

Degenerative cervical myelopathy case series

see also [Cervical spinal stenosis case series](#).

2023

The study involved 166 patients with [cervical spondylotic myelopathy](#) (CSM). Fifty-two patients underwent double-door staple, 63 patients underwent single-door miniplate, and 51 patients underwent double-door spacer. The clinical outcomes were measured.

Results: There was no significant difference in the Japanese Orthopedic Association score among the 3 groups ($P > .05$). The operation time was significantly shorter in the double-door staple and single-door miniplate groups than in the double-door spacer group ($P < .005$). The estimated blood loss was significantly more in the single-door miniplate group than in the double-door staple and double-door spacer groups ($P < .005$). The expansion ratio of the cervical intraspinal cross-sectional area decreased in the order of double-door staple > double-door spacer > single-door mini plate. There were no significant differences in the expansion ratio of the dural sac cross-sectional area among the 3 groups.

[Double-door staples](#), double-door spacers, and single-door miniplate can achieve favorable clinical outcomes for [cervical spondylotic myelopathy](#). The blood loss of a double-door staple is less than that of a single-door miniplate, and the operation time of a double-door staple is shorter than that of a double-door spacer. The mean expansion ratio of cervical intraspinal cross-sectional area decreased in the order of double-door staple > double-door spacer > single-door mini plate. Overall, the double-door staple is a safe and innovative alternative choice for the treatment of CSM ¹⁾

2022

Individuals treated with [cervical laminectomy](#) with [fusion](#) or [laminectomy](#) alone at or below the second [cervical vertebra](#) were identified in the [Swedish spine register](#). 66 individuals treated with laminectomy and instrumented fusion were age matched to 132 individuals treated with laminectomy alone. The [European myelopathy score](#) (EMS), the [Neck Disability Index](#) (NDI), the [Numeric Rating Scale](#) (NRS) for [neck pain](#) and the [EQ-5D](#) index were available at baseline, and at 1 and 2 year follow-ups. [Statistics](#) were performed with [Mann-Whitney U tests](#) and [paired T tests](#). Effect sizes were described with [Cohen's D](#).

Data at [baseline](#) did not differ significantly between the groups with the exception of a longer laminectomy in the fusion group (4.2 vs 3.4 vertebrae; $p < 0.001$). Both groups improved EMS, NDI, NRS and EQ-5D from baseline to 1 year ($p \leq 0.011$), with no additional improvement between 1 and 2 years (all $p \geq 0.09$). Effect sizes for change from baseline were small to medium in both groups. At 2 years the laminectomy with fusion group and the laminectomy alone group had a median (25th;75th percentile) EMS of 13 (11;13) and 13 (11;15) ($p = 0.77$), NDI of 39 (24;54) and 27 (10;41) ($p = 0.045$), NRS of 4 (1;2) and 2 (0;5) ($p = 0.048$), and EQ-5D index of 0.67 (0.25;0.73) and 0.66 (0.17;0.76) ($p = 0.96$).

The results of this study suggest similar effectiveness of laminectomy with instrumented fusion and laminectomy alone in degenerative cervical myelopathy ²⁾.

614 degenerative cervical myelopathy patients undergoing surgery responded to Patient-Reported Outcome Measures (PROMs) prior to, 3 and 12 months after surgery. External criterion was the Global Perceived Effect Scale (1-7), defining MCID as “slightly better”, “much better” and “completely recovered”. MCID estimates with highest sensitivity and specificity were calculated by Receiver Operating Curves for change and percentage change scores in the whole sample and in anterior and posterior procedural groups.

Results: The NDI and NRS-NP percentage change scores were the most accurate PROMs with a MCID of 16%. The change score for NDI and percentage change scores for NDI, NRS-AP and NRS-NP were slightly higher in the anterior procedure group compared to the posterior procedure group, while remaining PROM estimates were similar across procedure type. The MCID achievement rates at 12-month follow-up ranged from 51% in EMS to 62% in NRS-NP.

Conclusion: The NDI and NRS-NP percentage change scores were the most accurate PROMs to measure clinical improvement after surgery for degenerative cervical myelopathy. We recommend using different cut-off estimates for anterior and posterior approach procedures. A MCID achievement rate of 60% or less must be interpreted in the perspective that the main goal of surgery for degenerative cervical myelopathy is to prevent worsening of the condition ³⁾.

