

The odds of achieving GO at 5Y in 2+ decreased by 47% for each additional comorbidity and decreased by 74% in those that had lower extremity paresthesias at BL (both $p < .05$). Decreased number of levels fused, decreased correction in SVA and increased correction in PI-LL to be predictive of sustaining 2Y GO till 5Y (all $p < 0.05$).

CONCLUSIONS: Overall, 47% had substantial clinical benefit till 5Y. While 71% of patients at 2Y sustained good clinical outcome till 5Y, major contributors to its loss were adjacent segment changes and rod fracture. The odds of achieving SCB till 5Y decreased by nearly 50% for each additional comorbidity. Decreased levels fused along with decreased correction of SVA and increased correction in PI-LL were predictive of optimal sustaining of clinical outcomes.

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Quantifying the Effect of Fracture Morphology on Nonunion for Traumatic, Isolated Odontoid Fractures Managed Nonoperatively: A Propensity Score Matched Analysis

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INTRODUCTION: Odontoid fractures disproportionately affect older patients who have high surgical risk, but also high rates of fracture nonunion.

METHODS: We examined all patients with isolated odontoid fractures treated nonoperatively at our institution between 2010 and 2020. Multivariable regression and propensity score matching were used to quantify the effect of fracture type, angulation, comminution, and displacement on bony healing by 26 weeks from injury.

RESULTS: 303 consecutive traumatic odontoid fracture patients were identified, of whom 163 (53.8%) had isolated fractures that were managed nonoperatively. Selection for nonoperative management was more likely with older age (OR = 1.45 [1.14, 1.84], $p = 0.003$), and less likely with angulated fractures (OR = 0.31 [0.14, 0.65], $p = 0.002$), or higher presenting Nurick scores (OR = 0.78 [0.63, 0.97], $p = 0.023$). Factors associated with nonunion at 26 weeks were angulated morphology (OR = 16.14 [2.93, 89.00], $p = 0.001$) and Anderson-D'Alonzo Type II morphology (OR = 6.54 [2.16, 19.77], $p = 0.001$). Cox proportional hazards regression demonstrated slower healing time for angulated (HR 0.144 [0.044, 0.377], $p = 0.0003$) and type II fractures (HR = 0.380 [0.214, 0.673], $p = 0.0009$). Propensity score matching to assess the effect of type II fracture, fracture angulation, displacement, and comminution all yielded balanced models (Rubin's B < 25.0, 0.5 < Rubin's R < 2.0). By 26 weeks, controlling for confounders, 77.3% of type I or III fractures healed, compared to 38.3% of type II fractures ($p = 0.001$), and 56.3% of non-angulated fractures healed compared to 12.5% of angulated fractures ($p = 0.015$). Fracture displacement and comminution had no significant effect.

CONCLUSIONS: Type II fracture morphology and fracture angulation significantly increase nonunion among nonoperatively managed isolated traumatic odontoid fractures, but fracture comminution and displacement do not.

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Disc Space Height in Relation to Neural Foraminal Dimensions and Patient Characteristics: A Morphometric Analysis From L1-S1 Using Computed Tomography

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INTRODUCTION: The normative relationship between lumbar intervertebral disc space height (DSH) and neuroforaminal dimensions (NFD) has yet to be defined.

METHODS: Anterior, middle, and posterior DSH were measured on 350 female and 350 male patients between 18 and 35 years of age without spinal pathology. NFD were defined as sagittal anterior-to-posterior (AP) width, axial AP width, foraminal height, and area. Statistical analyses were performed to assess associations among DSH, NFD, and patient height, weight, body mass index, sex, and ethnicity.

RESULTS: DSH measurements demonstrated increasing, linear trends moving caudally from L1-L2 to L5-S1, while NFD demonstrated a unimodal distribution pattern with largest NFD at L3-L4 and smallest NFD at L1-2 and L5-S1. Accounting for confounding due to height, weight, and ethnicity, male patients demonstrated larger DSH compared to female patients across all levels L1-S1 ($p < .001$). Asian patients demonstrated taller DSH compared to Caucasian, Hispanic, and African-American patients across all levels L1-S1 ($p = .014$). Zero moderate or strong correlations were observed between DSH and NFD measurements or patient characteristics for all levels L1-S1, though weight and foraminal height were weakly ($r = .3$) associated with increased DSH ($p < .001$).

CONCLUSIONS: This study describes 38,500 CT-based L1-S1 disc space height and neuroforaminal measurements in young patients without spinal pathology. Among these patients, disc space height follows an increasing trend moving caudally from L1-S1, while foraminal dimensions demonstrate a unimodal distribution clustered at L3-L4. Neuroforaminal dimensions, including foraminal height, are not moderately or strongly associated with disc space height. Disc space height is influenced by sex and ethnicity but is not moderately or strongly influenced by patient height, weight, and BMI.

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Not Just a Matter of Retained Embryonic Spinal Cord: Histopathology of the Filum Terminale in Tethered Cord Syndrome

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INTRODUCTION: We present a large consecutive series of patients with tethered cord syndrome who underwent resection of the filum terminale (FT) and the histopathologic findings as analyzed by the neuropathologists.

