs,[4] David W. Cadotte,[4] Jérôme Paquet,[5] Michael H. Weber,[6] Philippe Phan,[7] Sean D. Christie,[8] Andrew Nataraj,[9] Christopher S. Bailey,[10] Michael G. Johnson,[11] Charles G. Fisher,[3] Neil Manson,[12] Y. Raja Rampersaud,[13] Kenneth C. Thomas,[4] Hamilton Hall,[14] Michael G. Fehlings,[13] Henry Ahn,[15] Howard J. Ginsberg,[1] Christopher D. Witiw,[1,2] Jefferson R. Wilson.[12]***
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Background: Existing severity scales for degenerative cervical myelopathy (DCM) are limited by arbitrary response item hierarchy, poor reliability and inadequate sensitivity to change, creating a strong impetus for development of a practical measurement tool with improved psychometric properties. To this end, we sought to create a new patient-reported outcome measure known as the Cervical Myelopathy Severity Index (CMSI). **Methods:** Phase 1: Item generation was performed using semistructured patient focus groups to gauge the relative importance of symptoms and functional limitations. Based on these interviews, a preliminary questionnaire was generated. Phase 2: Item reduction was performed in a prospective fashion with patients enrolled into 3 categories: 1) an observation group (patients with mild DCM not requiring surgery), 2) a preoperative group and 3) a postoperative group. Respondents completed the questionnaire at baseline and at 2 weeks. Response items were collated within subgroups and the total cohort for item severity and item importance. A survey of spine surgeons was also performed, to assess surgeons' perception of item importance. Final item reduction was based on clinician item importance scores in addition to patient importance and disease severity scores. Additionally, measurement properties of inter-item reliability and inter-item Spearman rank correlation coefficient were used for item reduction, based on criteria defined a priori. **Results:** In phase 1, 42 items were generated, based on focus group interviews involving 22 patients. We performed thematic analysis of semistructured interviews of patients with DCM, with emphasis on domains of functional impairment and symptoms. In phase 2, 98 patients and 51 surgeons participated in item reduction by ranking relative importance and disease severity. After application of median importance and severity thresholds and weighted κ cut-offs (> 0.60), 23 items remained. Once highly correlated (> 0.80) items had been eliminated, the final CMSI questionnaire list included 14 items from 7 domains of cervical myelopathy symptoms and functional impairments. **Conclusion:** We performed a patient-centred, specialist-informed item generation, reduction and measurement property evaluation for the CMSI, a new DCM measurement tool. Future efforts will validate this tool in a multicentre prospective fashion.

G-73
Abstract ID 75

The preoperative expectations of patients with degenerative cervical myelopathy. ***Alwalaa Althagafi,[1] Greg McIntosh,[2] Raphaële Charest-Morin.[1]*** **The [1]Combined Neurosurgical and Orthopedic Spine Program, Department of Orthopaedic Surgery, University of British Columbia, Vancouver, B.C.; the [2]Canadian Spine Outcomes and Research Network, Markdale, Ont.**

Background: Despite the abundance of literature on degenerative cervical myelopathy (DCM), very little is known about the preoperative expectations of patients with DCM undergoing surgical treatment. Our primary objective was to describe patient preoperative expectations and rank their importance to patients. The secondary objective was to identify predictors of high preoperative expectations. **Methods:** This was a retrospective observational cohort study of prospectively collected multicentre data of patients with DCM. Patients who consented to undergo surgical treatment between 2019 and 2022 were included. An overall expectations score (0–100) was calculated by the sum of each expectation. The high-expectations group was defined as patients who had an expectation score above the 75th percentile. Predictors of patients with high expectations were determined using a multivariate logistic regression model. **Results:** In total, 262 patients met our inclusion criteria. The most common important expectation was preventing neurological worsening (40.8%), followed by improved balance when standing or walking (14.5%) and independence in everyday activities (10.3%). The mean overall expectation score was 63.05 (± standard deviation 20.86). Identified predictors of high patient expectations were having fewer comorbidities, a shorter duration of symptoms, no contribution from "failure of other treatments" on the decision to undergo surgery, and more severe neck pain. Each additional comorbidity decreased the odds of having high expectations by 30%. For each 1-point increase in numeric rating scale neck pain rating, the odds of having high expectations increased by almost 20%. Patients who did not indicate failure of other treatments as the reason to seek surgery had close to 1.5 times the odds of having high expectations. Patients who had symptom duration of more than 2 years were less likely to have high expectations (odds ratio 0.922, 95% confidence interval 0.349–1.1880). **Conclusion:** Our findings highlight the need for further understanding of patients' preoperative expectations and studying their effect on postoperative satisfaction to enhance patient-centred care in the future.

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Abstract ID 61

Satisfaction with surgical treatment for degenerative cervical myelopathy is driven by improvement in patient-reported outcomes. ***Michael A. Rizzuto,[1] Tamir Ailon,[1] Nicolas Dea,[1] Nathan Evaniew,[2] Bradley W. Jacobs,[3] Jerome Paquet,[4] Raja Rampersaud,[5] Hamilton Hall,[6] Christopher S. Bailey,[7] Michael Weber,[8] Michael G. Johnson,[9] Andrew Nataraj,[10] Najmedden Attabib,[11] David W. Cadotte,[3] Neil Manson,[12] Alexandra Stratton,[13] Sean D. Christie,[14] Kenneth***

C. Thomas,[5] Jefferson R. Wilson,[6] Charles G. Fisher,[1] Raphaele Charest-Morin.[1] **The [1]Combined Neurosurgical and Orthopedic Spine Program, Department of Orthopedic Surgery, University of British Columbia, Vancouver, B.C.; the [2]Canadian Spine Outcomes and Research Network, Markdale, Ont.; the [3]Combined Neurosurgical and Orthopedic Spine Program, University of Calgary, Calgary, Alta.; the [4]Centre de recherche du Centre hospitalier universitaire (CHU) de Québec, CHU de Québec-Université Laval, Québec, Que.; the [5]Divisions of Orthopaedics and Neurosurgery, University of Toronto, Toronto, Ont.; the [6]Department of Surgery, University of Toronto, Toronto, Ont.; the [7]Department of Orthopedic Surgery, London Health Sciences Centre, Western University, London, Ont.; the [8]Department of Orthopedic Surgery, McGill University Health Centre, Montréal, Que.; the [9]Department of Surgery, Section of Orthopedics and Neurosurgery, University of Manitoba, Winnipeg, Man.; the [10]Division of Neurosurgery, Department of Surgery, University of Alberta Hospital, Edmonton, Alta.; the [11]Canada East Spine Centre, Division of Neurosurgery, Zone 2, Horizon Health Network, Saint John, N.B.; the [12]Canada East Spine Centre, Saint John Orthopedics, Dalhousie Medicine New Brunswick, Saint John Campus, Saint John, N.B.; the [13]Department of Orthopedic Surgery, The Ottawa Hospital, Ottawa, Ont.; the [14]Division of Neurosurgery, Dalhousie University, Halifax, N.S.**

Background: Degenerative cervical myelopathy (DCM) is the leading cause of spinal cord dysfunction in adults, and evidence supports the safety and efficacy of surgical treatment. Although the impact of surgery for DCM on patient-reported outcomes (PROs) is well known, the effect on patient satisfaction has not been thoroughly evaluated. Our objective was to evaluate satisfaction after surgical treatment of DCM and determine its drivers. **Methods:** Consecutive patients undergoing surgery for DCM and enrolled in the Canadian Spine Outcomes Research Network database were evaluated 12 months after surgery. Level of patient satisfaction was captured. Demographic, surgical, baseline and postoperative PROs were compared between satisfied and unsatisfied patients to determine potentiators of satisfaction. Logistic regression was employed to model satisfaction as a function of predictor variables identified as significant on univariate analysis. **Results:** In total, 663 patients undergoing surgery for DCM were identified: 255 (38.5%) were female, mean age was 59.8 (± standard deviation 11.8), 30.8% were working, 51.7% had a high school or higher education, 63.2% were taking pain medications and 14.8% had undergone previous cervical surgery. Baseline modified Japanese Orthopaedic Association (mJOA) score revealed mild (28.9%), moderate (39.6%) and severe (31.5%) degrees of myelopathy. Mean baseline neck and arm pain were both rated 5.5 ± 3.0. Baseline Neck Disability Index (NDI) score was 40 ± 19.5, 12-Item Short-Form Health Survey Physical Component Summary (PCS) score was 31.9 ± 10.0, Mental Component Summary (MCS) score was 43.3 ± 12.3 and EuroQol EQ-5D was 0.6 ± 0.2. All PROs and mJOA scores improved significantly at 12 months after surgery. Satisfaction was high: 85.8% at 3 months and 81.4% at 12 months. Shorter length of stay of 3 ± 3 versus 4 ± 5 days was significantly associated with 12-month satisfaction. All 12-month PROs and mJOA scores were significantly associated with satisfaction, as were all associated change scores. Mean mJOA increased 2.3 ± 2.5 versus 1.2 ± 2.6, and NDI decreased by 15.1 ± 15.9 versus increased by 0.5 ± 16.1 in satisfied and unsatisfied patients, respectively. Binary logistic regression with backward selection revealed change in MCS, PCS and NDI as significant predictors of patient satisfaction. **Conclusion:** Patient satisfaction after surgical treatment for DCM was largely independent of demographics, baseline PRO and surgical details; rather, improvements in PROs drove satisfaction.

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Abstract ID 98

Identification of surgical candidates for mild degenerative cervical myelopathy: a trajectory-based analysis. ***Alex B. Bak, Mohammed A. Alvi, Ali Moghaddamjou, Michael G. Fehlings.*** **From the Division of Neurosurgery, University of Toronto, Toronto, Ont.**

Background: Indications for surgical intervention of mild degenerative cervical myelopathy (DCM) remain controversial. Surgical candidates may be identified according to their response in change of physical function over time. **Methods:** Patients who underwent surgical decompression for mild DCM (modified Japanese Orthopaedic Association [mJOA] score 15–17) were identified from a pooled cohort of the AO Spine North America Cervical Spondylotic Myelopathy Study (CSM-North America) and CMS-International clinical studies. Latent class trajectory modelling was applied to classify patients into distinct recovery trajectories of their change in mJOA and 36-Item Short-Form Health Survey Physical Component Summary (SF-36 PCS) scores over 12 months after injury. Trajectory groups were dichotomized based on whether they reached minimal clinically important difference (MCID) of 1 point for mJOA and 5 points for SF-36 PCS. Predictors of recovery trajectories were identified using hierarchical mixed-effects multivariate logistic regression with hospital site as a random effect on baseline variables while controlling for operative differences. **Results:** From a total of 198 patients with mild DCM, 2 distinct trajectories of functional recovery were identified. The good recovery trajectory captured 164 patients (82.8%) achieving clinically important gains in their function, while 34 patients (17.2%) followed a trajectory of functional decline. Achieving functional recovery was associated with Asian race and higher self-reported baseline physical functioning. Patients who presented with Lhermitte sign, hypertension, history of smoking (currently or formerly), history of physiotherapy and stenosis caused by subluxation were associated with the functional decline trajectory. When projecting the courses of SF-36 PCS over time, 4 distinct trajectories were found. Two of the trajectories achieved improvements in physical functioning > 5 points for a total of 109 patients (57.4%), and 81 others (42.6%) failed to reach MCID. The trajectory of positive gains of patient-reported physical function was associated with higher baseline physical functioning and Asian race. **Conclusion:** Most patients with mild DCM achieve clinically important recoveries of their function and self-reported physical function after surgical intervention. However, surgery is not effective for a heterogeneous subgroup of patients. Further comparative studies on the effect of conservative management versus surgery in these patients are needed.

G-76
Abstract ID 100

The impact of surgery on pain in degenerative cervical myelopathy: a pooled analysis of 1047 patients from CSM-North America, CSM-International and CSM-Protect trials. ***Alex B. Bak, Mohammed A. Alvi, Ali Moghaddamjou, Michael G. Fehlings*. From the Division of Neurosurgery, University of Toronto, Toronto, Ont.**

Background: Pain is a significant contributor to quality of life in degenerative cervical myelopathy (DCM). However, its trajectory and factors associated with prolonged chronic pain and resolution are poorly understood. **Methods:** Patients with DCM and severe pain were queried using a harmonized data set of the AO Spine North America Cervical Spondylotic Myelopathy Study (CSM-North America), CSM-International and Efficacy of Riluzole in Surgical Treatment for Cervical Spondylotic Myelopathy (CSM-Protect) clinical trials. Severe acute pain was characterized as a Neck Disability Index pain intensity (NDI-PI) score of ≥ 3. Latent class trajectory modelling (LCTM) was applied to classify patients into distinct trajectories according to their NDI-PI score over the initial 12 months after injury. Predictors of recovery trajectories were identified using descriptive statistics and multinomial logistic regression with relative risk ratios on demographic and surgical variables. **Results:** From a total of 1047 patients, 3 distinct recovery trajectories were discovered from our analysis of 305 patients with severe baseline pain (29.1%). Their parabolic course was classified as: 1) complete resolution of pain (n = 134, 43.9%), 2) recovery to moderate pain (n = 105, 34.4%), and 3) marginal recovery (n = 72, 23.6%). In patients who had severe baseline pain, older age, being married and higher baseline Nurick and modified Japanese Orthopaedic Association scores were associated with complete resolution. Anxiety and depression were inversely associated with complete resolution. Surgically, complete pain resolution was associated with anterior autograft with autograft, cage and allograft. Posterior autograft was inversely associated with complete resolution. **Conclusion:** Severe acute pain can be classified into 1 of 3 distinct subpopulations with fundamentally differing clinical courses. There is more than 50% of unresolved chronic pain in patients with DCM presenting with severe acute pain over the course of 12 months. Given the high prevalence of chronic pain and impact on quality of life, factors associated with pain trajectories may be avenues for future comparative studies.

G-77
Abstract ID 104

National adverse event rates after cervical spine surgery for degenerative disorders, and impact on patient satisfaction. ***Alex Soroceanu, Fred Nicholls, Ken Thomas, Nathan Evaniew, Paul Salo, Jacques Bouchard, Brad Jacobs*. From the Department of Clinical Neurosciences and Division of Orthopaedic Surgery, The University of Calgary, Calgary, Alta.**

Background: Previous work looking at rates of national adverse events (AEs) have focused on lumbar pathology. This study aimed to establish the rates of AEs in elective spine surgery at a national level, assess variability in reporting, and determine the impact of AEs on postoperative patient satisfaction. **Methods:** The Canadian Spine Outcomes and Research Network prospective spine registry was utilized. Patients with degenerative cervical pathology who underwent elective surgery were included. We excluded patients with a diagnosis of tumour, trauma and infection. Adverse events were prospectively collected intraoperatively, at the time of discharge, and 3 months after surgery. Patients with incomplete AE information were excluded. The severity of each AE was scored from 1 to 6, and AEs grade 3 and above were classified as "major." Variability in AE reporting across enrolling sites was assessed using χ^2 tests. The effect of AEs on patient satisfaction and health-related quality of life 1 year after surgery was assessed using multivariate logistic and linear regression, accounting for confounders. **Results:** A total of 1206 patients met inclusion criteria, of whom 298 (24.7%) experienced at least 1 AE. 73 patients (6.05%) experienced at least 1 major AE. There was significant variability in reported AE rates across sites: overall AE range 13.5%–44.5% (p = 0.001), major AE range 2.2%–17.1% (p = 0.001). The rate of overall intraoperative AEs was 4.5%, the rate of perioperative AEs was 13.5%, and the rate of 3-month AEs was 9.96%. One year after surgery, 85% of patients were somewhat or extremely satisfied. The number of AEs experienced was an independent predictor of postoperative satisfaction, with patients who experienced a higher number of AEs having lower odds of being satisfied with the outcomes of surgery (odds ratio 0.78 for each additional AE experienced; p = 0.05). **Conclusion:** Of patients undergoing elective cervical spine surgery, 1 in 4 will experience at least 1 AE. The number of AEs was an independent predictor of poor postoperative patient satisfaction. The variability in reported AE rates between sites suggests either the need for standardization of recording practices or attention to AE prevention, or both.