Thirty-one patients (66.5 ± 9.75 years, range 53-85 years) were analyzed. Visual Analog Scale (VAS) and the 10-item Neck Disability Index (NDI) were assessed preoperatively and during follow-up on a regular basis after surgery and after one year at least. Assessment of radiographic fusion, subsidence, and lordosis measurement of Global cervical lordosis (GCL); fusion site lordosis (FSL); the anterior interbody space height (ant. DSH); the posterior interbody space height (post. DSH); the distance of the cage to the posterior wall of the vertebral body (CD) were done retrospectively. Mean clinical and radiographic follow-up was 20.0 ± 4.39 months.

Results: VAS-neck ($p = 0.001$) and VAS-arm ($p < 0.001$) improved from preoperatively to postoperatively. The NDI improved at the final follow-up ($p < 0.001$). Neither significant subsidence of the cages nor significant loss of lordotic correction were seen. All patients showed a radiographic union of the surgically addressed segments at the last follow up.

Conclusions: Application of a stand-alone expandable cage in the cervical spine after one or two-level ACCF without additional posterior fixation or anterior plating is a safe procedure that results in fusion. Neither significant subsidence of the cages nor significant loss of lordotic correction were seen.

Trial registration: Retrospectively registered. According to the Decision of the ethics committee, Jena on 25th of July 2018, that this study doesn't need any registration.

<https://www.laek-thueringen.de/aerzte/ethikkommission/registrierung/> ⁴⁾.

2020

Between April 2010 and December 2018, 21 patients aged ≥ 80 years (older group: 8 men and 13 women; age range, 80-90 years) who underwent [laminoplasty](#) were reviewed and compared with 23 patients aged < 80 years (younger group: 13 men and 10 women; age range, 42-79 years) who underwent laminoplasty. The following data were obtained from chart reviews: age; sex; cervical canal stenosis level; time to operation; symptoms (e.g., gait disturbance); comorbidities (hypertension, diabetes mellitus, cancer, heart disease, ischemic cerebrovascular disease, and lumbar canal stenosis); antithrombotic drug use; cardiac, pulmonary, and renal functions; operative time; volume of blood loss during the operation; postoperative delirium; and follow-up period. Neurological deficits before and after the surgery were assessed using the neurosurgical cervical spine scale (NCSS). Data were statistically analyzed, and p-values < 0.05 were considered statistically significant.

Results: The operative time, symptoms (hypertension), renal function, and preoperative NCSS score were significantly different between the older and younger groups. Meanwhile, most variables showed no significant differences between the groups. Although the preoperative NCSS score was lower in the older group, there was no significant difference in the degree of improvement in the NCSS score after surgery.

Conclusions: The findings of this study suggest that we should not hesitate to perform surgery for cervical spondylotic myelopathy in elderly patients with favorable cardiorespiratory function ⁵⁾.

2019

A retrospective review of surgeries for cervical myelopathy from disc herniation, spondylosis, or ossification of the posterior longitudinal ligament (OPLL) over a twelve-year period identifying patients presenting without symptoms in the upper extremities.

Of 982 surgically-treated cervical myelopathy patients, 12 (1.2%) had no upper extremity complaints. All had difficulty ambulating and 7 of 12 (58%) had objective lower extremity weakness. Ten of twelve (83%) patients with a history of lumbar degenerative disease. On sensory examination, four (33%) had a discernable mid-thoracic pin level, three (25%) had loss of sensation from the upper leg and genital area down, and two (17%) had only genital/upper thigh area sensory loss. All demonstrated neurological improvement after decompressive surgery.

Cervical myelopathy may rarely present without patient complaints of symptoms in the upper extremities, manifesting with numbness perceived from the upper trunk, waist area, or perineum and legs in addition to leg weakness and gait difficulty. All had cervical cord compression at either the C5/6 or C6/7 levels, comprising 1 percent of all patients undergoing cervical surgery. Awareness of this atypical pattern of presentation may aid in the clinical assessment of a subset of patients with cervical cord compression ⁶⁾.

