Degenerative cervical myelopathy surgery

- Pseudogout-Induced Cervical Myelopathy: A Report of Two Cases and Review of the Literature
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Cervical Spine Fusion Surgery is an international set process for handling degenerative cervical myelopathy [1) 2)]

Indications

Poor prognostic indicators and, therefore, absolute indications for surgery are:

1. Progression of signs and symptoms.

2. Presence of myelopathy for six months or longer.

3. Compression ratio approaching 0.4 or transverse area of the spinal cord of 40 square millimeters or less. Improvement is unusual with nonoperative treatment and almost all patients progressively worsen.

Kadanka et al. have demonstrated that patients with mild CSM were successfully treat (no significant deterioration in the mJOA score, recovery ratio, or timed 10 m walk within either group during the 2 years of follow-up) with close clinical observation in one randomized controlled study comparing conservative versus surgery in spondylotic cervical myelopathy [3)].

Approaches

Anterior cervical discectomy and fusion

see Anterior cervical discectomy and fusion for cervical spondylotic myelopathy.

Cervical arthroplasty

see Cervical arthroplasty for cervical spondylotic myelopathy.

Cervical laminoplasty (LP) or cervical laminectomy plus fusion (LF) are accepted operative options and alternatives to anterior approaches. Both LP and LF have distinctive disadvantages, which might be avoided by unilateral hemilaminectomy and bilateral decompression of the spinal cord.

Unilateral hemilaminectomy allows bilateral decompression of the whole dorsal circumference of spinal cord from nerve root to nerve root. The potential major advantages are a reduction of invasiveness by only unilateral muscle detachment, avoidance of implants, and shorter operation times. [4)].

Laminoplasty has been proposed as a treatment for cervical stenotic myelopathy (CSM) as an alternative to standard cervical laminectomy as this has been considered directly associated with an increased risk of postoperative deformity.

Standard laminectomy seems to be associated to late cervical spine deformities in a more relevant percentage of patients, possibly leading to severe forms of kyphosis and segmental instability over time compared with open-door expansive laminoplasty. The unilateral approach represents an evolution to standard open door technique that further spares posterior elements, may decrease the incidence of progressive spinal deformity and prevent the need for subsequent spinal stabilization [5)].

A paucity of high-quality literature exists regarding treatment outcomes associated with arthroplasty, oblique corpectomy without fusion, and skip laminectomy for symptomatic CSM. Comparative prospective studies with long-term follow-up and standardized outcome measures are needed to assess treatment outcomes associated with these alternative techniques appropriately. EVIDENCE-BASED CLINICAL RECOMMENDATIONS: RECOMMENDATION 1: No recommendation can be made from comparative literature regarding treatment outcomes comparing ADR with ACDF for CSM. OVERALL STRENGTH OF EVIDENCE: Insufficient. STRENGTH OF RECOMMENDATION: Strong. RECOMMENDATION 2: No recommendation can be made from comparative literature regarding treatment outcomes comparing laminoplasty with skip laminectomy for CSM. OVERALL STRENGTH OF EVIDENCE: Low. STRENGTH OF RECOMMENDATION: Strong. SUMMARY STATEMENTS: Oblique corpectomy is an option in selected cases of CSM. It should not be considered a first-line treatment strategy because of the relatively high morbidity associated with this procedure [6)].

Posterior approach

see Posterior approach for cervical spondylotic myelopathy.

Choice of approach

The results of a study suggest similar effectiveness of laminectomy with instrumented fusion and laminectomy alone in degenerative cervical myelopathy [7].

A posterior approach was favored and more commonly used to treat multi-level degenerative cervical myelopathy (DCM), in an international cohort of surgeons. Posterior techniques including laminectomy, laminectomy and fusion or laminoplasty appeared to be equally popular [8].

The debate between anterior approaches (anterior cervical discectomy or corpectomy) and posterior approaches (decompressive cervical laminectomy or laminoplasty) dates back to the time that both became widely practiced. The general sentiment is to treat anterior disease at the disc level (e.g. osteophytic bar, herniated disc...) usually limited to≤3 levels (or occasionally 4) with an anterior approach, and to use a posterior approach as the initial procedure in the situations outlined below. Considerations of spinal curvature may need to enter into the decision process.

There was not enough evidence to recommend any of the following techniques over the other (in terms of short-term success in treating CSM): ACDF, anterior corpectomy and fusion, laminectomy

Laminectomy without fusion, however, is associated with a higher incidence of late kyphotic de- (with or without fusion) and laminoplasty (Level D Class III).