G-78
Abstract ID 8

The unsustainable growth of out-of-hours emergent surgery for degenerative spinal disease in Canada: a retrospective cohort study from a national registry. ***Charlotte Dandurand, Pedram Farimani Laghaei, Tamir Ailon, Raphaele Charest-Morin, Nicolas Dea, Marcel Dvorak, Charles Fisher, Brian K. Kwon, Scott Paquette, John Street*. From the Combined Neurosurgical and Orthopedic Spine Program, University of British Columbia, Vancouver, B.C.**

Background: Although spinal degenerative disease is a growing burden on our health care system, little is known about longitudinal surgical trends. The main goal of this study was to examine surgical long-term trends for degenerative spinal pathologies within Canada. **Methods:** We used the Canadian Institute for Health Information (CIHI) registry to identify patients who received surgery for a degenerative spinal condition from 2006 to 2019. The trends in number of spinal interventions, unscheduled versus scheduled hospitalizations, in-hours versus out-of-hours spinal interventions, resource utilization and adverse events were analyzed using linear regression models. **Results:** This study analyzed a total of 338658 spinal interventions and 256351 hospitalizations. The number of spinal interventions

increased by on average 2.5% per year (95% confidence interval [CI] 1.023–1.028; $p < 0.001$). Scheduled procedures increased by an average of 2% per year (95% CI 1.017–1.023; $p < 0.001$) while unscheduled procedures had a more rapid growth, with an average annual increase of 3.4% (95% CI 1.027–1.040; $p < 0.001$). "In-hours" surgeries increased on average by 2.7% per year (95% CI 1.021–1.033; $p < 0.001$), while "out-of-hours" surgeries increased more rapidly, with a 6.1% annual increase (95% CI 1.051–1.071; $p < 0.001$). Surgeries associated with an adverse event increased by on average 6.3% per year (95% CI 1.049–1.077; $p < 0.001$). **Conclusion:** Our findings highlight the increasing demand for surgical treatment for degenerative spinal disease with a growth rate of 2.5% per year. Secondarily, we observed a faster growth rate in emergent out-of-hours procedures than for elective in-hours operations, suggesting an overload of the Canadian health care system. We hypothesize that the overall increase in surgical load and the increase in adverse events is likely related to the growing population of older adults receiving spinal surgical care and progress of expanding surgical indications. This new knowledge is crucial for health care decision-makers to minimize the burden on the health care system owing to the changing spinal care environment and the growing population, especially in older adults.

G-79
Abstract ID 102

Effect of compensation claim status on perioperative outcomes in patients with degenerative spine conditions. ***Alex Soroceanu*, *Fred Nicholls*, *Ken Thomas*, *Nathan Evaniew*, *Jacques Bouchard*, *Paul Salo*, *Brad Jacobs*. From the Department of Clinical Neurosciences and Division of Orthopaedic Surgery, University of Calgary, Calgary, Alta.**

Background: A significant number of patients undergoing spine surgery who present with degenerative surgical pathology have pre-existing compensation claims. We aimed to assess the effect of compensation claim status on preoperative health care utilization, opioid use, and postoperative patient outcomes and satisfaction. **Methods:** The Canadian Spine Outcomes and Research Network prospective spine registry was utilized. Patients with degenerative cervical and thoracolumbar pathology who underwent elective surgery and completed 1-year follow-up were included. We excluded patients with a diagnosis of tumour, trauma and infection, and those with no reported compensation claim status. Compensation claim status was dichotomized: *no* compensation claim versus *any* compensation claim. Baseline demographics and surgical factors were compared using Student t or χ^2 tests. The impact of compensation claims on time away from work before surgery, emergency room and family physician visits, opioid use, patient outcomes, and patient satisfaction was analyzed using linear or logistic regression, accounting for identified confounders. **Results:** In total, 5605 patients were included in 2 groups: the no claim group ($n = 4405$) and the any claim group ($n = 1200$: workers' compensation alone, $n = 361$; insurance claim alone, $n = 629$; legal consultation alone, $n = 39$; ≥ 2 concurrent claims, $n = 171$). The 2 groups were different in terms of age, American Society of Anesthesiologists score, sex, smoking status, previous spine surgery, reported preoperative neurologic deficit, Opioid Risk Tool score, estimated blood loss and adverse events; these differences were accounted for through multivariate analysis. Patients with compensation claims were more likely to be on daily opioids preoperatively (odds ratio [OR] 1.5; $p = 0.00001$), and have more frequent health care utilization in the 6 months preceding surgery (> 1 emergency room visit, OR 1.35, $p = 0.0001$; > 3 general practitioner visits, OR 1.81, $p = 0.0001$). Patients with compensation claims reported more days off work before surgery (305 days difference; $p = 0.0001$). One year after surgery, despite similar improvements in health-related quality of life ($p > 0.05$), patients with compensation claims were more likely to continue using opioids daily (OR 1.35; $p = 0.008$) and less likely to be satisfied (OR 0.69; $p = 0.0001$). **Conclusion:** Twenty percent of patients undergoing spine surgery have a compensation claim. They have more reported days off work and more frequent health care utilization. After surgery, they are more likely to persist with using opioids, and less likely to be satisfied.

G-80
Abstract ID 13

Outcomes of spinal cord stimulation for management of neuropathic pain in patients with spinal cord injury. ***Vishal P. Varshney*,[1,2] *Ramesh Sahjpaul*,[1–3] *Scott Paquette*,[1–3] *Jill Osborn*.[1,2] From the [1]Department of Anesthesia, Providence Healthcare, Vancouver, B.C.; the [2]Department of Anesthesiology, Pharmacology, Therapeutics, University of British Columbia, Vancouver, B.C.; the [3]Division of Neurosurgery, University of British Columbia, Vancouver, B.C.**

Background: Neuropathic pain in patients with spinal cord injury (SCI) is a challenging condition to manage for both patients and clinicians alike. Recent Canadian clinical practice guidelines for management of neuropathic pain after SCI acknowledge a paucity of evidence to support the use of advanced interventional options such as spinal cord stimulation (SCS). Despite the high quality of evidence supporting SCS for neuropathic pain in the non-SCI patient population, it has been rarely used in the SCI population. We aim to review our outcomes of SCS for management of neuropathic pain in patients with SCI to demonstrate its efficacy, and advocate for utilization in practice guidelines. **Methods:** We performed a single-centre retrospective review of patients with SCI who were assessed, trialled and implanted with SCS devices at our multidisciplinary pain clinic, with primary outcomes being reduction in baseline pain intensity at 6 months and secondary outcomes to evaluate patient pain pattern and electrode placement relative to SCI lesion. Patients were assessed by a team consisting of a pain physician, psychiatrist and neurosurgeon. **Results:** From 2019 to 2022, 11 patients with SCI (1 American Spinal Cord Injury Association [ASIA]-A, 3 ASIA-B, 7 ASIA-C) were assessed for consideration of SCS. Of these, 3 were declined either because of limitations with epidural access and potential electrode placement or patient refusal. All 8 patients who underwent an SCS trial proceeded to implant (1 ASIA-A, 2 ASIA-B, 5 ASIA-C). At 6 months, patients reported a mean reduction of baseline pain intensity of 54% (median 50%). Patient pain patterns were predominantly bilateral lower extremity pain. Electrode placement was most effective at conventional levels for lower extremity

neuropathic pain (i.e., anode-cathode configuration at the T8–9 or T9–10 disc space), regardless of the SCI level above or below the level of implant. **Conclusion:** Spinal cord stimulation is a useful modality in the management of neuropathic pain in patients with SCI, demonstrating sustained reduction in pain intensity. Interestingly, level of SCI lesion does not affect SCS electrode placement, with conventional anode–cathode configurations achieving results similar to those of the non-SCI population.

P-81
Abstract ID 97

Meaningfulness in clinical improvements at 12 months after surgery for degenerative cervical myelopathy: comparison of 30% change versus absolute change values of minimal clinically important difference. ***Alex B. Bak, Ali Moghaddamjou, Michael G. Fehlings.*** **From the Division of Neurosurgery, University of Toronto, Toronto, Ont.**

Background: Traditionally, an absolute point-change of minimal clinically important difference (MCID) was used to assess the efficacy of interventions on patient outcomes. Recent studies advise the use of a more dynamic criterion of 30% change for assessing randomized controlled trials. **Methods:** Individuals with degenerative cervical myelopathy (DCM) who had undergone surgical decompression (2005–2018) were identified from a harmonized, prospective, multicentre database of the AO Spine North America Cervical Spondylotic Myelopathy Study (CSM-North America), CSM-International and Efficacy of Riluzole in Surgical Treatment for Cervical Spondylotic Myelopathy (CSM-Protect) clinical studies. Rating of change was defined with the second item of the 36-Item Short-Form Health Survey (SF-36), which asks about general health currently compared with 12 months ago on a 5-point scale, from "much worse" to "much better." Previously established absolute MCIDs for the modified Japanese Orthopaedic Association (mJOA) score of 2 and SF-36 Physical Component Summary (PCS) score of 4 were compared with a 30% change rule in predicting patient change. Odds ratios (ORs) were estimated with ordinal regression and presented with 95% confidence intervals (CIs) and p values (α = 0.05). **Results:** A total of 631 individuals (age ± standard deviation: 57.5 ± 11.3 yr; 39.3% female) were identified. Compared with 12 months earlier, 206 patients (32.7%) said they found their current health to be "much better," 209 patients (33.1%) felt "somewhat better," 123 patients (19.5%) felt "about the same," 75 patients (11.9%) felt "somewhat worse," and 18 patients (2.9%) felt "much worse." Compared with 63.7% and 60.0% of patients who made the absolute MCID of mJOA and SF-36 PCS, respectively, 34.2% and 35.7% of patients achieved the 30% threshold. Absolute MCID had higher ORs than 30% threshold for mJOA (absolute: OR 3.19, 95% CI 2.35–4.33, $p < 0.001$; 30%: OR 2.66, 95% CI 1.96–3.63, $p < 0.001$) and SF-36 PCS (absolute: OR 5.70, 95% CI 4.14–7.85, $p < 0.001$; 30%: OR 4.26, 95% CI 3.09–5.88, $p < 0.001$). **Conclusion:** In patients with DCM who have had surgery, the dynamic 30% change and static absolute point-change values for MCID of physical function were both significant predictors of patient-reported change in health at 12 months. However, the absolute point-change values were associated with higher ORs than 30% change values of MCID.

P-82
Abstract ID 22

An exploration of the evolving perception of quality of life from the perspective of individuals living with a cervical spinal cord injury in Nova Scotia. ***Erika Leck, Emily Marshall, Sean Christie.*** **From the Division of Neurosurgery, Dalhousie University, Halifax, N.S.**

Background: Spinal cord injuries (SCIs) invoke enormous life changes for the individual, with impacts not just on physical functioning but also on social and psychological well-being. Individuals learn to deal with these changes and handle these new stressors in different ways. Extant literature suggests that the majority of people eventually obtain a quality of life (QOL) similar to able-bodied individuals, but little is known about the evolution in QOL and the journey that individuals embark on as they progress through their recovery. We sought to validate these observations in a contemporary cohort and specifically explore how patients' perceptions of QOL evolve over time. **Methods:** We conducted hour-long, semistructured interviews with 15 individuals living with cervical SCI. Interviews took place over the telephone or virtually via Microsoft Teams. Interview transcripts were then analyzed using an iterative coding process and thematic analysis (NVivo). **Results:** The overarching journey that most participants described was a continuous evolution in QOL, as they learned to adapt and function with their injury. However, these trajectories were disparate and heavily reliant on personal supports and resources available, their psychosocial environment and inherent coping strategies. As people recovered, they began to adapt and learn how to live and function with their injury, but that evolution was not linear; nor was it the same for everyone. There were many enhancing and inhibiting contributors to QOL, from support networks and technological advances to lack of accessibility of the built environment and other facets of society, all of which greatly affected perceptions of QOL. **Conclusion:** This study emphasizes the unique nature of each person's journey, and that not all people attain a satisfactory QOL. Our approach needs to be individualized, adjusting to specific circumstances, in order to provide more inclusive and supportive care. As health care providers, being cognizant of each individual's personal set of circumstances can thus allow us to deliver more compassionate care, while striving for means of improving SCI care and delivery.

P-83
Abstract ID 41

Delays in diagnosis of degenerative cervical myelopathy: a population-based study using the Clinical Practice Research Datalink. ***Lior M. Elkaim, Oliver J. Lasry.*** **From the Department of Neurology and Neurosurgery, McGill University, Montréal, Que.**

Background: The objective of this study was to describe the time between initial presentation at a primary care provider (PCP) and final diagnosis in the general population of the United Kingdom, while describing erroneous diagnoses that occur early in the disease course. **Methods:** This study was an observational descriptive retrospective cohort study. All patients with a diagnosis of

degenerative cervical myelopathy (DCM) and age older than 18 years were identified in the Clinical Practice Research Datalink (CPRD), an anonymized UK-based data network of PCP practices covering more than 16 million registered patients. DCM was defined based on specific procedural and diagnostic codes for the condition. Previous medical codes, including previous false diagnoses, were used to identify the date of first visit to a PCP. Survival analysis using Kaplan–Meier plots was used to describe the time from first visit to diagnosis or surgical treatment. Risk factors for delay in diagnosis of DCM by a specialist were assessed using a Cox proportional hazards model. **Results:** The CPRD search identified 36 612 patients (51.1% male) older than 18 years with a diagnosis of DCM between April 1997 and March 2022. The mean (± standard deviation) age at diagnosis of DCM was 67.3 ± 12.4 years. The most common false diagnoses were pain (41.9%), falls (19.1%) and numbness or paresthesia (15.4%). The average number of visits for DCM-related features before a false diagnosis of DCM was given, among the entire cohort, was 1.8 ± 4.4. Among those with at least 1 false diagnosis, the median (interquartile range [IQR]) time from first PCP visit to DCM diagnosis was 22.1 (5.7–43.3) months. The median (IQR) time from DCM diagnosis to surgical treatment was 33.4 (5.8–81.4) months. **Conclusion:** Patients face significant delays in both the diagnosis and treatment of DCM. The most common DCM-related visits before a diagnosis is made are for pain, falls and paresthesia. Imaging modality requests other than cervical spine MRIs may further delay diagnosis and treatment.