Seventy-eight [patients](#) underwent surgical [management](#) for [Degenerative cervical myelopathy](#) (DCM) with completion of pre-operative and 6-month follow-up assessments. Surgical management consisted of either [anterior cervical decompression](#) or [posterior cervical decompression](#). All patients underwent neurological evaluation, including an [ASIA](#) assessment pre-surgery and 6 months post-

surgery, and completed the [Modified Japanese Orthopaedic Association scale](#) (mJOA), [neck disability index](#) (NDI), and Short Form-36 ([SF-36](#)) scales pre- and post-operatively, to measure both disease-specific and general perceived outcomes.

The objective physician-derived neurological testing (ASIA) did not correlate with patient-derived scales (mJOA, NDI, and SF-36) pre- or post-operatively. Patients reported significant improvements ($p < 0.001$) at 6 months post-surgery in extremity functioning (mJOA), neck pain (NDI), overall physical health (SF-36), and objective strength and sensory examination (ASIA). All patient-perceived outcome measures correlated with each other pre- and post-operatively ($p < 0.01$).

Objective scoring of the post-operative neurological function did not correlate with patient-perceived outcomes in [Degenerative cervical myelopathy outcome](#) (DCM). Traditional testing of motor and sensory function as part of the neurological assessment may not be sensitive enough to assess the scope of neurological changes experienced by [Degenerative cervical myelopathy](#) patients ⁷⁾.

2018

Thirty-six patients were included in the study of Zika et al., from the University Hospital of [Ioannina, Greece](#). There were 21 [males](#) and 15 [females](#), mean [age](#) 50.8 years, range 39-70 years. The mean [BMI](#) was 27.3.

From each patient, they recorded age, sex, BMI, symptoms, duration of symptoms, comorbidities, lifestyle, myelopathy grade based on MRI and levels of compression. All patients completed the modified JOA (mJOA) and [Neck pain questionnaires](#) preoperatively and at 1, 3, 12 months and 5-years postoperatively.

The mean mJOA score significant improved from 10.8 ± 1.9 points preoperatively to 16.6 ± 2.2 points at 12 months postoperatively. The mean mJOA score at 5-years postoperatively was 15.5 ± 3 points. The difference was still highly significant. The mean NPE score significant improved from 59.8 ± 12.2 points preoperatively to 28.2 ± 8.5 points at 1 month, to 35.8 ± 8.1 points at 3 month and to 28.2 ± 8.8 points at 12 months postoperatively. Younger patients had significant higher baseline mJOA scores and significant higher mJOA scores 5-year postoperatively. No correlation was found between sex, BMI, symptom duration, baseline mJOA or myelopathy grade and outcome at 12 months or 5-year postoperatively.

Age was highly predictive factor of outcome for patients undergoing surgical treatment of CSM ⁸⁾.

Predictors of outcome after surgery for degenerative cervical myelopathy (DCM) have been determined previously through hypothesis-driven multivariate statistical models that rely on a priori knowledge of potential confounders, exclude potentially important variables due to restrictions in model building, cannot include highly collinear variables in the same model, and ignore intrinsic correlations among variables.

PURPOSE: To apply a data-driven approach to identify patient phenotypes that may predict outcomes after surgery for mild DCM.

STUDY DESIGN: Principal component analysis (PCA) of data from two related prospective, multi-center

cohort studies.

PATIENT SAMPLE: Patients with mild DCM, defined by a modified Japanese Orthopaedic Association score of 15 to 17, undergoing surgical decompression as part of the AOSpine CSM-NA or CSM-I trials.

OUTCOME MEASURES: Patient outcomes were evaluated pre-operatively at baseline and at 6 months, 1 year, and 2 years after surgery. Quality of life was evaluated by the Neck Disability Index (NDI) and Short Form-36 version 2 (SF-36v2). These are both patient self-reported measures that evaluate health-related quality of life, the NDI being specific to neck conditions and the SF-36v2 being a generic instrument.

METHODS: The analysis included 154 patients. A heterogeneous correlation matrix was created using a combination of Pearson, polyserial, and polychoric regressions among 67 variables, which then underwent eigen decomposition. Scores of significant principal components (PCs) (with eigenvalues > 1) were included in multivariate logistic regression analyses for three dichotomous outcomes of interest: achievement of the minimum clinically important difference (MCID) in 1) NDI (≤ -7.5); 2) SF-36v2 Physical Component Summary (PCS) score (≥ 5); and 3) SF-36v2 Mental Component Summary (MCS) score (≥ 5).