Deformity (Level D Class III; incidence 14–47%, not all cases are symptomatic, not all cases need treatment

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There are multiple types of anterior approaches. Many strategies have been developed to reduce complications for multilevel anterior surgery. Posterior approaches are sometimes used to supplement more extensive anterior approaches. More recently, multilevel cervical arthroplasty has been used for this condition. More data soon will be available comparing anterior and posterior approaches with the goal of optimizing patient-related quality of life and reducing complications, which include dysphagia, weakness, and instrumentation failure in some cases [9].

Farrokhi et al., searched for evidence regarding the surgical approach to Cervical spondylotic myelopathy (CSM) in medical databases with articles dated from 1985 to 2016.

In patients with effective cervical lordosis (fewer than 3 levels of ventral disease), anterior cervical discectomy and fusion (ACDF) or cervical arthroplasty is preferred. Patients with more than 3 levels of compression are generally treated by cervical laminoplasty, especially with preserved lordotic curvature. In patients with straightened spine who have less than 3 involved levels, ACDF with a cervical plate is recommended, whereas patients with more than 3 involved levels with instability should undergo posterior decompression and fusion. In young patients who have a stable cervical spine, laminoplasty is recommended and in old patients with ankylosed spine, only laminectomy

should be performed. Patients with mild cervical kyphosis (kyphotic angle ≤10°) should be managed in the same way as patients with straightened spine. However, in severe kyphosis, cervical traction is recommended. If the kyphosis is reducible, further posterior decompression and fusion is adequate. In patients with irreducible kyphosis, if the number of involved levels is less than 2, ACDF is adequate, but if it is more than 2 levels, anterior cervical corpectomy and fusion should be performed using cervical magnetic resonance imaging for evaluation of the patency of the subarachnoid space (SAS). With patent SAS, only posterior fusion is adequate, whereas in closed SAS, posterior decompression with posterior fusion is required. These approaches are based on the most recent evidence [10].

In 1993 Law et al recommended anterior decompression when there is anterior compression at one or two levels and no significant developmental narrowing of the canal. For compression at more than two levels, developmental narrowing of the canal, posterior compression, and ossification of the posterior longitudinal ligament, we recommend posterior decompression. In order for posterior decompression to be effective there must be lordosis of the cervical spine. If kyphosis is present, anterior decompression is needed. Kyphosis associated with a developmentally narrow canal or posterior compression may require combined anterior and posterior approaches. Fusion is required for instability.

In cases with moderate or severe CSM, surgical treatment is clearly indicated as non-operative management will lead to continued, and possibly irreversible, neurological decline. Additionally, although recovery of lost function after surgery is generally uncertain, the best surgical results are generally associated with patients with mild CSM and early symptoms [11].

Previous work has shown that private insurance status, gender and patient race are predictive of the operative approach patients receive (anterior-only, posterior-only, combined anterior-posterior).

Private insurance status, female sex, and Caucasian race independently predict receipt of anterior-only CSM approaches, while non-Caucasian race (Black, Hispanic, Asian/Pacific Islander, Native American) and non-private insurance predict receiving posterior-only CSM approaches. Given recent literature demonstrating posterior-only approaches as predictive of increased mortality in CSM, this findings indicate that for CSM patients, non-Caucasian race may significantly increase mortality risk, while private insurance status may significantly decrease the risk of mortality. Further prospective study will be needed to more definitively address these issues [12].

The Nationwide Inpatient Sample from 2001 to 2010 was used to assess the potential role of multilevel CSM as a contributing factor in determining which operative approach CSM patients receive, as it is rare for an anterior-only approach to be sufficient for CSM patients requiring fusion of four or more involved levels. Multivariate analysis revealed that female sex (OR=3.78; 95% CI=2.08-6.89; p<0.0001), private insurance (OR=5.02; 95% CI=2.26-11.12; p<0.0001), and elective admission type (OR=4.12; 95% CI=1.65-10.32; p=0.0025) were predictive of increased receipt of a 3+ level fusion in CSM. No other variables, including patient age, race, income, or admission source were predictive of either increased or decreased likelihood of receiving fusion of at least three levels for CSM. In conclusion, female sex, private insurance status, and elective admission type are each independent predictors in CSM for receipt of a 3+ level fusion, while patient age, race and income are not. Given the propensity of fusions greater than three levels to require posterior approaches and the association between posterior CSM approaches and increased morbidity/mortality, these findings may prove useful as to which patient demographics are predictive of increased morbidity and mortality in operative treatment of CSM [13].