P-84
Abstract ID 119

Sex, drugs and spine surgery: a nationwide analysis of opioid utilization and patient-reported outcomes in males and females. ***Aditya Raj,[1] Jean-Christophe Murray,[2] Ahmed Cherry,[1] Greg McIntosh,[3] Christopher Nielsen,[1] Nisaharan Srikandarajah,[1] Ragavan Manoharan,[1] Carlo Iorio,[1] Mark Xu,[1] Anthony Perruccio,[1] Mayilee Canizares,[1] Yoga Raja Rampersaud.[1]*** **From the [1]University Health Network, Toronto, Ont.; the [2]Orthopaedic Surgery Division, Université Laval, Québec, Que.; the [3]Canadian Spine Outcomes and Research Network, Markdale, Ont.**

Background: There is increasing evidence of biological sex differences in pain experience and opioid utilization. Our primary objective was to identify any preoperative differences in opioid use between males and females. Our secondary objectives were to identify 1) factors associated with baseline opioid use and 2) the impact of baseline use on 12-month patient-reported outcome measures (PROMs). **Methods:** We carried out a retrospective review of Canadian Spine Outcomes and Research Network data. Surgical patients (n = 6691) with degenerative spinal disorders and available data on baseline opioid use were included. Univariate and multivariable analyses were stratified by sex. Logistic regression was performed to identify independent factors associated with baseline opioid use. **Results:** Overall, 48.4% of all patients used opioids at baseline. Among males, 44.8% were opioid users, and among females, 52.7% were opioid users ($p < 0.001$). There were no sex differences in most baseline factors between opioid users and nonusers. Univariate analysis by user status revealed that age, body mass index (BMI), number of comorbidities, thoracolumbar location, smoking status, compensation claims, work status, routine exercise, Patient Health Questionnaire-9 (PHQ-9) score, disc herniation and stenosis were differentially significant in both sexes; for females, there was also a difference in spondylolisthesis diagnosis, while education status also differed in males. Multivariable analysis demonstrated more comorbidities, thoracolumbar location of pain, not working, not exercising, and worse PHQ-9 score were independently associated with opioid use in females. More comorbidities, thoracolumbar location of pain, smoking, not working, worse PHQ-9 score, and disc herniation were independently associated in males. Regardless of sex, in males and females, opioid users and nonusers showed significant and similar degrees of improvements ($p < 0.001$) in all PROMs at 12 months, compared with baseline. However, opioid users had worse scores for all PROMs at both baseline and 12 months. **Conclusion:** Preoperative opioid use was significantly higher in females than males. Our study demonstrates sex differences in independent baseline factors associated with opioid use. Further investigation to determine interaction by sex and subsequent development of sex-specific mitigation strategies in the perioperative period is required.

P-85
Abstract ID 117

The feasibility of a multidisciplinary transitional pain service in patients undergoing spine surgery to minimize opioid use and improve perioperative outcomes: a quality improvement study. ***Alexandra Stratton,[1,2] Sarah Tierney,[1,2] Eugene K. Wai,[1,2] Philippe Phan,[1,2] Stephen Kingwell,[1,2] Marie-Claude Magnan.[1]*** **From the [1]Orthopaedic Surgery Division, University of Ottawa, Ottawa, Ont.; the [2]Ottawa Hospital Research Institute, Ottawa, Ont.**

Background: Patients who undergo spine surgery have high rates of perioperative opioid consumption compared with patients undergoing other types of surgery, and unfortunately many opioid-naive patients going into spine surgery remain on opioids long term. A proposed solution to minimize the rate of, and morbidity associated with, long-term opioid use is the implementation of a transitional pain service (TPS). The main objective of this study was to evaluate the feasibility of a TPS program in patients undergoing spine surgery. **Methods:** Patients were recruited between July 2020 and November 2021 at a single tertiary-care academic centre. Twenty-six individuals identified as high risk for long-term opioid use were enrolled and followed pre- and postoperatively by the TPS team in addition to the standard visits with the surgeon. The TPS team consisted of an anesthesiologist and psychologist with expertise in pain management. Success of our feasibility study was defined a priori as 1) enroll at least 80% of eligible patients, 2) establish ability to collect health outcome measures and track resources required for an expanded TPS program, and 3) wean at least 80% of patients postoperatively back to their baseline (intake) opioid amount or lower. **Results:** Of 36 eligible patients, 30 (83.3%) were enrolled in our feasibility study, 26 of whom underwent surgery and were included in the analysis. Predefined program outcome and resource measures were collected for more than 80% of patients. The mean number of TPS appointments attended was

3.57 before surgery, 4.16 after surgery. Twenty-four patients (92.3%) consumed fewer oral morphine equivalents (OME) at program discharge than at intake — including 8 (31%) patients who weaned off opioids altogether — and 2 (7%) went back to their baseline OME. **Conclusion:** Our feasibility study successfully met or exceeded our 3 main targets. Given this success and the defined clinical need for a TPS program, we plan to expand our TPS care model to a larger cohort and evaluate specific components of the program for efficacy.

P-86
Abstract ID 103

Predictors of poor postoperative patient satisfaction in patients undergoing elective spine surgery with pre-existing compensation claims. ***Alex Soroceanu, Fred Nicholls, Ken Thomas, Nathan Evaniew, Paul Salo, Jacques Bouchard, Brad Jacobs.*** **From the Department of Clinical Neurosciences and Division of Orthopaedic Surgery, University of Calgary, Calgary, Alta.**

Background: A significant number of patients who undergo spine surgery have pre-existing compensation claims. Compensation claims are an independent risk factor for poor postoperative satisfaction. We aimed to identify predictors of poor postoperative satisfaction in these patients with compensation claims. **Methods:** The Canadian Spine Outcomes and Research Network prospective spine registry was utilized. Surgical patients with degenerative cervical and thoracolumbar pathology who reported at least 1 compensation claim and completed 1 year follow-up were included. We excluded patients with a diagnosis of tumour, trauma and infection, and those with missing postoperative satisfaction status. Compensation claims included workers' compensation, legal consultations and insurance claims. Satisfaction was measured 1 year after surgery. Poor satisfaction was defined as "extremely dissatisfied," "somewhat dissatisfied" and "neither satisfied nor dissatisfied." Multivariate logistic regression modelling was used to build a prediction model of poor satisfaction. Potential predictors were identified using univariate analysis. The model was built using a combination of backward elimination and bootstrap selection. Model fit was assessed using the Hosmer–Lemeshow test and the C statistic or receiving operating characteristic (ROC) curve. Split sample internal cross-validation was performed. **Results:** In total, 1190 patients with compensation claims were included. One year postoperatively, 232 of 1190 (19.5%) patients were not satisfied. Multivariate logistic regression identified independent predictors of poor satisfaction. The following predictors were associated with higher odds of poor satisfaction: preoperative opioid use (daily: odds ratio [OR] 1.64, $p = 0.041$; weekly: OR 1.90, $p = 0.02$), longer wait time for surgery ($p = 0.015$), major intraoperative adverse events (OR 4.4; $p = 0.042$), postoperative adverse events (OR 2.11; $p = 0.003$) and lower preoperative 12-Item Short-Form Health Survey (SF-12) Mental Component Summary score ($p = 0.0001$). The following predictors were associated with lower odds of poor satisfaction: higher education (undergraduate and postgraduate: OR 0.54; $p = 0.004$), exercising at least once a week (OR 0.66; $p = 0.037$) and having an "insurance" type of claim (OR 0.61; $p = 0.014$). The predictive model had a good discrimination (ROC curve 0.72) and good calibration (Hosmer–Lemeshow, $p = 0.27$). **Conclusion:** Of patients who had spine surgery and had pre-existing compensation claims, 20% were not satisfied with their postoperative outcome at 1 year. This study identified predictors of poor satisfaction in this cohort.

P-87
Abstract ID 60

The efficacy and safety of P-15 peptide enhanced bone graft in bone regeneration: a systematic review. ***Barend Spanninga,[1] Thomáy-Claire A. Hoelen,[2] Scott Johnson,[3] Jacobus J.C. Arts.[2,4]*** **From the [1]Laboratory for Experimental Orthopaedics, Department of Orthopaedic Surgery, Maastricht University, Maastricht, Limburg, Netherlands; the [2]Department of Orthopaedic Surgery, Care and Public Health Research Institute, Maastricht University Medical Center, Maastricht, Limburg, Netherlands; [3]Cerapedics Inc., Westminster, Colo.; [4]Orthopaedic Biomechanics, Department of Biomedical Engineering, Eindhoven University of Technology, Eindhoven, North Brabant, Netherlands.**

Background: Recent bone graft advancements have focused on supporting and enhancing host bone regeneration. The use of growth factors is controversial, with known clinical complications and high costs. Peptides offer the potential to retain specific biological activity without the potential risks associated with growth factors. P-15 is a peptide found in type I collagen, which has been found to enhance osteogenic cell attachment, proliferation and differentiation. The objective of this study was to conduct a systematic review to determine the efficacy and safety of P-15 peptide in bone regeneration. **Methods:** A Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA)–compliant systematic review was performed. PubMed, Embase, Web of Science and the Cochrane Library were searched on June 30, 2022, for relevant articles (search terms: Cell-binding peptide P-15 OR P-15 OR i-FACTOR AND general surgery OR surgical procedures, operative OR bone regeneration). Full-text English language articles considering P-15 peptide published from 1990 onward were eligible. Studies including systematic bone disease, malignancy or infection were excluded. Risk of bias of the eligible studies was evaluated using the methodological index for non-randomized studies (MINORS) tool and the Risk of Bias 2 assessment tool for randomized controlled trials. **Results:** Of the 25 articles included in the systematic review, 18 focused on the application of P-15 in oral cavity procedures. Next were cervical spine ($n = 3$), lumbar spine ($n = 3$) and long bone interventions ($n = 1$). Most studies displayed low bias (1-B or 2-B). All published results showed quick bone formation and remodelling. In spine surgery, i-FACTOR Bone Graft outperformed autograft in bone formation speed and did not show the complications reported for growth factors. Few postoperative complications related to P-15 were reported. **Conclusion:** High-quality clinical evidence exists for the safety and efficacy of P-15 in multiple surgical contexts. Compared with autograft, bone forms faster and remodels quicker. We conclude that i-FACTOR P-15 peptide is a safe and effective biomaterial resulting in a standardized bone formation reaction with a low probability for complications.

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Abstract ID 113

The influence of preoperative back pain on patient-rated outcomes after decompression with or without fusion for degenerative lumbar spondylolisthesis: results from the Canadian Spine Outcomes and Research Network prospective degenerative lumbar spondylolisthesis study.
Chris S. Bailey,[1] Jennifer C. Urquhart,[1] R. Andrew Glennie,[2] Y. Raja Rampersaud,[3] Charles G. Fisher.[4] **From the [1]London Health Sciences Centre Combined Neurosurgical and Orthopaedic Spine Program, Schulich School of Medicine, Western University, London, Ont.; the [2]Departments of Orthopedics and Neurosurgery, Dalhousie University, Halifax, N.S.; the [3]Department of Surgery, University of Toronto, Toronto, Ont.; the [4]Department of Surgery, University of British Columbia, Vancouver, B.C.**

Background: Back pain is recognized to have an important influence on the outcome after surgery for degenerative lumbar spondylolisthesis (DLS). For some surgeons, it is a factor to consider in the decision to fuse. The objective of this study was to determine whether the severity of preoperative back pain influences patient-reported outcome measures (PROMs) and if so, whether there is a difference between decompression and decompression with fusion. **Methods:** The Canadian Spine Outcomes and Research Network multicentre prospective study on the assessment and management of DLS was retrospectively reviewed to identify patients enrolled between 2015 and 2021. All patients enrolled into this study had to have symptoms of neurogenic claudication or radiculopathy or both. Patients were separated into the following cohorts according to their preoperative chief complaint, as determined by their treating surgeon: back pain, neurogenic claudication (NC) or radiculopathy. Pearson correlation was performed with numeric rating scale (NRS) back pain and postoperative NRS back pain (NRS-BP) and leg pain (NRS-LP), Oswestry Disability Index (ODI), and 12-Item Short-Form Health Survey (SF-12) Physical Component Summary (PCS) score. **Results:** There were 535 eligible patients enrolled at 8 Canadian sites, of whom 29 had a chief complaint of BP, 405 had NC, and 101 had radiculopathy. In the BP cohort, preoperative NRS-BP strongly correlated with postoperative NRS-BP at 12 months (r = 0.533, p = 0.011). In the NC and radiculopathy cohorts, significant correlation was found with NRS-BP as well as ODI and PCS at 3 months, 1 year and 2 years (R range: 0.156–0.408; p range: 0.034 to ≤ 0.001). Similar findings were found for the radiculopathy and neurogenic claudication subcohorts who had a fusion. **Conclusion:** Preoperative BP remains an important determinant to postoperative PROMs for both decompression and fusion cohorts.

P-89
Abstract ID 55

Publication retraction in spine surgery: a systematic review.
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Background: The number of articles retracted by peer-reviewed journals has increased in recent years. This study systematically reviewed retracted publications in the spine surgery literature. **Methods:** A search of PubMed MEDLINE, Ovid Embase, Retraction Watch, and the independent websites of 15 spine surgery–related journals from inception to September 2022 was performed without language restrictions. Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines were followed with title and abstract screening, and full-text screening was conducted independently and in duplicate by 2 reviewers. Study characteristics and bibliometric information for each publication was extracted. **Results:** Of 250 studies collected from the search, 65 met the inclusion criteria. The most common reason for retraction was data error (n = 15 [21.13%]), followed by plagiarism (n = 14 [19.72%]) and submission to another journal (n = 14 [19.72%]). Most studies pertained to degenerative pathologies of the spine (n = 32 [80.00%]). Most articles had no indication of retraction in their manuscript (n = 24 [36.92%]), while others had a watermark or notice at the beginning of the article. The median number of citations per retracted publication was 10.0 (interquartile range [IQR] 3–29), and the median 4-year impact factor of the journals was 5.05 (IQR 3.20–6.50). On multivariable linear regression, the years from publication to retraction (p = 0.0343, β = 6.56, 95% confidence interval [CI] 0.50–12.62) and the journal 4-year impact factor (p = 0.0029, β = 7.47, 95% CI 2.66–12.28) had a significant difference on the number of citations per retracted publication. Most articles originated from China (n = 30 [46.15%]) followed by the United States (n = 12 [18.46%]) and Germany (n = 3 [4.62%]). The most common study design was retrospective cohort studies (n = 14 [21.54%]). **Conclusion:** The retraction of publications has increased in recent years in spine surgery. Researchers consulting this body of literature should remain vigilant. Institutions and journals should collaborate to increase publication transparency and scientific integrity.