RESULTS: Twenty-four significant principal components accounting for 75% of the variance in the data were identified. Two principal components were associated with achievement of the MCID in NDI. The first (PC 1) was dominated by variables related to surgical approach and number of operated levels; the second (PC 21) consisted of variables related to patient demographics, severity and etiology of DCM, comorbid status, and surgical approach. Both PC 1 and PC 21 also correlated with SF-36v2 PCS score, in addition to PC 4, which described patients' physical profile, including gender, height, and weight, as well as comorbid renal disease; PC 6, which received large loadings from variables related to cardiac disease, impaired mobility, and length of surgery and recovery; and PC 9, which harbored large contributions from features of upper limb dysfunction, cardiorespiratory disease, surgical approach, and region. In addition to PC 21, a component profiling patients' socioeconomic status and support systems and degree of physical disability (PC 24), was associated with achievement of the MCID in SF-36 MCS score.

CONCLUSIONS: Through a data-driven approach, we identified several phenotypes associated with disability and physical and mental health-related QOL. Such data reduction methods may separate patient-, disease-, and treatment-related variables more accurately into clinically meaningful phenotypes that may inform patient care and recruitment into clinical trials ⁹.

2016

Fifteen patients with CSM were enrolled in this prospective study. Clinical data and scores from standard outcomes questionnaires were obtained before and after surgery. Patients also participated in experimental test protocols consisting of standard kinematic gait testing, the Purdue pegboard test, and the novel [single leg squat test](#) (SLS).

The SLS test protocol was well tolerated by CSM patients and generated objective performance data over short test periods. In patients who participated in postoperative testing, the group measures of mean SLS errors decreased following surgery. Gait velocity measures followed a similar pattern of group improvement postoperatively. Practical barriers to implementing this extensive battery of tests resulted in subject attrition over time. Compared with kinematic gait testing, the SLS protocol required less space and could be effectively implemented more efficiently.

The SLS test provides a practical means of obtaining objective measures of leg motor sensory functions in patients with CSM. Additional testing with a larger cohort of patients is required to use SLS data to rigorously examine group treatment effects ¹⁰⁾.

Goncalves et al., hypothesized that changes in the concentration of [N acetylaspartate](#) (NAA) in the motor and sensory cortices in the brain would emulate the time course of neurological recovery following decompression surgery for [cervical spondylotic myelopathy](#) (CSM). Their aim was to compare and contrast how metabolite levels in the motor and sensory cortices change after surgery to reverse downstream spinal cord compression.

Twenty-four patients with CSM and 8 control subjects were studied using [proton magnetic resonance spectroscopic imaging](#) (Proton magnetic resonance spectroscopic imaging) acquired on a 3.0-T Siemens MRI unit. The Proton magnetic resonance spectroscopic imaging data (TE 135 msec, TR 2000 msec) were acquired to measure absolute levels of NAA from the motor and sensory cortices in the cerebral hemisphere contralateral to the side of greater deficit at baseline in each subject. Data were also acquired at 6 weeks and 6 months following surgery. Control subjects were also evaluated at 6 weeks and 6 months following baseline data acquisition. Neurological function was measured in each subject at all time points using the [Neck Disability Index](#) (NDI), [Modified Japanese Orthopaedic Association scale](#) (mJOA), and the [ASIA impairment scale](#).

In the motor cortex of patients, NAA levels decreased significantly ($p < 0.05$) at 6 weeks and 6 months postsurgery compared with baseline levels. In the sensory cortex of patients, NAA levels decreased significantly ($p < 0.05$) only at 6 months after surgery compared with baseline and 6-week levels. No significant changes in NAA were found in control subjects. Clinical scores demonstrated significant ($p < 0.05$) motor recovery by 6 weeks, whereas sensory improvements ($p < 0.05$) appeared at only 6 months.

Findings suggest that metabolite changes in both the motor and sensory cortices mimic the time course of functional motor and sensory recovery in patients with CSM. The temporal course of neurological recovery may be influenced by metabolic changes in respective cortical regions ¹¹⁾.

