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Failure Rates and Complications of Interspinous Process Decompression Devices: a European Multicenter Study

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INTRODUCTION: Spacers placed between the lumbar spinous processes represent a promising surgical treatment alternative for a variety of spinal pathologies. They provide an unloading distractive force to the stenotic motion segment, restoring foraminal height, and have the potential to relieve symptoms of degenerative disc disease. The authors performed a retrospective, multicenter nonrandomized study consisting of 1108 patients to evaluate implant survival and failure modes after the implantation of 8 different interspinous process devices (IPDs).

METHODS: The medical records of patients who had undergone placement of an IPD were retrospectively evaluated, and demographic information, diagnosis, and preoperative pain levels were recorded. Preoperative and postoperative clinical assessments in the patients were based on the visual analog scale. A minimum of 3 years after IPD placement, information on long-term outcomes was obtained from additional follow-up or from patient medical and radiological records.

RESULTS: One thousand one hundred eight patients affected by symptomatic 1- or 2-level segmental lumbar spine degenerative disease underwent placement of an IPD. The complication rate was 7.8%. There were 27 fractures of the spinous process and 23 dura mater tears with cerebrospinal fluid leakage. The ultimate failure rate requiring additional surgery was 9.6%. The reasons for revision, which always involved removal of the original implant, were acute worsening of low-back pain or lack of improvement (45 cases), recurrence of symptoms after an initial good outcome (42 cases), and implant dislocation (20 cases).

CONCLUSION: The IPD is not a substitute for a more invasive 3-column fusion procedure in cases of major instability and spondylolisthesis. Overdistraction, poor bone density, and poor patient selection may all be factors in the development of complications. Preoperatively, careful attention should be paid to bone density, appropriate implant size, and optimal patient selection.

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What Is the Effect of Open vs Percutaneous Screws on Complications Among Patients Undergoing Lateral Interbody Fusion for Adult Spinal Deformity?

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INTRODUCTION: This study aims to compare differences in incidence and type of complications (COMP) between circumferential minimally invasive surgery (cMIS, ie MIS transforaminal lumbar interbody fusion [TLIF] and/or lumbar lateral interbody fusion [LLIF] with MIS screws) and hybrid approaches (HYB, ie MIS LLIF ± with open screws).

METHODS: A retrospective review of a multicenter MIS deformity database was performed. Inclusion criteria for this database: age >18 years, and at least one of the following: coronal Cobb angle (CCA) >20, SVA >5 cm, PI-LL >10, and PT > 20. Only patients who underwent cMIS or HYB approaches were included for this study, and were propensity matched by levels instrumented.

RESULTS: Of 420 patients that met inclusion criteria, 165 had complete data. One hundred thirty-seven were available for analysis after excluding 3 column osteotomies and 76 remained after propensity matching (38 cMIS and 38 HYB). There were no differences in demographics, number of levels instrumented (6.8 HYB vs 6.1 cMIS; $P = .622$), and pre- and postoperative radiographic results. HYB had significantly longer OR time (623 vs 490 minutes; $P = .015$) and larger expected blood loss (1396 vs 637; $P = .001$). 55.3% of HYB vs 44.7% cMIS patients experienced at least 1 COMP ($P = .359$). cMIS patients had significantly fewer neurological ($P = .044$), operative ($P = .005$), and minor ($P = .034$) COMPs. Reoperation was similar between groups (28.9% HYB, 26.3% cMIS). The most common COMP for cMIS was radiographic (n = 10; 6 with pseudoarthrosis) and neurological for HYB (n = 11; 8 with radiculopathy). Both groups saw improvement from pre- to postoperative Oswestry Disability Index, visual analog scale (VAS) back and leg (all $P < .05$); however, cMIS had a greater reduction in VAS leg ($P = .002$).

CONCLUSION: The overall COMP rate between cMIS and HYB is similar. cMIS surgery results in significantly fewer neurological, operative, and minor COMPs, Reoperation rates were similar, and, despite complications, patients saw significant improvement in pain and function.

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Predictive Modeling of Length of Hospital Stay Following Adult Spinal Deformity Correction: Analysis of 653 Patients With an Accuracy of 75% Within 2 Days

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INTRODUCTION: The length of stay (LOS) following adult spinal deformity (ASD) surgery is a critical time period allowing for recovery to levels safe enough to return home or to rehabilitation. Thus, the goal is to minimize it for conserving hospital resources and third-party payer pressure. Factors related to LOS have not been studied nor has a predictive model been created. The goal of this study was to construct a preadmission predictive model based on patients' baseline variables and modifiable surgical parameters.

METHODS: Retrospective review of a multicenter, prospective ASD database. Inclusion criteria: operative patients, age >18 years, ASD. Patients with staged surgery at a separate hospitalization or LOS >30 days were excluded. Sixty-six variables were initially evaluated with 40 being used for model building following univariable predictor importance = 0.90, redundancy, and collinearity testing. Variables included: demographics, comorbidities, preoperative health-related quality of life, preoperative coronal and sagittal radiographic parameters, and modifiable surgical factors. A generalized linear model was constructed by using a training data set developed from a bootstrapped sample with replacement using a random number generator. Patients randomly omitted from the bootstrapped sample

composed the testing data set. Accuracy was calculated by comparison of predicted LOS with the actual LOS.

RESULTS: A total of 689 patients were eligible; 653 met inclusion criteria. The mean LOS was 7.9 ± 4.1 days (range: 1-28). Following bootstrapping, 893 patients were modeled in total, Training: 653, Testing: 240 (36.6%). The linear correlations for the training and testing data sets were 0.632 and 0.507, respectively. Testing dataset accuracy within 2 days of actual LOS was 75.4% (181/240 patients).