P-90
Abstract ID 12

The use of a standardized surgical case log to document operative exposure to procedural competencies in a spine surgery fellowship curriculum: a university-wide initiative.
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Background: Spine surgery fellowship includes trainees from both neurosurgical and orthopedic backgrounds and is increasingly undertaken in preparation for a career in spine surgery. Currently, there is a paucity of Canadian literature assessing the

competencies required and exposure of trainees completing a spine fellowship in Canada. **Methods:** Data from 2015 to 2022 were obtained via case logs entered into the T-res logbook software by fellows in the University of Toronto spine fellowship program. This includes the Hospital for Sick Children (HSC), Sunnybrook Health Sciences Centre (SHSC), Toronto Western Hospital (TWH) and St. Michael's Hospital (SMH). **Results:** A total of 9275 cases were logged, with an average of 1325 cases per year. Of cases, 51%were performed at TWH, 29% at SHSC, 20.5% at SMH and 5.9% at HSC. Diagnoses at the time of surgery were determined to be degenerative or inflammatory in 5403 cases (58.3%) and 1047 cases of deformity (11.2%). Of the remaining primary diagnosis identified, there were 338 cases of infection (3.6%), 946 cases of tumour or malignancy (10.2%) and 868 cases for traumatic spine injuries (9.3%). Of all cases, 77 involved the occiput (0.83%), 2455 the cervical spine (26.4%), 2076 the thoracic spine (22.4%), 4265 the lumbar spine (46.0%) and 68 the sacral region (0.73%). The highest number of cases logged by a single trainee was 235 procedures in an academic year, with a mean of 77 cases logged by each fellow annually over the 7-year collection period. **Conclusion:** The use of a standardized case log for procedure tracking can be an effective way to document trainee exposure to procedural competencies during fellowship. Documented exposure is increasingly being requested by hospitals during the credentialling process for surgical privileges. Case logs are one of several accepted methods for capturing training exposure as part of the Royal College of Physicians and Surgeons' accredited Area of Focused Competence diploma pathway. Fellowship educators can also leverage case-log data to advance curriculum opportunities that further develop training experience.

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Abstract ID 90

Preoperative psychosocial factors affect the outcomes experienced by patients who undergo anterior cervical discectomy and fusion surgery for cervical radiculopathy. ***Erin Cunningham,[1,2] Tyler Adams,[1,2] Dana El-Mughayyar,[1,2] Erin Bigney,[1,2] Amanda Vandewint,[2,3] Neil Manson,[2,4] Edward Abraham,[2,4] Chris Small,[2,4] Najmedden Attabib,[4] Eden Richardson,[2] Jeffery Hebert.[1]*** **The [1]Faculty of Medicine, University of New Brunswick, Fredericton, N.B.; the [2]Canada East Spine Centre, Saint John, N.B.; [3] Faculty of Medicine, Dalhousie University, Saint John, N.B.; the [4]Horizon Health Network, Saint John, N.B.**

Background: We aimed to estimate the effects of preoperative psychological factors on pain and disability outcomes in patients undergoing anterior cervical discectomy and fusion (ACDF) surgery for cervical radiculopathy. **Methods:** In this national retrospective analysis of prospectively collected data, we analyzed data from patients enrolled in the Canadian Spine Outcomes and Research Network with cervical radiculopathy who underwent ACDF surgery. Psychosocial variables were self-reported depression, moderate-to-severe depression risk measured with the Patient Health Questionnaire-8 (PHQ-8), and the Mental Component Summary score of the 12-Item Short-Form Health Survey (SF-12). Outcomes were neck and arm pain intensity and pain-related disability, measured preoperatively and 3, 12 and 24 months after surgery. We identified postoperative trajectories consistent with poor clinical outcomes using latent class growth analysis and estimated the effects of the psychosocial factors with robust Poisson models. Models were controlled for age, baseline pain and disability, sex, education and smoking. **Results:** Trajectory models with data from 352 patients (age 50.85 [± standard deviation (SD) 9.52] yr and 43.75% female) showed that 15.5%, 23.2% and 23.5% of patients experienced a poor postoperative outcome measure for neck disability, neck pain and arm pain, respectively. Self-reported depression (incidence rate ratio [IRR] 2.82, 95% confidence interval [CI] 1.62–4.89) and moderate-to-severe depression risk scores (IRR 9.72, 95% CI 3.12–30.35) increased the risk of poor disability outcome. Greater SF-12 scores reduced the risk of poor pain-related disability outcome (IRR 0.53, 95% CI 0.39–0.72 per 1 SD). **Conclusion:** After controlling for confounders, preoperative depression and depression risk alone affect postoperative disability outcomes experienced by patients with cervical radiculopathy after ACDF surgery. Clinicians should consider the psychosocial health of patients with cervical radiculopathy when engaged in clinical decision-making.

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Abstract ID 91

Virtual reality for patient-specific, multidisciplinary planning of complex orthopedic oncological surgery including the spine. ***Joel Werier,[1–3] Kevin Smit,[3,4] James Villeneuve,[1–3] Adam Sachs,[1–3] Hesham Abdelbary,[1–3] Yusra Kassim Al-Mosuli,[2] Kawan Rakhra,[1–3] Philippe Phan.[1–3]*** **From the [1]Ottawa Hospital, Ottawa, Ont.; the [2]Ottawa Hospital Research Institute, Ottawa, Ont.; the [3]Orthopaedic Surgery Division, University of Ottawa, Ottawa, Ont.; the [4]Children's Hospital of Eastern Ontario, Ottawa, Ont.**

Background: Surgical planning for complex orthopedic oncology cases requires thorough understanding of anatomy and relationships to critical structures. Virtual Reality (VR) visualization and planning is a dynamic, immersive experience offering enhanced understanding of complex anatomical relationships, and the ability to manipulate and layer 3D models. Here we describe our initial experience with a novel VR planning system in a pilot study. **Methods:** Six patients with complex anatomic tumours were reviewed preoperatively by a multidisciplinary team of orthopaedic oncology surgeons, neurosurgeons, thoracic surgeons, spine surgeons and a musculoskeletal radiologist. Three cases involved the chest wall and spine and 3 cases arose from the pelvis. Pathology included Ewing sarcoma, neuroblastoma and chondrosarcoma. Three-dimensional models of relevant bony and soft-tissue anatomy were derived directly from diagnostic computed tomography and magnetic resonance imaging using 3D modelling tools in the virtual environment while noting the length of time and cost to prepare cases. The VR system was also validated for model and measurement accuracy via direct comparisons with a reference system, and for overall ease of use and clinical utility. The Sørensen–Dice Coefficient was used to score similarity of models generated in VR to those made in the reference platform. **Results:** On multidisciplinary debrief, each case

reviewed in VR provided more information to the surgical team than standard imaging did. This included better understanding of the tumour margins and relationships to critical structures and, in 3 cases, modified surgical approach. The mean time to prepare cases was 70 (range 25–90) minutes, dependent on number of anatomical structures to be modelled, which represented a mean cost per case of $233 USD (range $85–$300). Sørensen–Dice Coefficient values for 3D structures created in VR were 0.97 or higher, confirming geometric accuracy of models relative to a reference system. **Conclusion:** VR planning of complex multidisciplinary cases is dynamic, feasible and cost-effective, providing enhanced appreciation of complex anatomical relationships, leading to increased surgeon confidence and affecting surgical approach.

P-93
Abstract ID 35

Malposition in robotic-assisted cortical bone trajectory screw placement: analysis of 1025 consecutive screws. ***Kosei Nagata, Jeffrey L. Gum, Morgan E. Brown, Christy L. Daniels, Leah Y. Carreon.*** **From the Norton Leatherman Spine Center, Louisville, Ky.**

Background: Pedicle screw malposition can lead to serious complications such as neurologic deficits or the need for reoperation. Cortical bone trajectory (CBT) screw insertion requires a unique angle, especially in the upper instrumented vertebra (UIV). Robotic-assisted CBT (RA-CBT) screw malposition occurs through 2 distinct modes, shift or skive. Shift is a change in position of the RA system relative to the patient. Skive occurs when a downward force applied to the cannula, drill or tap causes the instrument to deflect relative to its bony landmark. The purpose of this study is to report the incidence of intraoperative shift and skive in RA-CBT cases. **Methods:** Patients older than 18 years who underwent RA-CBT screw placement between January 2019 and July 2022 were identified. Standard demographic and surgical data were collected. The location of planned RA-CBT screws was classified into UIV, mid-construct and lower instrumented vertebra (LIV). Incidence of intraoperative shift and skive were recorded. **Results:** A total of 1025 CBT screws in 187 consecutive patients (mean age 59 yr; 98 male and 89 female) were analyzed. Of 1025 screws, 18 (1.8%) were malpositioned. Skive was observed in 10 screws (1.0%) in 9 patients and shift was observed in 8 screws (0.8%) in 3 patients. These 12 patients had higher body mass index (BMI) than the other patients (35.1 kg/m^2 v. 30.3 kg/m^2; $p < 0.001$). The incidence of malposition was 2.7% in the UIV (skive = 8, shift = 2), 2.0% mid-construct (skive = 3, shift = 3), and 0.6% in the LIV (skive = 0, shift = 2). Skive was more common in the UIV (8/374, 2%) than the LIV or mid-construct (3/652 [0.5%]; $p = 0.022$). All malpositioned screws were identified intraoperatively and no patients returned to the operating room. **Conclusion:** In 1025 CBT screws inserted in 187 patients, malposition occurred in 1.8% of CBT screws in 6% of patients. High BMI was associated with skive or shift in RA-CBT screw placement. This may be a result of the relatively deeper position of the bony landmarks. Skive was more common in the UIV owing to the more challenging insertion angle.

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Abstract ID 79

Accuracy of computer-assisted spine navigation platforms: a meta-analysis of 16 040 screws. ***John-Peter Bonello,[1] Robert Koucheki,[1,2] Aazad Abbas,[1] Johnathan Lex,[2,3] Nicholas Nucci,[4] Cari Whyne,[5] Jeremie Larouche,[3,6] Henry Ahn,[3,6] Joel Finkelstein,[3,6] Stephen Lewis,[3,7] Jay Toor.[3]*** **From the [1]Temerty Faculty of Medicine, University of Toronto, Toronto, Ont.; the [2]Institute of Biomedical Engineering, University of Toronto, Toronto, Ont.; the [3]Division of Orthopedic Surgery, University of Toronto, Toronto, Ont.; the [4]Division of Orthopedic Surgery, University of Ottawa, Ottawa, Ont.; the [5]Holland Musculoskeletal Research Program, Sunnybrook Research Institute, Toronto, Ont.; the [6]Department of Orthopedic Surgery, Sunnybrook Health Sciences Centre, Toronto, Ont.; the [7]Department of Orthopedic Surgery, Toronto Western Hospital, Toronto, Ont.**

Background: Navigation technologies continue to develop to aid the instrumentation of spinal hardware. This meta-analysis attempted to evaluate all available published literature on computer-assisted spine navigation, comparing the accuracy and secondary surgical outcomes between prominent platforms such as Medtronic, Brainlab and Stryker, using conventional techniques (free-hand or fluoroscopy) as a common control. **Methods:** Literature searches were performed using Ovid MEDLINE and Embase. Included studies must have performed postoperative computed tomography to evaluate screw placement. Screw placement accuracy and secondary surgical outcomes — including neurologic complications, operative time and blood loss — were then analyzed via subgroup statistical analysis, and more directly via network meta-analysis. **Results:** Among the 28 extracted studies, a total of 2959 patients underwent spinal instrumentation surgery in which 16 040 screws were placed; 1471 patients and 7957 screws were included in the computer-assisted navigation group, and 1488 patients and 8083 screws were included in the conventional group. At all spinal levels, there was a significantly lower risk of major breach in the navigation group than in the conventional group (odds ratio [OR] 0.42, 95% confidence interval [CI] 0.27 to 0.63; $p < 0.0001$; $I^2 = 56\%$, random effect model [REM]). The best navigation platform compared with conventional controls was Stryker, with an OR of 0.16 (95% CI 0.06 to 0.41, $p < 0.00001$; $I^2 = 0\%$, REM) followed by Medtronic with an OR of 0.48 (95% CI 0.29 to 0.77, $p < 0.00001$; $I^2 = 0\%$, REM). Additionally, there was no significant difference in surgical outcome measures between groups; however, on subanalysis, Brainlab demonstrated significantly faster operative time than Medtronic by about 30 minutes (95% CI –63.27 to –2.47, $p = 0.03$; $I^2 = 74\%$). **Conclusion:** These results indicate that use of computer-assisted navigation platforms in spine surgery leads to an approximately 60% reduction in risk of breach without a change in secondary surgical outcomes. These findings have implications as an aid in guiding the choice of navigation platforms by surgeons and institutions.

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Abstract ID 86

Which is better: percutaneous or open robot-assisted spine surgery? Prospective, multicentre study of 2524 screws in 336 patients. ***Nathan J. Lee,[1] Lindsay D. Orosz,[2] Jeffrey L. Gum,[3] Gregory T. Poulter,[4] Ehsan Jazini,[5] Colin M. Haines,[5] Christopher R. Good,[5] Ronald A. Lehman.[1]*** **From the [1]Columbia University Medical Center, New York, N.Y.; the [2]National Spine Health Foundation, Reston, Va.; the [3]Norton Leatherman Spine Center, Louisville, Ky.; the [4]OrthoIndy, Indianapolis, Ind.; the [5]Virginia Spine Institute, Reston, Va.**

Background: A plethora of literature exists comparing outcomes between robot-assisted minimally invasive techniques and conventional open approaches; however, the differences in outcomes and complications between robot-assisted percutaneous and robot-assisted open surgeries remain largely unknown. Comparing these cohorts can inform surgeons and patients during their preoperative planning. This is the first prospective, multicentre study of 4 geographically diverse institutions on robot-assisted spine surgery to compare the outcomes and complications between 2 robot-assisted techniques. **Methods:** Adult patients undergoing spine surgery with a bone-mounted robotic assist with navigation confirmation were enrolled from 2020 to 2022 at 4 independent institutions, among 6 spine surgeons. A propensity score matching (PSM) algorithm was employed to control for potential selection bias between percutaneous and open surgery. The minimum follow-up was 90 days. **Results:** After PSM, 336 patients with 2524 robot-assisted screws remained without significant differences in demographics or comorbidities, diagnoses and operative factors. Overall, the patients had a mean (± standard deviation) American Society of Anesthesiologists (ASA) score of 2.3 ± 0.6, body mass index (BMI) of 29.8 ± 5.5kg/m^2, and length of stay (LOS) of 3.1 ± 1.8 days, and 9.0% were nicotine users. Most common diagnoses were spondylolisthesis (40%), lumbar stenosis (21%) and deformity (15%); mean number of levels fused was 4.0 ± 3.1. Although no difference was found for operative time (195 ± 88 min open, 197 ± 120 min percutaneous; $p = 0.839$), robot time per screw was significantly lower for open (4.3 ± 2.5 min open, 8.3 ± 3.8 min percutaneous; $p < 0.001$). There was no difference in robot abandonment (2.1% open, 0% percutaneous; $p = 0.081$) and screw accuracy (99.1% open, 98.6% percutaneous; $p = 0.307$); however, open was associated with screws not executed owing to registration or unreachability issues (1% open, 0% percutaneous; $p = 0.001$). Intraoperative blood loss was greater for open (301 mL open, 108 mL percutaneous; $p < 0.001$). No difference was observed for intraoperative complications, LOS, 90-day surgical or medical complications, and revision surgery. **Conclusion:** In this prospective, multicentre robot-assisted surgery study, the open approach was associated with shorter robot time per screw, higher robot-related registration or unreachability issues, and greater intraoperative blood loss than the percutaneous approach. Both had high screw accuracy (99%) with no difference in robot abandonment, screw accuracy, LOS, revision surgery and intraoperative or 90-day postoperative complications between groups.