METHODS: FT specimens obtained from a consecutive series of 288 pediatric and adult patients that underwent spinal cord releases performed

at a single academic institution from 2013-2021 were analyzed retrospectively (IRB #787945). Hematoxylin and eosin (HE) and immunohistochemistry staining was performed to study the spectrum of cells known to reside in connective tissues.

RESULTS: The most common structures included peripheral nerves (97.6%), ependymal cells (70.8%), ganglion cells (38.5%), and neuropil (15.3%). Cases with excess ependymal cells were associated with ependymal canals (5.9%), ependymal cysts (3.1%), and one case with extensive ependymal "proliferation" (0.3%). With regards to the inflammatory cellular findings, eleven specimens (3.8%) contained scattered or accumulated lymphocytes, macrophages, mast cells, macrophage-derived giant cells, and a secondary lymph follicle in one patient. 36 patients (12.5%) had increased vascularity with enlarged capillaries. Nine patients (3.1%) had an associated type of vascular malformation. A group of specimens included dystrophic calcification within the FT (7.6%).

CONCLUSIONS: Both vascular and inflammatory changes along with calcifications have been overlooked as possible associated histologic secondary to mechanical stress on the FT. Additionally, vascular anomalies could alter the filum's mechanical properties due to venous congestion.

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Does the Number of Social Risk Factors Affect Long-term Patient-Reported Outcomes and Satisfaction in Those With Cervical Myelopathy? A QOD Study

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INTRODUCTION: It is not clear whether there is an additive effect of social risk factors in affecting patients with cervical spondylotic myelopathy (CSM) from achieving both a minimum clinically important difference (MCID) in outcomes and satisfaction after surgery.

METHODS: This was a retrospective study of the prospective Quality Outcomes Database Cervical Spondylotic Myelopathy (QOD CSM) cohort. Social risk factors included race, education, employment, and insurance. Patients were considered to have improved from surgery if 1) they reported a score of 1 or 2 on the NASS index and 2) met the MCID in patient-reported outcomes (VAS neck and arm pain, NDI, EQ5D, or mJOA score) at 24-month follow-up.

RESULTS: Of the 1,141 patients included in the study, 205 (18.0%) had zero, 347 (30.4%) had one, 334 (29.3%) had two, and 255 (22.3%) had three social risk factors. The 24-month follow-up rate was 87.4% for patient-reported outcomes. After adjusting for all significant covariates, patients with one or more social risk factors were less likely to improve from surgery in all

measured outcomes including VAS neck and arm pain, NDI, EQ-5D, and mJOA (all $p < 0.05$) compared to those without any social risk factors. Patients with two or three social risk factors were more likely to fare worse in all outcomes compared to those with only one social risk factor (all $p < 0.05$).

CONCLUSIONS: Compared to those without any social risk factors, patients who had at least one social risk factor were less likely to achieve MCID and feel satisfied after surgery. The effect of social risk factors is additive in that those with a higher number of risk factors are less likely to improve compared to those with only one social risk factor.

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Electrical Stimulation Used as an Adjunct to Cervical Spine Fusion in Patients at Risk for Pseudarthrosis

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INTRODUCTION: Prior studies show that pulsed electromagnetic field (PEMF) stimulation promotes bone healing and can be a valuable tool to help overcome biological deficiencies in patients at risk. The current study further evaluates the adjunct effect of PEMF in subjects undergoing cervical spinal surgery presenting with risk factors for pseudarthrosis.

METHODS: A prospective multicenter clinical trial (NCT 03177473) was conducted at eleven clinical sites. Subjects undergoing cervical spinal fusion surgery with one or more risk factors for pseudarthrosis were identified for enrollment. Risk factors for pseudarthrosis included multilevel fusion, prior failed cervical spine fusion, diabetes, osteoporosis, or smoking. Subjects undergoing cervical spinal fusion were required to wear the PEMF device for 4 hours/day for 6 months post-op. Fusion status was determined at the 12-month visit using anterior/posterior, lateral, and flexion/extension radiographs and computed tomography (without contrast). NDI, EQ-5D, SF-36, and VAS for neck and arm pain were collected as secondary outcome measures.

RESULTS: Out of 160 subjects, 144 (90.0%) were graded as fused (all levels) at the 12-month visit. Fusion success was 91.7% ($n = 55/60$), 89.0% ($n = 89/100$), and 90.9% ($n = 20/22$) for subjects with 1, 2+, or 3+ risk factors, respectively. Significant improvements in NDI, SF-36, EQ-5D, VAS-arm and VAS-neck were observed compared to baseline ($p < 0.001$). A device compliance rate of 85.0% was observed at 3-months and 78.3% at 6-months in subjects who had successful cervical fusion.

CONCLUSIONS: The PEMF bone growth stimulator device is a valuable tool to aid in fusion healing, especially in challenging populations. Subjects in this study experienced favorable fusion rates of 90% and significant improvement in patient reported outcomes despite having elevated comorbidity and/or complex surgeries.

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Developing Mixed-Effects Models to Optimize Prediction of Postoperative Outcomes in a Modern Sample of Over 450,000 Patients Undergoing Elective Cervical Spine Fusion Surgery

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