bona fide spinal cord NSPCs and their isogenic iPSC-derived counterparts, iPSC-SC and iPSC-Br. Methods: Human spinal cord and skin tissue were obtained with ethics approval to establish primary NSPC cultures. iPSCs were derived from these primary cells and differentiated into iPSC-SC and iPSC-Br NSPCs. Assessments encompassed differentiation, proliferation capabilities, immunostaining, and RNA sequencing for differential gene expression. Results: Functional and transcriptional differences were identified between bona fide NSPCs and iPSC-SC/iPSC-Br. Bona fide and iPSC-SC NSPCs exhibited spinal cord regionalization, while iPSC-Br displayed forebrain regionalization. iPSC-derived NSPCs shared features reminiscent of early developmental stages, including embryonic patterning genes and increased proliferation rates. Notably, differentiation profiles were most similar between bona fide and iPSC-Br, with substantial distinctions observed between bona fide and iPSC-SC. Conclusions: This study unveils unique regional, developmental, and functional characteristics distinguishing spinal cord NSPCs from iPSC-derived counterparts. Addressing these disparities holds promise for enhancing iPSC-derived NSPC therapies in spinal cord injuries, contributing to a deeper understanding of their potential applications in regenerative medicine.

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The growing problem of spine surgery wait times in British Columbia: longitudinal trends and impacts on perioperative outcomes

JC Wang (Vancouver) R Charest-Morin (Vancouver) N Dea (Vancouver) C Fisher (Vancouver) M Dvorak (Vancouver) B Kwon (Vancouver) T Ailon (Vancouver) S Paquette (Vancouver) J Street (Vancouver) C Dandurand (Vancouver)*

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Background: Surgical delays are in common in Canada. Wait times in elective spine surgery and their impact on outcomes remain uncharacterized. Methods: This was a single-center analysis of elective spine surgery data between 2009-2020. Wait times between referral and consultation (T1), consultation and surgical booking (Ti), and booking and surgery (T2) were assessed. Results: 2041 patients were included. Longitudinal analyses were adjusted for age, sex, diagnosis, surgical volume, while outcomes analyses were age and sex-adjusted. Total T1+Ti +T2 increased 8.1% annually ($p<0.001$). T1 decreased 4.3% annually ($p=0.032$). It was not associated with adverse events (AEs) or disposition. Every 100 days of T1 was associated with 1.0% longer hospitalization ($p=0.001$). Ti increased 21.0% annually ($p<0.001$). Every 100 days of Ti was associated with 2.9% increased odds of an adverse event ($p=0.002$), 1.8% longer hospitalization ($p<0.001$), and 15.9% increased likelihood of discharge home ($p<0.001$). T2 increased 7.0% annually ($p<0.001$) and was not associated with AEs. Every 100 days of T2 was associated with 11.6% longer hospitalization ($p<0.001$) and 76.5% increased likelihood of discharge home ($p<0.001$). Conclusions: Total wait times for elective spine surgery have increased between 2009-2020. Notably, Ti increased ninefold and was associated with AEs. This study highlights areas of delay and targets for healthcare optimization.

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Consult and kyphoplasty delay impacts on geriatric vertebral compression fracture outcomes

V Surendran (Hamilton) V Shi (Hamilton) D Kwok (Hamilton) A Martinyuk (Hamilton) M Pahuta (Hamilton) D Guha (Hamilton)*

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Background: Vertebral compression fractures (VCF) lead to both considerable morbidity and increased mortality. Kyphoplasty, a minimally invasive surgery, treats VCFs providing significant pain relief, preserving vertebral height, and reducing spinal deformity. Methods: A retrospective cohort study at Hamilton Health Sciences (HHS) was conducted on elderly patients (60 years or older) who underwent kyphoplasty at between 2012 and 2022. The patients had prior hospital admissions under non-spine-related specialties at HHS within two years before their surgery. Primary outcomes were the progression of vertebral height loss and focal kyphotic deformity. Results: The study included 119 patients (52.1% female, mean age 70.71 years). A significant increase in vertebral height loss was observed from diagnosis to pre-kyphoplasty (0.32% change, $p < 0.0001$) and from diagnosis to post-kyphoplasty (0.24% change, $p = 0.015$). However, there were no significant correlations between delay times and changes in vertebral height or focal kyphotic deformity. Conclusions: Delays in neurosurgical consultation and kyphoplasty did not significantly affect radiographic outcomes in elderly patients with VCF despite the progression of vertebral height loss. This suggests that while timely patient care is essential, delayed treatment may not adversely affect key radiographic metrics in elderly VCF patients.

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Saskatchewan spine pathway classification is associated with post-operative outcome and improved quality-adjusted life years following lumbosacral fusion

B Ridha (Saskatoon) E Liu (Saskatoon) AR Persad (Palo Alto) DR Fourney (Saskatoon)*

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Background: Low back pain (LBP) is a common cause of disability and decreased quality of life. The Saskatchewan Spine Pathway classification (SSPc) is a method for triaging patients who are candidates for surgery. Methods: Consecutive patients who underwent lumbosacral instrumented fusion for degenerative spinal pathology from Jan 1, 2012, to Sept 20, 2018, by a single surgeon at our institution were retrospectively reviewed. Patients were stratified by SSPc into 4 groups based on pain pattern. Demographic and clinical data were collected. Outcomes were compared between cohorts both for absolute values and achieving MCID. Results: 169 consecutive patients were included in our study. After stratifying by SSPc grouping, there were 61 SSPc I patients, 45 SSPc III patients, and 63 SSPc IV patients. Patients in all groups had clinical improvement following surgery. Patients classified as SSPc III had superior outcomes in ODI, EQ-5D and EQ-VAS, and were more likely to achieve the

MCID for ED-5D. Multivariate analysis demonstrated that SSPc grouping is an independent predictor of final VAS back, ODI, EQ-5D, and EQ-VAS as well as achieving the MCID for EQ-5D. Conclusions: The SSPc classification is associated with outcomes following lumbosacral fusion. In particular, patients with SSPc pattern 3 had better outcomes and improved QALY.