P-96
Abstract ID 124

Opioid use in low back pain is associated with decreased quality of life, increased disability and worse treatment outcomes: a stratified propensity score analysis. ***Eric J. Crawford,[1] Robert A. Ravinsky,[2] Anthony V. Perruccio,[1,3] Peter C. Coyte,[1] Y. Raja Rampersaud.[3,4]*** **From the [1]Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, Ont.; the [2]Department of Orthopaedics & Physical Medicine, Medical University of South Carolina, Charleston, S.C.; the [3]Schroeder Arthritis Institute, University Health Network, Toronto, Ont.; the [4]Division of Orthopaedic Surgery, Toronto Western Hospital, University Health Network & University of Toronto, Toronto, Ont.**

Background: Low back pain (LBP) is extremely common, affecting most adults during their lifetime. Opioids are frequently prescribed in this population, despite little evidence regarding their efficacy. The objective of this study was to determine if opioid use in a primary care LBP cohort is associated with quality of life and treatment outcomes. **Methods:** A retrospective review of the Inter-professional Spine Assessment and Education Clinics (ISAEC) program database, which contains prospectively collected patient-reported outcome data, was undertaken. Patients with LBP without leg-dominant symptoms were selected. Opioid use was determined from patient-reported medication lists at entry to ISAEC. Quality of life was measured with EuroQoL-5 Dimension Questionnaire (EQ-5D) utility scores, and disability was assessed with the Oswestry Disability Index (ODI). Propensity scores for opioid use were calculated for each patient, based on a logistic regression model. Propensity scores were stratified into quintiles and treatment effects of opioid use (change in ODI scores at 6 mo) were determined across each stratum. Overall treatment effect was calculated as a weighted average of treatment effects by strata. **Results:** A review of the ISAEC database identified 1218 patients with LBP, with 211 (17.3%) reporting opioid use at baseline. A multivariable regression analysis identified that patients with reported opioid use had decreased EQ-5D utility scores at both baseline (mean difference [MD] –0.069, 95% confidence interval [CI] –0.103 to –0.036; $p < 0.001$) and 6-month follow-up (MD –0.051, 95% CI –0.086 to –0.015l; $p = 0.006$). Similarly, opioid use was associated with increased patient-reported ODI scores at baseline (MD 6.43, CI 3.48 to 9.4; $p < 0.001$) and follow-up (MD 4.99, 95% CI 1.50 to 8.48; $p = 0.005$). A propensity score analysis demonstrated that patients with reported opioid use had less improvement in their ODI scores at 6-month follow-up (MD –4.12, –6.89 to –1.37; $p = 0.0034$) than patients not reporting opioid use. **Conclusion:** Opioid use in LBP is associated with decreased quality of life, increased disability and worse treatment outcomes and should therefore be avoided. Stratified models of care for LBP should screen referred patients for opioid use and target them with mitigation strategies to reduce opioid use.

P-97
Abstract ID 85

Incidence and management of deep spine surgical-site infections: a systematic review and meta-analysis. ***Millaray***

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Background: Estimates of the incidence of deep surgical site infection (SSI) after spinal instrumentation vary widely, ranging from 1% to 20%. The management of deep SSI can include irrigation and debridement, hardware retention or removal, topical antibiotics, and the use of vacuum dressings. There is little consensus on treatment protocols for deep SSI, despite its prevalence. The purpose of this study was to determine a pooled incidence rate for deep SSI, and to collect and compare available evidence on the surgical management of deep SSI. **Methods:** A search of MEDLINE and Embase databases was performed, and 54 studies were included. Subsequently, a meta-analysis was performed. The primary outcome was the incidence of deep SSI in adult patients who underwent thoracic, lumbar and/or sacral instrumented spine surgery. Secondary outcomes included persistent deep SSI after initial debridement, mean number of debridements and microbiology. Surgical techniques were assessed qualitatively. **Results:** The pooled and bias-adjusted incidence rate was 1.5%, based on 209 347 index procedures. The number of patients with persistent infection requiring additional intervention was 11.5%, while the mean number of debridements was 1.4. Most cultures were gram positive, and *Staphylococcus aureus* was the most common organism, with a pooled incidence rate of 45.5%. Qualitative review showed that there are comparative studies examining hardware management with consensus trending toward implant retention in acute deep SSI. There are very few studies describing fluid type and volume for irrigation, use of vacuum dressings, topical antibiotics, or closure techniques. **Conclusion:** The pooled incidence rate of 1.5% is an important reference point, although there remains significant heterogeneity in infection reporting, even in large-scale studies. There is a high rate of recurrence and unplanned repeat debridement, suggesting that persistent infection is a significant risk, and highlighting the need for standardized treatment protocols.

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Abstract ID 110

Associations of preoperative analgesic use with postoperative pain and disability after spinal surgery for cervical myelopathy and radiculopathy. *Lalita Bharadwaj,[1] Dana El-Mughayyar,[1–4] Erin Bigney,[1–3] Neil Manson,[2–4] Edward Abraham,[2,4,5] Chris Small,[2,4,5] Najmedden Attabib,[2–4] Eden Richardson,[2,3,6] Jill Kearney,[2] Uday Kundap,[2] CSORN Investigators,[6] Jeffrey Hebert.[1]* **From the [1]Orthopaedic Surgery Division, University of New Brunswick, Fredericton, N.B.; the [2]Canada East Spine Centre, Saint John, N.B.; the [3]Horizon Health Network, Saint John, N.B.; [4]Dalhousie Medicine New Brunswick, Saint John, N.B.; [5]Saint John Orthopaedics, Saint John, N.B.; the [6]Canadian Spine Outcomes and Research Network, Markdale, Ont.**

Background: We sought to estimate the effect of preoperative analgesics on postoperative pain and disability in patients with cervical myelopathy and radiculopathy. **Methods:** In this retrospective cohort study, we included data from patients enrolled in the Canadian Spine Outcomes and Research Network, who were aged 18 years or older and had undergone spine surgery for degenerative cervical myelopathy and radiculopathy. Patients reported if they used the following preoperative analgesics: over-the-counter, nonsteroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, neuroleptics and opioids. The study outcomes were pain-related disability, neck pain and arm pain, measured before surgery and 3 and 12 months after surgery. Disability was measured using the 0–100 Neck Disability Index (NDI), and neck and arm pain intensity were measured using 0–10 numeric pain rating scales. We modelled propensity score models using inverse probability weighting and regression adjustment to account for potential confounding due to age, sex, education, smoking, depression risk, and baseline pain or disability. **Results:** We included data from 706 patients (39.1% female; mean age 59.0 [± standard deviation 12.0] yr) with cervical myelopathy and 629 patients (42.9% female; mean age 50.8 ± 9.81 yr) with cervical radiculopathy. There were no significant effects of preoperative analgesics on neck pain and disability outcomes measured at 3 months for both populations. However, patients with cervical radiculopathy who consumed narcotics experienced significantly reduced arm pain (mean difference [MD] –0.54, 95% confidence interval [CI] –0.97 to –0.11) 3 months after surgery, compared with nonusers. Similarly, compared with nonusers, patients with cervical myelopathy who consumed muscle relaxants (MD –0.61, 95% CI –1.09 to –0.13) experienced significantly reduced arm pain, 3 months after surgery. There were no significant effects of preoperative analgesics on 12-month outcomes of neck pain, arm pain and disability for patients with cervical myelopathy and radiculopathy. **Conclusion:** Preoperative use of narcotics and muscle relaxants significantly reduced arm pain 3 months after surgery for patients with cervical radiculopathy and myelopathy, respectively. However, these effects are not clinically important. This information can help guide health care providers and patients to make informed decisions about preoperative analgesics use for patients with symptomatic cervical myelopathy and radiculopathy.

P-100
Abstract ID 42

Cervical myelopathy and social media: a mixed-methods analysis. *Lior M. Elkaim,[1] Jordan J. Levett,[2] Farbod Niazi,[2] Rakan Bokhari,[1] Naif M. Alotaibi,[3] Oliver J. Lasry.[1]* **From the [1]Department of Neurology and Neurosurgery, McGill University, Montréal, Que.; the [2]Faculty of Medicine, Université de Montréal, Montréal, Que.; [3]King Fahd Medical City, Riyadh, Saudi Arabia.**

Background: This manuscript describes the landscape of social media use and degenerative cervical myelopathy (DCM) in patients, caretakers, clinicians, and researchers. **Methods:** A comprehensive search of the entire Twitter application programming interface (API) database from inception to March 2022 was performed to identify all Tweets about DCM. Data on the Tweet user included geographic location, number of followers and number of

Tweets. The number of likes, reTweets, quotes and total engagement was collected. Tweets were also categorized according to their underlying themes. A natural language–processing algorithm was used to assign a polarity score, subjectivity score and analysis label to each Tweet for sentiment analysis. **Results:** Overall, 1859 unique tweets from 1769 accounts met inclusion criteria. The highest frequency of Tweets was seen in 2018 and 2019 and decreased significantly in 2020–2021. Most (50.3%) of the Tweets were written by authors in the United States, United Kingdom or Canada. Account categorization showed that 37.8% of users discussing DCM on Twitter were medical doctors or researchers, 23.5% were patients or caregivers, and 11.4% were news media outlets. Tweets most often discussed research (40.9%), followed by spreading awareness or informing the public on DCM (30.1%). Tweets describing personal patient perspectives of living with DCM were seen in 15.9% of posts, with 24% of these discussing upcoming or past surgical experiences. Few Tweets were related to advertising (1.7%) or fundraising (0.4%). Overall, 847 (45.6%) Tweets were classified as neutral, 717 (38.6%) as positive and 295 (15.9%) as negative. **Conclusion:** When categorized thematically, most Tweets are related to research, followed by spreading awareness or informing the public on DCM. Almost 25% of Tweets describing patients' personal experiences with DCM discuss past or upcoming surgical interventions. Few posts pertain to advertising or fundraising. These data can help identify areas for improvement of public awareness online, particularly regarding education, support and fundraising.

P-101
Abstract ID 24

The use of machine learning to predict the presence of cauda equina syndrome among patients with disc herniation. ***Vincent Bissonnette, David Yen.*** **From the Department of Surgery, Queen's University, Kingston, Ont.**

Background: The objectives of this study were to identify the factors that help differentiate between patients with and without cauda equina syndrome, and to use machine learning algorithms to predict whether patients with disc herniation have cauda equina syndrome. **Methods:** A retrospective chart review was performed for patients for whom an orthopedic consultation was requested for possible cauda equina syndrome. Important factors that could potentially differentiate between patients with and without cauda equina were identified through literature research and expert opinion of spine surgeons. These factors were then normalized and selected using an analysis of variance (ANOVA) feature selection technique on the classification learner application in MATLAB. Machine learning algorithms were then trained and tested using 5-fold cross-validation. **Results:** Of patients for whom the orthopedic service was consulted for possible cauda equina syndrome, 42 were identified in the retrospective chart review. Of these, 25 had the available documentation to be included in the study; 23 factors were identified as potentially being helpful in differentiating between individuals with and without cauda equina syndrome. Using the ANOVA feature selection technique, we identified 6 factors to differentiate between patients with and without cauda equina: magnetic resonance imaging–reported findings, history of previous lumbar stenosis, saddle anesthesia, obesity, power examination and sensation examination. Machine learning algorithms were trained on these 6 factors and tested using 5 fold cross-validation on the classifier learner application in MATLAB. The artificial neural networks (ANN) and Ensemble (Subspace k-nearest neighbours [KNN]) algorithm provided the best accuracy at 92%. **Conclusion:** Machine learning algorithms could potentially help identify important factors to help differentiate between patients presenting with and without cauda equina syndrome. Further studies with larger data sets should be performed to identify the most critical factors to help differentiate between patients with and without cauda equina.

P-102
Abstract ID 112

A systematic review of the content and structure of composite end points in spine surgery interventional trials. ***Varun S. Muddaluru,[1] Pranjan Gandhi,[2] Alexander Mastrolonardo,[2] Daipayan Guha,[3] Markian A. Pahuta.[4]*** **From [1]Graduate Entry Medicine, Royal College of Surgeons in Ireland, Dublin, Leinster, Ireland; the [2]Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Ont.; the [3]Division of Neurosurgery, McMaster University, Hamilton, Ont.; the [4]Division of Orthopaedic Surgery, McMaster University, Hamilton, Ont.**

Background: Composite end points consist of 2 or more component end points and are commonly used in clinical trials to define the overall success of an intervention. The use of composite end points results in higher event rates and statistical precision, thereby decreasing the required sample size for a clinical trial and mitigating costs. The objective of this study was to characterize and collate the use of composite end points in spine surgery intervention studies. **Methods:** An electronic librarian-assisted search of the Cochrane Central Register of Controlled Trials (CENTRAL) from inception to Aug. 5, 2022, was used to identify publications on spine surgery. Comparative studies reporting original research in English language on interventions relevant to spine surgery were included, of which 1569 titles and abstracts were independently screened for eligibility by 2 reviewers using the online platform Covidence (Melbourne, Australia). Two reviewers independently extracted study data for each study selected for inclusion. **Results:** In total, 49 comparative studies (47 randomized controlled trials and 2 nonrandomized controlled trials) were identified for the following interventions: cervical total disc replacement (21 studies), lumbar total disc replacement (10 studies), composite bone graft (5 studies), interlaminar stabilization (4 studies) and other (9 studies). In 83.7% of studies (41/49), the primary end point was a composite outcome. Composite outcomes most commonly consisted of 4 component outcomes (22/49 studies [44.9%]), with a range of 2 to 10 component outcomes. Within studies that have multiple composite outcomes, using a higher number of component outcomes to define overall success of an intervention decreased the success rate of intervention at various postoperative follow-up time points. Finally, there has been an increasing trend in the use of composite outcomes to determine the overall success of an intervention, with 11 studies (22.4%) incorporating composite outcomes before 2010, and 38 studies (77.6%) after 2010. **Conclusion:** Establishing standardized composite end points for

various spine surgery interventions that are evaluated at similar time points will provide valuable data for critically evaluating and comparing the success of similar interventions.

P-103
Abstract ID 106

Surveying the knowledge and attitudes of moving to a high-quality, low-carbon health care system. ***Sean D. Christie, Trevor Vandertuin, Gillian Ritcey, Daniel Rainham.* From the Division of Neurosurgery, Dalhousie University, Halifax, N.S.**

Background: The Canadian health system is the third-most carbon-intensive health system in the world, contributing up to 5% of total national emissions. If Canada is to achieve its carbon-neutrality goals by 2050, the health care sector must be involved. This study focused on the attitudes and interests of patients, practitioners and administrators, to get a broad picture of the current attitude and opinion on this subject. **Methods:** We conducted a multiphase study incorporating electronic surveys (health care practitioners), a hard-copy survey (patients attending clinic), and a series of structured interviews (leaders and administrators) within the health care sector in Nova Scotia. Surveys and the interview script differed in form, but addressed the same topics. Survey results were compared descriptively, with categorical variables being expressed as frequencies and percentages, and continuous variables as means and standard deviations. Level of knowledge on and interest in each specific topic was assessed statistically to determine strength of association between specific responses and collected demographics. Interview responses were subjected to qualitative analysis via coding based on pre-established themes. **Results:** Nearly all respondents agreed that health care organizations and professionals should play an important role in reducing the environmental impact of care delivery. Most physicians (77.4%) agreed or strongly agreed that health care delivery organizations should reduce the environmental harms of health care by decreasing greenhouse gas emissions. Conversely, 79.0% of patients either believed the health care sector made no contribution to climate change or were not aware of the issue. Several opportunities for improvement were identified, including waste reduction, upgrading facilities and virtual care, which 79.7% of practitioner respondents felt would have a positive impact. Respondents also identified several barriers to change including low morale, lack of funds and government failure to create resources for change. **Conclusion:** There is broad agreement among health professionals, patients and decision-makers that there are opportunities for the health care sector to reduce carbon emissions and impacts on the environment.