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Between 2008 and 2011, 36 patients with CSM were observed following cervical decompression surgery. Patient data including mJOA and a new MS scores were prospectively collected and analyzed preoperatively and at 1 year after surgery.

In this cohort, reflex, Babinski, and proprioception signs showed statistically significant improvement following surgery at 1 year ($p = < 0.001$, $p = 0.008$, and $p = 0.015$, respectively). A lesser degree of improvement was observed with the Hoffman sign ($p = 0.091$). No statistically significant improvement in clonus occurred ($p = 0.368$). There was a significant improvement in mJOA ($p \leq 0.001$) and MS ($p \leq 0.001$) scores at 1 year compared with the preoperative scores. The results showed an inverse correlation between MS and mJOA scores both pre- and postoperatively (Spearman's correlation coefficient = -0.202 preoperatively and -0.361 postoperatively).

Improvement in myelopathic signs was noted following cervical decompression surgery in patients with CSM. The newly devised MS scale demonstrated these findings, and the new MS scale correlates with improvement in mJOA scores in this patient cohort ¹³⁾.

Four hundred and seventy-nine patients with symptomatic [Cervical spondylotic myelopathy](#) were enrolled in the prospective [AOSpine](#) CSM-International study at 16 global sites. Preoperatively and at each follow-up, patients were evaluated using the modified [Japanese Orthopaedic Association scale](#) (mJOA), the [Nurick scale](#), the [Neck Disability Index](#) (NDI), and the Short- Form 36 (SF-36) Health Survey. A mixed model analytic approach was used to evaluate differences in outcomes between races at 24 months postoperatively, while controlling for relevant [baseline characteristics](#) and surgical factors.

Three hundred and twenty-four (67.64%) patients were Caucasian and 106 (22.13%) were East Asian. There was no difference in the incidence of ossification of the posterior longitudinal ligament (OPLL) between the two races; however a greater percentage of Caucasians in India (46.15%) and Turkey (41.38%) displayed evidence of OPLL than Caucasians in other regions ($p < 0.001$). The frequency of spondylosis was significantly higher in Caucasians ($p < 0.001$). Caucasians had a longer duration of symptoms (27.33 ± 34.47 months) than East Asians (23.11 ± 35.68 months) ($p < 0.001$), and a lower preoperative score on the SF-36 Physical Component Score (33.85 ± 9.04) compared to East Asians (37.47 ± 8.67) ($p < 0.001$). At 24-months after surgery, there were no differences in functional status or QOL between East Asians and Caucasians, after adjusting for baseline characteristics, surgical preferences and disease causation. Rates of perioperative complications were not significantly different between the races ($p = 0.261$).

Decompressive surgery results in comparable functional gains and is equally safe in Caucasians and East Asians ¹⁴⁾.

1986

Sixty-nine patients with cervical spondylotic myelopathy (CSM), radiculopathy (CSR), or both (CSMR) were studied with computed tomography (CT). Computer-assisted myelography (CAM) accurately determines the site and nature of spondylotic protrusions and provides good visualisation of the subarachnoid space and cord deformities even in areas with dilute metrizamide. However, excessive vertebral movement and bulging ligamenta flava with their effects on cord deformity, so easily visualised in myelograms, are completely or partially missed. In the assessment of CSM, metrizamide myelography (MM) followed by CAM should be performed, particularly when the myelographic images are unsatisfactory due to contrast dilution or blockage, when cord compression cannot be ascertained with MM and when cord atrophy is suspected. In CSR, the diagnostic information from MM and CAM is comparable. The diagnostic criteria in CAM are, however, less direct and since MM is adequate in uncomplicated cases, CAM is generally not necessary. The APD, APD/TD ratio, area and circularity are sensitive indices of cord deformity and the first two should be used more often to assist visual assessment of cord deformity. The relation between cord parameters and treatment response is better reflected in CSM cases managed conservatively and the results suggest that the degree of cord deformity is helpful in determining the outcome and hence the choice between surgical and conservative treatment. In plain CT, the osteophytes and calcified discs are adequately visualised and canal dimensions measured with accuracy, but the cervical cord and roots cannot be properly assessed and the diagnosis of CSM or CSR cannot be ascertained. At present, its role in cervical spondylosis is therefore limited ¹⁵⁾.

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