CONCLUSION: A successful model was created to predict LOS to an accuracy of 75% within 2 days. There are some factors related to LOS that are not likely captured in large databases, which may partially explain the 75% accuracy, such as rehabilitation bed availability and social support resources.

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Reducing Radiation an Order of Magnitude During Fluoroscopic-Guided Kyphoplasty

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INTRODUCTION: Radiation exposure during x-ray intensive medical procedures is a potential health threat to physicians, staff, and patients alike. Simple steps, based around altering the dose settings and pulse rate on a conventional fluoroscope, can reduce radiation over 90% compared with conventional fluoroscopy, but these unfortunately affect image clarity, limiting their utility in clinical practice.

METHODS: Physicians with experience performing kyphoplasty were asked to perform 2 kyphoplasties in cadaveric specimens at adjacent spinal levels. The physicians were blinded, randomly performing identical procedures with either conventional fluoroscopy or 1 pulse/low-dose imaging coupled with image enhancement. The number of images before cement injection and the amount of radiation in mGy for each procedure was recorded.

RESULTS: Seven spine surgeons performed 14 kyphoplasties throughout the thoracolumbar spines of 2 human cadavers. Despite statistically similar number of images with both methods before cement injection (24 Conventional vs 21 Lessray Enhanced, $P = .30$), the pulsed/low-dosed procedures achieved an overall 88.8% radiation reduction over conventional imaging (36.1 mGy vs 4 mGy, $P < .001$).

CONCLUSION: This study demonstrates that setting the c-arm to pulse and low-dose imaging significantly reduces the amount of radiation exposure during a radiation intensive medical procedure when compared with conventional fluoroscopy. By digitally improving low-radiation images, the procedure can progress without altering the steps or the number of images taken. This order of magnitude reduction in radiation can potentially help mitigate the health hazards associated with ionizing radiation.

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Impact of Initial Clinical and Imaging Parameters on Long-Term Neurological Outcomes in Acute Traumatic Cervical Spinal Cord Injury

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INTRODUCTION: The influence of initial clinical and imaging parameters on long-term outcomes following spinal cord injury (SCI) has been examined in previous studies, often with inconsistent or contradictory findings. In this study, we evaluated a comprehensive set of admission parameters and analyzed their relationships with long-term neurological recovery.

METHODS: Institutional databases were used to retrospectively identify consecutive patients with cervical SCI admitted between 2008 and 2015. Admission MR studies were independently examined by 2 reviewers and stratified according to the axial T2 Brain and Spinal injury score (BASIC; score 0-4), length of intramedullary T2 lesion (IML), maximal canal compromise (MCC) and maximal spinal cord compression (MSCC). A combined axial and sagittal score (CASS) was also derived by summing the BASIC and IML scores.

RESULTS: A total of 91 patients with a mean age of 50.9 ± 19.1 years were included. Patients with an injury severity score <25, central cord syndrome, and no associated fracture had comparatively improved neurological recoveries (positive ASIA conversion) at 1 year ($P < .001$). Higher initial BASIC scores and IML length significantly correlated with severe neurological deficits at admission ($r = 0.81$ and 0.72, respectively; $P < .001$) and 1 year ($r = 0.82$ and 0.79, respectively; $P < .001$). Patients with BASIC scores 3 and 4, and IML length >40 mm had decreased chance of neurological recovery ($P = .036$, 0.012, and 0.031, respectively). CASS scores of 4 to 5 and 6 to 7 were similarly associated with higher risk of severe neurological deficit on admission ($P = .010$ and $P < .001$, respectively) and decreased chance of neurological recovery at 1 year ($P = .021$ and $P < .001$, respectively). Neurological outcome parameters were not affected by MCC or MSCC.

CONCLUSION: Taken together, the extent of early axial and longitudinal MRI T2-signal changes appear to reliably correlate with neurological outcomes. The CASS provides a measurement of overall early T2-signal lesion load and appears to sensitively predict neurological recovery at 1-year follow-up.

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Laminoplasty vs Laminectomy With Posterior Spinal Fusion for Multilevel Cervical Spondylotic Myelopathy: Matched Cohorts of Regional Sagittal Balance

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INTRODUCTION: Cervical curvature is an important factor when deciding between laminoplasty or laminectomy with posterior spinal fusion (PSF). This study compares outcomes of laminoplasty and laminectomy with PSF in patients with matched regional sagittal balance.

METHODS: Adults from 2011 to 2014 undergoing laminoplasty or laminectomy with PSF for cervical spondylotic myelopathy were identified. Matched cohorts were obtained by excluding laminectomy with PSF patients with postoperative cervical Cobb angles outside the range of laminoplasty patients. Perioperative and follow-up outcomes were compared. Subgroup analysis of patients with and without preoperative pain was performed.

RESULTS: A total of 145 patients were included in the analysis: 44 laminectomy with PSF and 101 laminoplasty patients were included. Preoperative Nurick scores were similar (2.1 vs 2.2) ($P = .738$). The laminectomy with PSF group had higher preoperative pain rate (77.1% vs 46.5%) ($P = .002$), higher visual analog scale (VAS) (6.8 vs 5.1) ($P = .017$), and less cervical lordosis (5.7 vs 10.1°) ($P = .082$). Laminectomy with PSF had higher blood loss (335.3 vs 198.8 mL) ($P = .001$), longer