P-104
Abstract ID 125

Variability in treatment of adult spinal deformity, a Canadian survey. ***Mamdoh Albawsawi,[1,2] Robail Mumtaz,[3] Mark Abdelnour,[3] Feras Qumquji,[1,2] Alex Soroceanu,[4] Ganesh Swamy,[4] Kenneth Thomas,[4] Eugene Wai,[3] Philippe Phan.[3]* From [1]King Saud Medical City, Riyadh, Saudi Arabia; the [2]Ottawa Civic Hospital, Ottawa, Ont.; the [3]Ottawa Hospital, Ottawa, Ont.; [4]Foothills Medical Center, Calgary, Alta.**

Background: The objectives of this study were to survey Canadian spine surgeons on their approach to adult spinal deformity (ASD) and to extract research questions of interest for Canadian spine surgeons on the topic of ASD. **Methods:** An online survey was developed, asking surgeons about their educational background, experience and surgical practice. Questions about approach to conservative treatment, handling of osteoporosis and surgical strategies related to spinal deformity were then presented. Finally, 4 clinical vignettes with common ASD pathologies were presented: namely, high-grade isthmic spondylolisthesis, adolescent idiopathic scoliosis in adults, flatback syndrome and adult degenerative scoliosis. For each of those pathologies, surgeons were asked their surgical strategy (approach, levels of fusion, minimally invasive spine surgery v. open), the classification or guidelines used to guide their treatments, and what questions they would like answered concerning this pathology. An invitation to all Canadian Spine Society members was sent with a link to the survey, which was open for a period of 2 months. Descriptive statistics were used to display the results of the survey. **Results:** Twenty-five surgeons from across Canada participated in the study. There was significant variability in the definition of spine deformity, the approach to the treatment of osteoporosis, the handling of osteoporosis, the evaluation of the deformity intraoperatively and the surgical treatment of each clinical vignette. Most surgeons agreed that complex deformity cases should be approached with 2 surgeons, the use of intraoperative monitoring and a dedicated anesthetist team. For all clinical vignettes, surgeons described research questions that would benefit their practice. **Conclusion:** This survey showed variability in the approach to conservative and surgical treatment of ASD from surgeons across the country, highlighting which areas might benefit from stronger guidelines but also which are the areas of agreement among Canadian surgeons. It allowed us to survey the surgeon population on research questions for ASD, which will be useful for guiding research efforts.

P-105
Abstract ID 83

Anterior cervical hybrid constructs reduce upper adjacent segment hypermobility compared with anterior cervical discectomy and fusion. ***Fenil R. Bhatt,[1] Lindsay D. Orosz,[2] Tarek Yamout,[1] Christopher R. Good,[1] Thomas C. Schuler,[1] Tiffany Nguyen,[2] Ehsan Jazini,[1] Colin M. Haines.[1]* From the [1]Virginia Spine Institute, Reston, Va.; the [2]National Spine Health Foundation, Reston, Va.**

Background: Traditional surgical treatment for symptomatic cervical degenerative disc disease is anterior cervical discectomy and fusion (ACDF). However, there is increased risk of adjacent segment degeneration requiring additional surgery. Disc arthroplasty can preserve physiologic range of motion (pROM), decreasing the need for adjacent segment surgery. For patients with multilevel pathology requiring at least 1-level fusion, there is growing interest in anterior cervical hybrid (ACH) constructs as a partial motion-preserving procedure. The aim of this study was to compare post-operative adjacent segment motion between ACH and ACDF. Secondarily, total global (C2–7) motion, construct motion and alignment parameters were compared between groups. **Methods:** In this single-centre retrospective cohort study, 2- and 3-level ACH and ACDF cases were identified between 2013 and 2021.

Patients with incomplete records, imaging or < 6 months of follow-up were excluded. Degrees of motion (DOM) were analyzed on flexion/extension views using Cobb angles to measure lordosis at C2–C7 (global), constructs, adjacent segments. Pre- and postoperative neutral lateral x-rays were analyzed for alignment parameters: global lordosis, cervical sagittal vertical axis, T1 slope. Differences were determined via independent Student *t* and Fisher exact test. **Results:** Each cohort had 50 patients (2-level: 18 ACH, 20 ACDF; 3-level: 32 ACH, 30 ACDF). Hybrid patients were younger (51 ACH, 59 ACDF; $p < 0.001$) with lower Charlson Comorbidity Index scores (0.8 ACH, 1.7 ACDF; $p < 0.001$). Postoperatively, total ROM across the construct (16.3° ACH, 4.7° ACDF; $p < 0.001$) and total global ROM (38.0° ACH, 28.0° ACDF; $p < 0.001$) were greater in the ACH cohort. Degrees of motion decreased at the construct level were less in the ACH cohort (–10.0° ACH, –18.1° ACDF; $p < 0.001$). Postoperatively, DOM at the upper adjacent segment increased only in the ACDF cohort (–1.3° ACH, 1.6° ACDF; $p < 0.005$). **Conclusion:** Hybrid constructs partially preserved motion across operative levels compared with ACDF constructs. Postoperative total global ROM was greater with ACH constructs and postoperative upper adjacent segment hypermobility was seen only with ACDF constructs, supporting consideration of hybrid surgery in patients with multilevel cervical pathology requiring at least a 1-level fusion.

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Abstract ID 48

A preliminary report of robotic screw insertion in cadaveric vertebrae using the Mazor X system. ***Marcelo Oppermann,[1,2] Shaurya Gupta,[2] Joel Ramjist,[2] Priscila Santos Oppermann,[1] Victor X.D. Yang.[1,2]*** **From the [1]Department of Clinical Neurological Science, Schulich School of Medicine & Dentistry, Western University, London, Ont.; the [2]Department of Electrical Computer & Biomedical Engineering, Toronto Metropolitan University, Toronto, Ont.**

Background: All companies offer "weekend cadaver lab training" and full-time representative availability to ensure proper use of robotic column systems. That might not be enough. We report our experience with the Mazor X (Medtronic) when testing it in our lab. Briefly, Mazor X comprises 3 processes — image acquisition, screw planning and robotic navigation — and 2 methods for carrying them out. In the first, an intraoperative "O-arm" is used to scan the spine and a tracking device. This device, combined with the computed tomography (CT) image, will allow the robotic arm to move under continuous navigation. In the second technique, a preoperative CT scan is used. In this method, tracking is acquired through intraoperative fluoroscopy. The 2 images are merged, and the arm can move while navigating. **Methods:** Our training used pig lumbar vertebrae and human cadaveric spines. Two types of surgical exposure were applied. For the CT/C-arm technique, both minimally invasive surgical (MIS) and open approaches were utilized, whereas only MIS was used for the "O-arm" method. All specimens were CT scanned at the end. The positions of the implants were assessed through a new screw-bone parameter (6 in total), and their values were compared pre- and postoperatively. Differences greater than 2 mm or 5° degrees were considered unacceptable. **Results:** Although 155 screws were implanted (> 50 hr of training), only 38 implants were fit for comparison. Overall, 5 screws had unacceptable parameters (13%). The system showed better precision with the O-arm ($p < 0.001$ v. preoperative CT) and percutaneous ($p = 0.05$ v. open) techniques. The most common reason for inaccuracy was seen on axial planes with medial or lateral screw shifts. **Conclusion:** Our study confirms that the Mazor X robot is accurate but has a long learning curve. Most of the screws in our training (75.4%) were mistakenly placed as a result of improper robot settings. Inappropriate arm mounting position, insufficient planning and imprecise C-arm acquisition interfered negatively with screw implantation. Therefore, we recommend extensive training before considering using the device on patients.

P-107
Abstract ID 54

Invasive brain–computer interface for motor restoration in spinal cord injury: a systematic review. ***Jordan J. Levett,[1] Lior M. Elkaim,[2] Farbod Niazi,[1] Michael H. Weber,[3] Christian Ioro-Morin,[4] Marco Bonizzato,[5,6] Alexander G. Weil.[7]*** **From the [1]Faculty of Medicine, Université de Montréal, Montréal, Que.; the [2]Department of Neurology and Neurosurgery, McGill University, Montréal, Que.; the [3]Department of Orthopaedic Surgery, McGill University, Montréal, Que.; the [4]Service de neurochirurgie, Département de chirurgie, Université de Sherbrooke, Sherbrooke, Que.; the [5]Department of Electrical Engineering and Institute of Biomedical Engineering, Polytechnique Montréal, Montréal, Que.; the [6]Department of Neuroscience and Centre interdisciplinaire sur le cerveau et l'apprentissage, Université de Montréal, Montréal, Que.; the [7]Division of Neurosurgery, St-Justine University Hospital, Montréal, Que.**

Background: In recent years, brain–computer interface (BCI) has emerged as a potential treatment for patients with spinal cord injury (SCI). To our knowledge, this is the first systematic review of the literature on invasive closed-loop BCI technologies for the treatment of SCI in humans. **Methods:** A comprehensive search of PubMed MEDLINE, Web of Science and Ovid Embase was conducted from inception to June 2022, without language restrictions. A registered protocol was followed using Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines. Studies were first screened by title and abstract, then underwent full-text screening for inclusion according to predetermined eligibility criteria. Relevant data at the study level and patient level were extracted. **Results:** Of 8316 articles collected, 19 studies met all inclusion criteria. Data from 21 patients were extracted from these studies. All patients had sustained a cervical SCI and were treated using either a BCI with intracortical microelectrode arrays ($n = 18$ [85.7%]) or electrocorticography ($n = 3$ [14.3%]). To decode these neural signals, machine learning and statistical models were used: support vector machine in 8 patients (38.1%), linear estimator in 7 patients (33.3%), hidden Markov model in 3 patients (14.3%), and other in 3 patients (14.3%). As the outputs, 10 patients (47.6%) underwent non-invasive functional electrical stimulation (FES) with a cuff, 1 (4.8%) had an invasive FES with percutaneous stimulation and 10 (47.6%) used an external device (neuroprosthesis or virtual avatar). Motor function was restored in all patients for each

assigned task. Clinical outcome measures were heterogeneous across all studies. **Conclusion:** Invasive techniques of BCI show promise for the treatment of SCI, but there is currently no technology that can restore complete functional autonomy in patients with SCI. The current techniques and outcomes of BCI vary greatly. Because invasive BCIs are still in the early stages of development, further clinical studies should be conducted to optimize the prognosis for patients with SCI.

P-108
Abstract ID 27

A new cost-effective technique to mimic pedicle screw trajectory in cadavers: a robotic validation study. ***Marcelo Oppermann,[1,2] Joel Ramjist,[2] Shaurya Gupta,[2] Priscila S. Oppermann,[1] Victor X.D. Yang.[1,2]*** **From the [1]Department of Clinical Neurological Science, Schulich School of Medicine & Dentistry, Western University, London, Ont.; the [2]Department of Electrical Computer & Biomedical Engineering, Toronto Metropolitan University, Toronto, Ont.**

Background: Many spine centres with robotic systems conduct cadaver lab training for their surgeons. Unfortunately, this process adds more expenditures to an already costly technique. The implants can cost up to $12 000 (40 screws for each cadaver, at $300 each). We present a new method to check accuracy using a phantom solution for the screw path at a fraction of the cost. **Methods:** Human cadaveric vertebrae were used. The screws were implanted using the Mazor X robotic (Medtronic) and immediately removed. Inside the screw cavity, we injected a customized solution containing 3 mL of contrast (iopromide 77%) and 6 mL of gelatin preparation (10 g powder in 30 mL water). Because the specimens were partially frozen, the texture of the phantom solution became firm in minutes. In the end, we scanned the spines via computed tomography (CT; GE Discovery). We compared the screw dimension (full length and diameter) with the CT image hyperintense appearance inside the vertebra. We assumed that the screw head was in contact with the entry point, so the total length was the dimension of the cortical bone entry point to the region where the contrast ended inside the vertebral body. The diameter was measured in 2 areas: at the pedicle and inside the vertebral body. **Results:** Screws were placed only on the right side of the vertebra to diminish contrast artifacts. Five screws were inserted and removed (2: 4.5 x 35 mm; 3: 5.5 x 45 mm). Comparing the size of the screws against the postinjection image, we noticed a mismatch of less than 2% in the screw length and 5% in the screw diameter. **Conclusion:** Overall, the phantom screw using gelatin solution with contrast is an inexpensive, reliable and easy method to mimic screw positioning for cadaver labs. Two technical notes must be obeyed to avoid unwanted contrast dispersion. First, the solution must be cooled down to achieve high consistency but still able to be injected. The cadaver's inner temperature should be kept below 10° C until the CT scanning process.

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Abstract ID 14

Developments and applications of augmented and virtual reality technology in spine surgery training: a systematic review. ***Youngkyung Jung,[1] Varun Muddalaru,[2] Pranjan Gandhi,[1] Daipayan Guha.[1]*** **From the [1]Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Ont.; the [2]Royal College of Surgeons in Ireland, Dublin, Leinster, Ireland.**

Background: In recent years, there has been a growing global interest in the role of augmented reality in surgical training, accelerated by the limitations on in-person training imposed by the COVID-19 pandemic. However, it remains in its infancy, with a paucity of literature reviewing its validity. To that end, we offer a systematic review of the literature summarizing the role of virtual and augmented reality on spine surgery training. **Methods:** A systematic review of the literature was conducted on May 13, 2022, to identify research published since database inception. PubMed, Web of Science, MEDLINE and Embase were reviewed for relevant studies. Studies from both orthopedic and neurosurgical spine programs were considered. There were no restrictions placed on the type of study, virtual or augmented reality modality, or type of procedure. Qualitative data analysis was performed, and all studies were assigned a Medical Education Research Study Quality Instrument (MERSQI) score. **Results:** The initial review identified 6748 studies, of which 14 were deemed relevant, examining a total of 7 unique augmented or virtual reality systems. These studies had a low to moderate methodological quality with a MERSQI score of 11.6 ± standard deviation 2.0; most studies were conducted at single-centre institutions and half the studies consisted of single cross-sectional groups. Statistical pooling of the data was limited by the heterogeneity of the study designs. **Conclusion:** This review examined the applications of augmented and virtual reality systems for training residents in various spine procedures. As this technology continues to advance, higher-quality, multicentre and long-term studies are required to further the adaptation of virtual and augmented reality technologies in spine surgery training programs.