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Effect of postoperative pain control and other perioperative risk factors on length of stay after elective spine surgery

R Far (Calgary) S Casha (Calgary) J Riva-Cambrin (Calgary) MM Yang (Calgary)*

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Background: Prolonged length of stay (LOS) after elective spine surgery increases patients' risk for in-hospital complications and contributes significantly to healthcare costs. Here we explored the role of pain control and other perioperative factors on LOS. Methods: Consecutive adult patients undergoing elective spine surgery were enrolled. The primary outcome was in-hospital LOS following surgery. The primary independent variable was poor pain control on postoperative day 1 (POD1). Univariable analyses followed by multivariable regression analysis were used to investigate the relationship between poor pain control and LOS. Results: 1305 patients were enrolled. Mean LOS was 4.38 days. Incidence of poor pain control was 56.9%. Multivariable analysis revealed poor POD1 pain control was significantly associated with increased LOS (p=0.03), after adjusting for other significant predictors of increased LOS including perioperative hemodynamic instability (p=0.001), perioperative blood transfusion (p=0.000), delirium (p=0.000), POD1 morphine equivalent dose (p=0.000), urinary tract infection (p=0.000), urinary retention (p=0.003), surgical site infection (p=0.000), wound complication (p=0.000), neurologic deterioration (p=0.000), surgical levels (p=0.016), operative time (p=0.007), ASA score (p=0.000), preoperative disability score (p=0.001). Conclusions: Poor pain control on POD1 was an independent predictor of increased LOS after elective spine surgery, highlighting the importance of a proactive approach to addressing pain in the immediate postoperative period.

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A critical appraisal of the application of frailty and sarcopenia in the spinal oncology population

MA MacLean (Halifax) AJ Charles (Durham) M Georgiopoulos (Montreal) J Phinney (Halifax) R Charest-Morin (Vancouver) CR Goodwin (Durham) MH Weber (Montreal)*

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Background: Frailty and sarcopenia predict worse surgical outcomes among spinal degenerative and deformity-related populations; this association is less clear in the context of spinal oncology. Here, we identified frailty and sarcopenia tools applied in spinal oncology and appraised their clinimetric properties. Methods: A systematic review was conducted from January 1st, 2000, until June 2022. Study characteristics, frailty tools, measures of sarcopenia, component domains, individual items, cut-off values, and measurement techniques were collected. Clinimetric assessment was performed according to Consensus-based Standards for Health Measurement Instruments. Results: Twenty-two studies were included (42,514 patients). The three most employed frailty tools were the Metastatic Spine tumor Frailty Index (MSTFI), Modified Frailty Index-11 (mFI-11), and the mFI-5. The three most common sarcopenia measures were the L3-Total Psoas Area (TPA)/Vertebral Body Area (VBA), L3-TPA/Height^2, and L3-Spinal Muscle Index (L3-Cross-Sectional Muscle Area/Height^2). Frailty and sarcopenia measures lacked content and construct validity. Positive predictive validity was observed in select studies employing the HFRS, mFI-5, MSTFI, and L3-TPA/VBA. All frailty tools had floor or ceiling effects. Conclusions: Existing tools for evaluating frailty and sarcopenia in surgical spine oncology have poor clinimetric properties. Here, we provide a pragmatic approach to utilizing existing frailty and sarcopenia tools, until more clinimetrically robust instruments are developed.

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In-vivo accuracy of pedicle screws utilizing a supervisory controlled 7DOF robot with OCT guidance

R Johnston (London) M Oppermann (London) V Yang (London)*

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Background: Pedicle screw fixation is an important technique in spine surgery. Violation of the pedicle can lead to neurovascular injury. Due to excellent pose repeatability, robotic technology may improve accuracy. Existing surgical spine robots use surgical assist architecture. This work explores the performance of a supervisory-control architecture robot (8i Robotics) for autonomous pedicle instrumentation. Methods: 3 porcine subjects underwent pedicle instrumentation utilizing the 7dof robot and were observed for 24 hours. Post-operative CT assessed screw location. Screws were graded clinically with the Gertzbein-Robbins Scale (GRS). Precision was assessed by a customized image processing pipeline. Euclidean error was calculated at screw head and screw tip. All points were normalized to a nominal screw, and confidence ellipses generated. Results: All animals were neurologically intact at 24 hours. All screws where GRS A. Mean tip and head Euclidean error where 2.47+/−1.25mm and 2.25+/-1.25mm respectively. Major and minor axes of the confidence ellipse at 99% was 2.19mm, and 1.28mm, and 2.07mm, and 0.42mm for tip and head respectively. Conclusions: 100% of screws obtained satisfactory clinical grading, with intact function in all animals post-operatively. This shows the capability of a supervisory-controlled 7DOF robot with OCT registration. Further investigation is warranted to further explore robotic capabilities, safety, and cost effectiveness.