Outcome

see Cervical spondylotic myelopathy surgery outcome.

Complications

see Cervical spondylotic myelopathy surgery complications.

Case series

In a retrospective study of 21 patients who had multilevel cervical spinal stenosis and spinal cord injury with unstable fracture. An open-door expansive posterior laminoplasty combined with transpedicular screw fixation was performed under persistent intraoperative skull traction. Outcome measures included postoperative improvement in Japanese Orthopedic Association (JOA) score and incidence of complications.

The average operation time was 190 min, with an average blood loss of 437 ml. A total of 120 transpedicular screws were implanted into the cervical vertebrae between vertebral C3 and C7, including 20 into C3, 34 into C4, 36 into C5, 20 into C6, and 10 into C7. The mean preoperative JOA score was 3.67 ± 0.53. The patients were followed for an average of 17.5 months, and the average JOA score improved to 8.17 ± 1.59, significantly higher than the preoperative score ($t = 1.798$, $P < 0.05$), with an average improvement of 44.7 ± 11.7%. Postoperative complications in four patients included Cerebrospinal fluid fistula, delayed wound healing, pulmonary infection, and urinary system infection. All four patients were responsive to antibiotic treatment; one died from respiratory failure 3 months postoperatively.

The open-door expansive laminoplasty combined with posterior transpedicular screw fixation is feasible for treating multilevel cervical spinal stenosis and spinal cord injury complicated by unstable fracture. Its advantages include minimum surgical trauma, less intraoperative blood loss, and satisfactory stable supportive effect for reduction of fracture [14].

2015

A post hoc analysis was performed of a prospective, multicenter database of patients with CSM from the AOSpine North American study. One hundred ten patients (34%) met inclusion criteria, which were symptomatic CSM, age over 18 years, baseline flexion/extension radiographs, and health-related quality of life (HRQOL) questionnaires (modified Japanese Orthopaedic Association [mJOA] score, Neck Disability Index [NDI], the 36-Item Short Form Health Survey Physical Component Score [SF-36 PCS], and Nurick grade). The mean age was 56.9 ± 12 years, and 42% of patients were women (n = 46). Correlations with HRQOL measures were analyzed for regional (cervical lordosis and cervical sagittal vertical axis) and focal parameters (kyphosis and spondylolisthesis between adjacent vertebrae) in flexion and extension. Baseline dynamic parameters (flexion/extension cone relative to a fixed C-7, center of rotation [COR], and range of motion arc relative to the COR) were also analyzed for correlations with HRQOL measures. RESULTS At baseline, the mean HRQOL measures demonstrated disability and the mean radiographic parameters demonstrated sagittal malalignment. Among

regional parameters, there was a significant correlation between decreased neck flexion (increased C2-7 angle in flexion) and worse Nurick grade (R = 0.189, p = 0.048), with no significant correlations in extension. Focal parameters, including increased C-7 sagittal translation overT-1 (slip), were significantly correlated with greater myelopathy severity (mJOA score, Flexion R = -0.377, p = 0.003; mJOA score, Extension R = -0.261, p = 0.027). Sagittal slip at C-2 and C-4 also correlated with worse HRQOL measures. Reduced flexion/extension motion cones, a more posterior COR, and smaller range of motion correlated with worse general health SF-36 PCS and Nurick grade. CONCLUSIONS Dynamic motion analysis may play an important role in understanding CSM. Focal parameters demonstrated a significant correlation with worse HRQOL measures, especially increased C-7 sagittal slip in flexion and extension. Novel methods of motion analysis demonstrating reduced motion cones correlated with worse myelopathy grades. More posterior COR and smaller range of motion were both correlated with worse general health scores (SF-36 PCS and Nurick grade). To the knowledge of the authors , this is the first study to demonstrate correlation of dynamic motion and listhesis with disability and myelopathy in CSM [15].

Case reports

A 67-year-old man presented with progressive weakness and clumsiness (mJOA: 5; Nurick: 4). An anterior discectomy, osteophytectomy and bilateral foraminotomy of the C4-C5; C5-C6; C6-C7 were performed. Polyether-Ether-Ketone spacers and a titanium plate were placed. The patient was mobilized 3-hour post-surgery and was released the following day. Medicament therapy and a neck-conditioning program were prescribed. Clinical examinations were normal within a month. Magnetic resonance imaging showed no traces of the preoperatively registered intramedullary focal T2 hyper-intensity [16].

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