P-110
Abstract ID 80

Comprehensive accuracy analysis of robotic models in spine surgery: a pooled analysis of 14 462 screws. ***Robert Koucheki,[1] John-Peter Bonello,[1] Aazad Abbas,[1] Johnathan R. Lex,[2] Nicholas Nucci,[3] Cari Whyne,[4] Albert Yee,[2,5] Henry Ahn,[2,6] Joel Finkelstein,[2,5] Jeremie Larouche,[2,5] Stephen Lewis,[2,7] Jay Toor.[2]*** **From the [1]Faculty of Medicine, University of Toronto, Toronto, Ont.; the [2]Division of Orthopaedic Surgery, University of Toronto, Toronto, Ont.; the [3]Division of Orthopedic Surgery, University of Ottawa, Ottawa, Ont.; the [4]Sunnybrook Holland Musculoskeletal Research Program, Toronto, Ont.; the [5]Sunnybrook Health Sciences Centre, Toronto, Ont.; the [6]St. Michael's Hospital, Toronto, Ont.; the [7]Toronto Western Hospital, Toronto, Ont.**

Background: This analysis attempts to evaluate the literature on robot-assisted spine surgery to compare prominent robotic models, using conventional techniques (free-hand or fluoroscopy) and nonrobotic navigation as common controls. **Methods:** Literature searches were performed using 4 major databases. All

level 3 or higher studies comparing robot-assisted surgery with free-hand or fluoroscopic screw placement, or nonrobotic navigation were included. Participants were adult patients undergoing spinal instrumentation surgery at any spinal level. The primary objective of this study was to compare screw placement accuracy and incidence of breaches by various robot models. Included studies must have had computed tomography confirmation of screw trajectory. **Results:** A total of 3404 patients underwent spinal instrumentation surgery, of whom 1279 had robotic surgery, 1573 were treated with conventional techniques and 552 with nonrobotic navigation. There were significantly fewer overall breaches in the robotic group than in the conventional group (odds ratio [OR] 0.54, 95% CI 0.39–0.76, $p = 0.0004$; $I^2 = 81\%$, random effect model [REM]). When using conventional techniques as common control, the TiRobot and Renaissance (Mazor) had the best overall accuracy. When interpreting these findings, it should also be noted that 60% of TiRobot studies and 30% of SpineAssist (Mazor) studies had potential conflicts of interest. Compared with nonrobotic navigation, robotic surgery had significantly lower rates of major breaches (OR 0.39, 95% CI 0.16–0.98, $p = 0.04$; $I^2 = 62\%$, REM). When using nonrobotic navigation as a common control, no significant differences existed between rates of overall breach between Mazor X (OR 0.28) versus TiRobot (OR 0.41) ($p = 0.26$) or rates of major breach between Mazor X (OR 0.05) versus TiRobot (OR 0.36) ($p = 0.22$). **Conclusion:** Our results indicate that in adults undergoing spinal instrumentation surgery, use of robot-assisted navigation platforms leads to almost significant reduction in rates of overall breach compared with conventional (free-hand or fluoroscopy) and nonrobotic navigation techniques. Mazor X (Mazor), TiRobot and Renaissance (Mazor) emerge as the current leaders in robotic spine surgery.

P-111
Abstract ID 99

Familial chiari malformation: a systematic review. ***Alaina Dhawan,[1] Jillian Dhawan,[1] Ajay N. Sharma,[2] Daniel B. Azzam,[3] Ahmed Cherry,[4] Michael G. Fehlings.[5]*** **From the [1]Faculty of Health Sciences, Queen's University, Kingston, Ont.; the [2]Faculty of Health Sciences, University of California, Irvine, Calif.; the [3]Faculty of Health Sciences, Tufts University, Boston, Mass.; the [4]Division of Orthopaedic Surgery, University of Toronto, Toronto, Ont.; the [5]Division of Neurosurgery, University of Toronto, Toronto, Ont.**

Background: Chiari malformations (CM) are a group of congenital or acquired disorders characterized by hindbrain overcrowding into an underdeveloped posterior cranial fossa. CM1 is considered sporadic; however, strong evidence exists for genetic underpinnings. The purpose of the study was to conduct the first and largest (to our knowledge) systematic review on all familial CM studies to 1) investigate the existence of an inherited component of CM, 2) identify symptom and comorbidity patterns, and 3) provide recommendations to manage and monitor at-risk family members. **Methods:** A total of 27 articles comprising 89 total familial CM cases were identified through a systematic literature review on PubMed on May 4, 2022. Study design, patient clinical details, familial relationship and surgical intervention outcome data were extracted and summarized from each study. **Results:** An average of 2.9 cases of CM were found per family among all generations. Chiari malformations spanned an average of 2 generations with an average tonsillar descent of 8.89 mm below the foramen magnum. Of all cases, 81% reported CM1, with the remaining (19%) reporting either CM0, CM1, CM1.5, CM2 or tonsillar ectopia. Of the 38% cases identified with a syringomyelia, 44% also reported a skeletal disorder. The most common comorbidities include skeletal abnormalities (Ehlers–Danlos, scoliosis, autosomal dominant spondyloepiphyseal dysplasia tarda) (31%), obstetric complications (10%) and endocrinopathies (7%). Most familial members with CM were found in the same generation as siblings (58%), of whom half were monozygotic twins (29%). Patients most often presented with generalized (nausea, weakness, headaches: 36%), sensory (paresthesia: 25%), or visual (nystagmus, diplopia: 20%) symptoms. **Conclusion:** This review highlights possible pathogenic factors, common comorbidities and distinct generational tendencies among families with CM. Rather than a classic Mendelian inheritance pattern, we suspect a polygenic architecture influenced by variable penetrance, cosegregation and nongenetic factors. We suggest closer clinical and radiographic monitoring, heightened patient education and consideration of genetic testing for first-degree relatives of those affected by CM. Future research involves stratifying CM according to co-occurring genetic disorders (skeletal or cranial, endocrine, neurologic, ophthalmic) to investigate a common affected gene.

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Abstract ID 31

Ninety-day complication and revision surgery rates using navigated robotics in thoracolumbar spine surgery. ***Lindsay D. Orosz,[1] Nathan J. Lee,[2] Tarek Yamout,[3] Jeffrey L. Gum,[4] Ronald A. Lehman,[2] Gregory T. Poulter,[5] Colin M. Haines,[3] Ehsan Jazini,[3] Christopher R. Good.[3]*** **From the [1]National Spine Health Foundation, Reston, Va.; the [2]Columbia University Medical Center, New York, N.Y.; the [3]Virginia Spine Institute, Reston, Va.; the [4]Norton Leatherman Spine Center, Louisville, Ky.; [5]OrthoIndy, Indianapolis, Ind.**

Background: Individually, robotic guidance and real-time 3-dimensional (3D) navigation assistance have been shown to improve surgical outcomes and accuracy in spine surgery. The more recent pairing of these technologies may further improve outcomes; however, data are needed to support this expectation. This large, prospective, multicentre cohort study focuses on outcomes associated with thoracolumbar spine surgery using an integrated robotic and navigation surgical platform. This study reports on 90-day complications and revision surgeries using a bone-mounted robotic with navigation confirmation platform. **Methods:** Adults undergoing navigated robotic thoracolumbar surgery from 2020 to 2022 were prospectively enrolled by 6 surgeons at 4 distinct centres across 3 regions in the United States. Each surgeon had advanced experience with using navigation and robotics. Medical, surgical and robot-related complications and revision surgeries were collected to 90 days. Demographics and outcomes were analyzed for means and frequencies. **Results:** Of 411 surgeries, 3469 screws were implanted (82.9% pedicle,

17.1% cortical). Most patients (93.4%) underwent interbody fusion, 56.2% staged and 43.8% single day (52.8% posterior, 40.6% anterior–posterior[AP] flip, 6.7% AP single position). Mean (± standard deviation) levels fused were 4.4 ± 3.7 and revision cases were 6.3%. Most frequent diagnoses were spondylolisthesis (37.2%) and spinal deformity (22.1%). Average American Society of Anesthesiologists score was 2.3 ± 0.6, Charlson Comorbidity Index score was 0.49 ± 1.0, body mass index was 29.6 ± 5.7 kg/m^2, and 11.9% of patients were nicotine users. Intraoperative adverse events occurred in 4.1%, 0.5% robot-related (1 durotomy, 1 implant-related). The frequency of patients with at least 1 postoperative complication was 21.7%. Unique complications were 6.6% surgical (19.4% before discharge, 38.7% within 2 weeks, 41.9% by 90 days), 18.2% medical (36.1% before discharge, 43.3% within 2 weeks, and 20.6% by 90 days), and 0% robot-related. Revision surgery rate at 90 days was 1.5%, none being robot-related. **Conclusion:** This study demonstrates that experienced users of an integrated navigation and robotic spine platform achieve low complication and revision surgery rates during thoracolumbar spine surgery. We found 4.1% intraoperative complications (0.5% robot-related), 21.7% with any postoperative complication (6.6% unique surgical, 0% robot-related), and 1.5% revision surgeries (0% robot-related).

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Abstract ID 111

Which baseline clinical factors and clinical indications are most correlated with outcome after lumbar fusion surgery? ***Barzany B. Ridha, Amit Persad, Daryl Fourney*. From the Orthopaedic Surgery Division, University of Saskatchewan, Saskatoon, Sask.**

Background: In lumbar fusion surgery, the association between baseline patient characteristics that predict long-term pain and clinical indication is variable in the literature. The Saskatchewan Spine Pathway classification (SSPc) is a reliable and valid clinical classification system that informs the clinical indication for lumbar fusion surgery. The objective of this study was to evaluate which clinical factors and which of 4 SSPcs correlate most with longer-term patient self-reported pain, functional outcomes, or quality-of-life scores after lumbar spine fusion. **Methods:** A retrospective review of 263 adults (aged ≥ 18 yr) who underwent elective lumbar fusion surgery between 2011 and 2019 was performed. Each patient had a SSPc assigned. Baseline and follow-up outcome measures used to quantify pain and quality of life included the Oswestry Disability Index (ODI), EuroQol Group 5-Dimension Self-Report (EQ-5D), and visual analogue scale (VAS) scores for back and leg pain. Outcomes were evaluated at 6–8 weeks and 18–24 months postoperatively. Multiple linear regression analysis was performed to quantify the extent and prevalence of significant differences between outcome measures and SSPc classifications. Minimal clinically important difference (MCID) was also calculated to identify the extent of clinically significant symptom improvement depending on SSPc. **Results:** In our multiple linear regression model, SSPc1 was significantly associated with improved VAS back scores, and SSPc3 with better VAS leg scores. Furthermore, of the baseline patient characteristics, opioid use predicted worse VAS back scores. For ODI outcomes, there was a statistically significant improvement of outcomes for patients with a diagnosis of SSPc1 or SSPc3. MCID analysis showed a greater proportion of patients with a SSPc1 reached VAS leg MCID. In patients with an SSPc3 or SSPc4, a greater proportion reached VAS back MCID. **Conclusion:** This study shows that certain SSPc classifications are associated with improved pain and functional outcomes, whereas certain personal characteristics are associated with worse pain outcomes postoperatively. This research suggests an association between clinical indication for lumbar fusion surgery and outcomes exists.

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Abstract ID 92

Characterization of the mechanical state of human mesenchymal stem cells on micro- or nano-textured Ti6Al4V surfaces. ***Elizabeth Byers*,[1] *Michelle Gallagher*,[2] *James Sugar*,[2] *Justin L. Brown*.[1] From [1]Biomedical Engineering, Pennsylvania State University, University Park, Pa.; [2]Medtronic, Memphis, Tenn.**

Background: Titanium with engineered surface textures has shown improved rates of osteogenic differentiation and mineralization by human mesenchymal stem cells (hMSCs) in vitro. These cellular processes may be controlled via signalling pathways stimulated as cells interact with the external environment through force-transmission complexes (FTCs). Mechanosensitive cell attachment sites (i.e., focal adhesions [FAs], adherens junctions [AJs]) help facilitate cellular adaptation to substrate texture and initiate signalling cascades via mechanotransduction. However, FAs and AJs are highly dynamic, transient and still poorly understood. To study how surface texture can influence mechanotransduction, we investigated differences in mechanosensitive complex distribution in hMSCs on titanium alloys with varied topographies. **Methods:** Ti6Al4V (Ti) alloy, anodized Ti6Al4V (AT), Ti6Al4V with macro-micro rough (MM) surface and Ti6Al4V with macro-micro-nano rough (MMN™) surface were seeded with hMSCs in growth media (α-MEM, 10% fetal bovine serum, 1% P/S) at 37°C and 5% CO_2. Samples were stained at hours 3 and 24 and day 7 with phalloidin (cytoskeleton), DAPI (nuclei), and antibodies for representative proteins of 3 different FTCs or fixed for scanning electron microscopy. Fluorescence microscopy was used to qualify localization and prevalence. To quantify FTCs, sample lysates at each time point were analyzed for structural and cytoskeletal proteins via western blotting. **Results:** Scanning electron microscopy and immunostaining results showed hMSCs adopted spindle-like morphologies on MM, which shifted to stellate morphologies on MMN™. MMN™ FA distribution was uniform throughout the cell body as compared with MM. Nontextured Ti and AT developed flat hMCs and monolayers by day 7, correlating with more AJ prevalence, which was largely absent on MM and MMN™. The cell cortex FTC does not yet appear to be affected by topography. **Conclusion:** These results demonstrate that hMSC morphology and mechanical complex structure is affected by surface topography. Greater understanding of surface features and mechanosensitive complexes' interactions is an important step in rationalizing biomaterial design. By intelligently selecting materials with particular properties, signalling pathways can be triggered to improve control over processes such as differentiation and tissue formation.

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Abstract ID 72

Short-term outcomes associated with the use of macro–micro–nano rough Ti6Al4V (nanoLOCK) interbody cages in patients with lumbar spine degenerative conditions. ***Zhi Wang, Jesse Shen, Ghassan Boubez, Fidaa Al-Shakfa, Sung-Joo Yuh, Daniel Shedid, Maroun Rizkallah.*** **From the Centre hospitalier universitaire de l'Université de Montréal, Montréal, Que.**

Background: In lumbar degenerative disease (LDD), interbody fusion involves inserting cages to reach indirect decompression, correction of spine malalignment, and increased fusion. The chosen material and topography are key factors influencing early events after implantation. Although basic science trials have demonstrated favourable results, no clinical studies have evaluated outcomes associated with the use of nanoLOCK interbody cages. **Methods:** This retrospective study included consecutive patients with LDD who underwent decompression and fusion using nanoLOCK interbody cages (Medtronic) with a minimum 6-month follow-up. This cohort was matched (2/1) for age, sex, weight and level of fusion with patients who received peek cages. Anterior disc height (ADH [mm]), posterior disk height (PDH [mm]), disc lordosis (DL [0]) and segmental lordosis (SL [0]) were measured on x-rays and compared between groups preoperatively, postoperatively and at 6 months. A 2 mm loss in ADH or PDH at last follow-up was considered to be a subsidence. **Results:** A total of 79 cages (28 nanoLOCK v. 51 peek) were included. In the nanoLOCK group, ADH went from 6.04 mm to 12.68 mm postoperatively ($p < 0.01$), then to 12.43 mm at 6 months ($p = 0.37$); PDH changed from 3.89 mm to 6.57 mm postoperatively ($p < 0.01$), then to 6.71 mm ($p = 0.77$); DL went from 6.39° to 11.81° postoperatively ($p < 0.01$), then to 10.76° ($p = 0.027$); SL went from 15.56° to 17.78° postoperatively ($p = 0.05$), then to 18.8° ($p = 0.23$). In the peek group, ADH went from 4.73 mm to 8.82 mm postoperatively ($p < 0.01$), then to 6.96 mm ($p < 0.01$); PDH changed from 3.54 mm to 5.57 mm postoperatively ($p < 0.01$), then to 4.38 mm ($p < 0.01$); DL went from 4.11° to 6.16° postoperatively ($p = 0.02$), then to 5.81° ($p = 0.59$); SL went from 13.32° to 15.45° ($p = 0.04$), then to 12.67° ($p = 0.04$). Of cages, 2/28 showed subsidence at 6 months follow-up in the nanoLOCK group compared with 30/51 in the peek group ($p < 0.01$). **Conclusion:** NanoLOCK technology, which in laboratories facilitated robust interaction between the implant and surrounding end plates, led clinically to better correction, stronger fixation and increased cage stability. The disc heights and lordosis angles reached postoperatively in the nanoLOCK group were maintained at 6 months follow-up, contrary to what was witnessed in the peek group.

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Abstract ID 127

Introduction of a novel concept to decompress foramen magnum in chiari-1 malformation without affecting stability. ***Manmohan Singh, Pankaj Kumar Singh.*** **From the All India Institute of Medical Sciences, New Delhi, Delhi, India.**

Background: Chiari-1 malformation that has crowding at the craniovertebral junction is treated by foramen magnum decompression (FMD) but is associated with high failure rates. The recently introduced concept of central instability explains this. We propose a newer concept to relieve the crowding without affecting stability by coring out of the internal surface of the C1 posterior arch, instead of complete laminectomy accompanying FMD. **Methods:** We prospectively included 9 patients with a mean (± standard deviation) age of 25.33 ± 7.97 years diagnosed with chiari-1 without Atlanta axial dislocation, who were operated with FMD with lax duraplasty and C1 laminectomy. The preoperative dural diameter and area covered under dura at the level of C1 were measured and compared from the postoperative state. Results were analyzed to derive a cut-off threshold, which can be drilled from the inner aspect of the C1 arch. **Results:** The postoperative anteroposterior (AP) diameter of dura increased statistically significantly from the preoperative status; however, the AP extension was less than the preoperative diameter with posterior arch included. Likewise, the area spanned by the dura increased statistically significantly from before surgery but was less than the cumulative area of the dura with the C1 arch included preoperatively. In the final analysis, a mean cut-off of 50.58% was achieved. **Conclusion:** We suggest FMD with partial coring (approximately 50%) of the inner part of arch of the C1, instead of full-thickness laminectomy with a wider area of coring as the target, and this will serve the intended purpose, without affecting stability.

P-117
Abstract ID 57

Minimally invasive tubular lumbar decompression without fusion in lumbar stenosis with underlying deformity: Friend or foe? ***Peyton Lloyd Lawrence,[1] Shevaughn Dell,[1] Ronette Goodluck-Tyndall,[1] Kevin Wade,[1] Mark Morgan,[2] Carl Bruce.[3]*** **From the [1]University Hospital of the West Indies, Kingston, Jamaica; the [2]Kingston Public Hospital, Kingston, Jamaica; the [3]Department of Surgery, University of the West Indies, Jamaica.**

Background: We performed an institutional audit of clinical outcomes in patients who underwent minimally invasive tubular decompression *without* fusion for lumbar spinal stenosis with or without low-grade degenerative spondylolisthesis or flat back syndrome. **Methods:** Patients with medically refractory spinal stenosis with or without low-grade degenerative deformity were prospectively and retrospectively assessed between 2019 and 2022 at the University Hospital of the West Indies. They were assessed on the basis of pain on the numeric pain rating scale (NRS) and lower extremity–related activities of daily living (ADLs) before and after undergoing minimally invasive tubular lumbar microdiscectomy without fusion. The patients were interviewed in person and by telephone questionnaire, using standard NRS and ADLs checklists starting from 6 weeks postoperatively. Excluded patients were those with high-grade degenerative spondylolisthesis (DS) or dynamic DS on flexion–extension lumbosacral spine x-rays. Predominance of back pain in the history in the absence of dynamic instability on imaging did not influence the decision to fuse. **Results:** To date, 87.5% of patients have demonstrated improvement in NRS versus 62.5% improvement in ADLs. The range of improvement in NRS was found to be 30%–100%, whereas the

range of improvement in ADLs was 17%–50%. There has been no record of worsened mechanical back pain or worsened ADLs. **Conclusion:** The long-standing view that decompression should accompany fusion for patients with stenosis and background low-grade degenerative deformity may be challenged by minimally invasive tension band–sparing surgery.

P-118
Abstract ID 64

The role of intraoperative ultrasound in nononcological intradural lumbar spine conditions: intradural lumbar disc herniation and subdural spinal abscess. ***Yan Gabriel Morais David Silva*,[1] *Newton Pimenta*,[2] *Bernard LaRue*,[2] *Salman Aldakhil*,[2] *Jocelyn Blanchard*,[2] *Jerome Couture*,[2] *Julien Goulet*.[2] From the [1]Faculty of Medicine, Université de Sherbrooke, Sherbrooke, Que.; the [2]Surgery Department, Université de Sherbrooke, Sherbrooke, Que.**

Background: Intraoperative ultrasound (IoUS) has long been used in spine surgery to help surgeons in many different situations, such as planning surgeries or confirming decompression status. Here we aimed to discuss the usefulness of IoUS in cases where standard imaging could not help us with a clear diagnosis between intradural or extradural lesions. We reviewed the use of IoUS for intradural pathologies and report 2 rare cases where IoUS was fundamental for surgical results. **Methods:** We conducted a literature review on MEDLINE using the terms "intraoperative, ultrasound and spine surgery." We searched for intradural spine pathologies where the IoUS was helpful. We also describe 2 cases, 1 intradural disc herniation (IdHD) and a spinal subdural abscess (SSA) with acute neurologic deficits. **Results:** A male aged 43 years, under conservative treatment for HD, had a new onset of pain. Magnetic resonance imaging (MRI) with gadolinium enhancement showed an HD with posterior ligament tear and a suspicion of an intradural herniation. Laminectomy was performed and the IoUS was used before dura incision to identify the HD and plan for intradural approach. A female aged 52 years, drug user, presented with fever, mechanical back pain and dyspnea. While she was under treatment for endocarditis, an MRI scan led to suspected spondylodiscitis and epidural abscess. After laminectomy, no abscess was found in the epidural space. IoUS was used to access dural space before durotomy for abscess decompression. **Conclusion:** Several studies show the benefits of IoUS for epidural pathology, intradural tumours in cervicothoracic region, evaluation of decompression and even helping with fracture reduction. Our report is the first, to our knowledge, to address IoUS for 2 rare nononcological intradural conditions, discussing the misdiagnosis in previous MRI and showing an important role for intraoperative evaluation, approach choice and length of durotomy.

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Abstract ID 120

Prospective Prophylactic Antibiotics Regimen in Spine Surgery: the PPARiSS cohort. ***Drew A. Bednar*. From the Orthopaedic Surgery Division, McMaster University, Hamilton, Ont.**

Background: The literature on antibiotic prophylaxis in lumbar spine reconstruction is known to be lacking in quality; it is largely a collection of very small studies and Class 3 data. This deficiency leads to today's commonly accepted practice of a single preoperative dose of antibiotics being considered adequate, in line with the guideline recommendation from the North American Spine Society. In conflict with this practice, wound biology suggests that a new surgical wound should be protected through at least the (first) inflammatory phase of wound healing. **Methods:** The author has followed a very standard practice of extended antibiotics prophylaxis in scheduled adult lumbar reconstructive surgery for well over a decade. All inpatients receive a minimum of 48 hours antibiotics aftercare, extended to 72 hours in the highest-risk insulin-dependent diabetes mellitus and morbidly obese groups. Ambulatory patients are prescribed 5 days of oral antibiotics to be taken at home. A scanning review of surgical practice logs found a frequency of surgical site infection (SSI) far below expectations. Independent review of this finding for validation was ongoing at the time of writing. **Results:** Exactly 1000 cases of scheduled lumbar reconstructive surgery for degenerative disease were reviewed. Fractures, tumours, cases of primary spine sepsis and fixed deformity requiring pedicle subtraction osteotomy were excluded. Only 5 cases of SSI requiring operative debridement (0.5%) were identified. **Conclusion:** In the absence of definitive high-quality data, a surgical practice of extended antibiotics aftercare adhering to what we know of basic wound biology has been highly effective and may substantiate a proper prospective and controlled investigation going forward.

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Abstract ID 70

Decompression versus decompression and fusion in cauda equina syndrome secondary to massive lumbar disc herniation. ***Rubeksh Raj, Jennifer Urquhart, Chris Bailey*. From the London Health Sciences Centre Combined Neurosurgical and Orthopaedic Spine Program, Schulich School of Medicine, Western University, London, Ont.**

Background: The objective of this study was to compare the long-term outcomes between a cohort of patients receiving decompression alone and a cohort of patients receiving decompression and fusion for a cauda equina syndrome (CES) secondary to a massive lumbar disc herniation. **Methods:** This was a retrospective study of patients treated for CES secondary to a massive lumbar disc herniation by the spine surgeons at Victoria Hospital for the years 2005–2015. Billing codes for lumbar decompression with or without fusion were used to identify patients who then had their charts and imaging reviewed to isolate potential patients for recruitment. Patient demographic and patient-reported outcome measures data were then collected and analyzed using a propensity-matched mixed-model repeated measures analysis to compare outcomes between the decompression and decompression and fusion groups. Long-term analysis looked at frequency tables outlining trends in the population. **Results:** Preoperative baseline demographics yielded significant differences for body mass index and surgeon between the 2 groups. There were no significant differences between functional outcome measures at first postoperative follow-up between the groups. High-grade disc herniations all went to fusion ($p < 0.045$) with the remainder of the low grades predominantly decompression. Long-term follow-up showed Oswestry Disability Index, numeric rating scale, and 12-Item Short-Form

Health Survey (SF-12) data consistent with literature results and Canadian normative data. **Conclusion:** Our long-term data, given limitation, showed findings for the decompression cohort alone and, as such, only trends could be ascertained. Certainly there appears to be a general improvement in lower-extremity motor grade and return of lower sacral symptoms compared with preoperative levels, but the initial hypothesis question remains unanswered. As such, further clinical study with a multicentre prospective approach would help illuminate this topic further.

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Abstract ID 105

Implementation of robot-assisted surgery for elective spine surgery. ***Sean D. Christie, Ryan Greene.* From the Division of Neurosurgery, Dalhousie University, Halifax, N.S.**

Background: Robotic-assisted surgery is increasingly prevalent, including within spinal surgery, where it was first introduced in 2004. In its current iteration, robotic assistance is focused on augmenting image-guided instrumentation placement, in either open or minimal access cases. The objective of this study was to describe the adoption and learning curve of spinal robotics within the Canadian context. **Methods:** We describe a single-centre, single-surgeon, prospective cohort defining our early experience with intraoperative robotics. Case mix included single- and multilevel degenerative spondylolisthesis and pedicle subtraction osteotomy. Demographic and anthropometric variables were recorded. Intraoperative variables related to the surgery were collected, including decompression, robot attachment, scanning and instrumentation times. Given hospital privacy issues, all initial cases utilized intraoperative 3D imaging for planning, with subsequent cases utilizing preoperative planning and fluoroscopic registration. **Results:** No cases could be completed as planned. There were 2 instances where accuracy was affected secondary to surgical manipulation, which mandated re-registration. Scanning times were consistent (mean [± standard deviation] 9.75 ± 0.5 min). Planning times were variable and depended upon case complexity (mean 16.25 ± 14.8 min). Mean instrumentation time was 30.5 ± 17.1 minutes and was influenced by 1) the need to re-scan and 2) the placement of the rod, which was longer in the minimal access cases. Procedure times were increased after implementation of each new variable (O-arm to fluoroscopic registration; attending surgeon to trainee placement, etc.). However, across all cases, individual screw placement times consistently decreased from 6 to 2 minutes (mean 3.2 ± 1.2 min) over the first 5 cases. No adverse events were observed. Additional anecdotal observations and surgical pearls will be presented. **Conclusion:** Robotic placement of spinal instrumentation is safe and can be implemented within the Canadian context. Surgical learning curve is fewer than 10 cases.

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Abstract ID 37

Spine surgery in patients with morbid obesity: tips and tricks. ***Jennyfer Paulla Galdino Chaves,[1] Mohammed Zarrabian,[1] Leif Sigurdson.*[2] From the [1]Health Sciences Centre, Spine Fellowship Program, Winnipeg, Man.; the [2]Health Sciences Centre, Plastic Surgery, Winnipeg, Man.**

Background: Patients with obesity are becoming more prevalent in our society, and spine surgery in patients with morbid obesity presents a challenge in several aspects. Our aim is to go beyond the regular discussion on comorbidities and postoperative risks, which is perspicuous in the literature. We provide a comprehensive guide to positioning, image acquisition and surgical tips and tricks. **Methods:** We performed an analysis of surgical cases from 2021 to 2022 and adaptation of intraoperative techniques. **Results:** Alterations necessary in the surgical management of patients with morbid obesity fall into the following categories: positioning, image acquisition, hardware placement, decompression and closure. **Conclusion:** The modifications listed above allow for more efficient and successful surgical management of patients with obesity while minimizing surgical time and ergonomic strain on the surgical staff.

P98
Abstract ID 71

Pelvic incidence is associated with reoperation for adjacent segment disease in degenerative lumbar spinal fusion surgery. ***Ragavan Manoharan, Ahmed Cherry, Carlo Iorio, Nisaharan Srikandarajah, Mark Xu, Aditya Raj, Christopher J. Nielsen, Yoga Raja Rampersaud, Stephen J Lewis.* From the Orthopaedic Surgery Division, Toronto Western Hospital, Toronto, Ont.**

Background: Pelvic incidence (PI) is related to the morphology of the lumbar lordotic arc in asymptomatic patients. We sought to investigate the role of PI in early and late reoperation outcomes after lumbar spinal fusion for degenerative conditions. **Methods:** A retrospective review of patients undergoing short lumbar fusions performed by the 2 senior authors over a 10-year period was carried out. Demographic and radiographic data were compiled and correlation to index level and adjacent level reoperation was explored. **Results:** Data were available for 335 patients with a mean follow-up of 64 months. Most patients had single-level (67%) or 2-level (31%) fusions. Patients were divided into the following subgroups based on PI: low (PI < 45; 12%), average (PI 45–60; 44%) or high (PI > 60; 44%). The male to female ratio was higher in the high PI group (1:1.6) than the other 2 groups (1:0.9 and 1:1.1). The underlying diagnosis was spondylolisthesis in 32% of low PI patients, 74% of average PI patients and 84% of high PI patients. The preoperative distal lordosis (L4–S1) was 28° in the low PI group and 30° in the average and high PI groups. The mean postoperative distal lordosis was unchanged in the low PI group, slightly reduced in the average PI group (–1°) and slightly increased in the high PI group (+2°). The index level reoperation rate for the cohort was 7% and the reoperation rate owing to adjacent segment disease (ASD) was 17% at a mean of 78 months after index surgery. Pelvic incidence was not associated with a higher risk of index level revision. On univariate and multivariate analysis, patients with a low or average PI were at higher odds of reoperation for ASD than those with a high PI (odds ratio 2.8, 95% confidence interval 1.4–5.3; $p = 0.001$). **Conclusion:** Patients with low or average PI are more at risk of adjacent level reoperation after lumbar fusion for degenerative conditions. Further study is required to validate this association and assess for confounders.