Cervical Spondylotic Myelopathy

Recommendations of WFNS Spine Committee 2019

Recommendations for Clinical Presentation of Cervical Spondylotic Myelopathy (CSM)

* Myelopathic signs (hyperreflexia, inverted brachioradialis reflex, Hoffmann sign, Babinski and clonus) are an integral component of clinical diagnosis of cervical myelopathy. However, they are not very sensitive and may be absent in about 20% of myelopathic patients.

* Individual myelopathic signs taken alone cannot diagnose cervical myelopathy in all patients but at least one is present in severe myelopathy.

* Clinical diagnosis of CSM relies heavily on characteristic symptoms and signs elicited during history and physical exam which prompt further investigation with cervical spine imaging.

* In severe myelopathic patients, after laminoplasty, major recovery in myelopathic signs occurs during the first 6 months and there after it plateaus.

* In patients with myelopathic signs, if there are no alternative explanations, a combination of clinical symptoms and imaging studies must form the basis of our treatment decisions. The absence of myelopathic signs does not preclude the diagnosis of CSM nor its successful surgical treatment.

Recommendations for Natural Course of CSM

* Natural course of patients with cervical stenosis and signs of myelopathy greatly vary.

* Progression of the disease is possible, but prediction of those patients is not well known. Some patients may remain static for lengthy periods, and some patients with severe disability can improve without treatment.

* For patients with no symptoms but having significant stenosis (pre-myelopathic), risk of developing myelopathy with cervical stenosis is approximately 3% per year.

Recommendations for Value of Electrophysiology

* Electrophysiological tests to be used in CSM patients are (in order of benefits): Motor Evoked Potential (MEP), Spinal Cord Evoked Potential (SCEP), Somatosensory Evoked Potential (SEP), and Electromyography (EMG).

* Routine electrophysiological tests are useful in differential diagnosis of CSM from other neurological conditions. However, especially during the early course of the disease differential diagnosis is very difficult, specific tests are necessary and mild forms of ALS and polyneuropathy may not be differentiated easily.

* Although MEP and SEP have been found as valuable tests to predict outcomes of CSM surgery, there is no evidence that they are more valuable than clinical parameters.

* Electrophysiological tests may have better outcome predictions than MR changes.

* Electrophysiological tests are not very useful in monitoring lower extremity power, and the value of monitoring during ACDF surgery is questionable.

* EMG and MEP monitoring have been found to be useful to decrease C5 root palsy during CSM surgery.

* Intraoperative MEP/SEP worsening is not specific, and it does not show clinical worsening in every incidence. Intraoperative MEP/SEP changes do not necessarily prevent neurological injury and improve the outcomes.

Recommendations for Value of Canal Diameters in CT and MRI

* In spite of conflicting evidence, Magnetic Resonance Imaging (MRI) morphometric analysis of the spine has a significant role in evaluation and prognostication of CSM and it should be included in the pre-operative workup.

* Among the many variables assessed using MRI – Compression Ratio (CR), Maximum Canal Compromise (MCC) and Transverse Area (TA) are most importantly correlated with functional outcomes following surgery in patients with CSM. Each parameter have its own strengths and limitations, therefore a combined assessment of MR parameters has a greater predictive yield.

Recommendations for Value of Signal Intensity Changes in MRI

* Intense spinal cord T2 hyperintensity on cervical MRI may be correlated with a worse outcome in CSM.

* Patients with lighter signal changes in T2 on cervical MRI should not be excluded from surgical treatment of CSM.

* More studies are needed to validate proposed grading systems, or to create new ones.

* T1 hyposignal should be considered as a sign of more advanced disease, with worse outcome

* More studies are needed to assess the effect of sagittal and axial extension of T1 signal changes on outcome.

Recommendations for New Imaging Techniques for CSM

* Diffusion MRI, MR Spectroscopy and dynamic MRI (dMRI) may be a part of MR examinations for CSM protocol apart from conventional MRI. We suggest their usage for outcome studies. With data pooling of clinical and imaging findings, we will be able to prognosticate better and identify patients earlier before the changes and permanent damage sets in.

Recommendations for Value of Surgery and Non-Surgical Approaches for CSM

* WFNS Spine Committee endorses the guidelines of Fehlings and coworkers. The new and adapted WFNS Spine Committee Recommendations after consensus are summarized below:

* For patients with moderate and severe CSM surgical intervention is recommended. We recommend using modified Japanese Orthopedic Association (mJOA) scale or its regional modifications to classify CSM as severe, moderate or mild.

* We suggest offering surgical intervention or rehabilitation for patients with mild CSM (mJOA score 15-17). If at the beginning nonoperative management was followed, we recommend operative intervention when rapid progression of symptoms appear. Nonoperative management may be considered for slowly progressive disease.

* Non-myelopathic patients with radiologic evidence of cord compression but without signs and symptoms of radiculopathy should not be offered a prophylactic surgery. These patients should be counselled about the potential risk of worsening, educated about the signs and symptoms of progression and followed up clinically regularly. An informed consent should be obtained about neurological deficits that may follow trivial injury.

* Non-myelopathic patients with radiologic evidence of cord compression and with clinical evidence of radiculopathy are potential candidates who may deteriorate thus carrying high risk and hence need to be counselled about it. These patients are recommended to undergo surgery or close observation with rehabilitation if the patient refuse to undergo surgery. In the event of developing myelopathic signs they are advised to go for surgery at the earliest. An informed consent should be obtained about neurological deficits that may follow trivial injury.

* There is a consistent lack of evidence regarding the value of nonoperative treatment of cervical myelopathy in the literature. Hence non-operative treatment may not be the final decision in most cases.

* Predicting factors that indicate a possible deterioration during non-operative management are: circumferential cord compression in axial MRI, reduced diameter of CSF space, hypermobility of spinal segment, angular edged deformity, instability, greater angle of vertebral slip, lower segmental lordotic angle, and presence of OPLL.

* Important predictors of myelopathy development include the presence of symptomatic radiculopathy, prolonged MEPs and SEPs and EMG signs of anterior horn cell lesions (low evidence).

* Duration of symptoms has a greater impact on outcomes. Substantial delay in surgical management leads to suboptimal outcome. In other words, patients are likely to achieve a better result after surgery if they have a shorter duration of symptoms (low evidence).

* As there is still clinical equipoise between surgery and conservative treatment in mild CSM, the WFNS Spine Committee strongly encourages randomized controlled trials comparing surgical versus nonsurgical interventions in mild CSM. There is also a need to analyze the cost effectiveness, standardized methodology and costs of long term follow up in mild CSM.

Recommendations for Surgical Indications for Treatment of CSM

* In patients with CSM, the indications for surgery include persistent or recurrent radiculopathy non-responsive to conservative treatment (3 years); progressive neurological deficit; static neurological deficit with severe radicular pain when associated with confirmatory imaging (CT, MRI) and clinical-radiological correlation.

* The indications of anterior surgery for patients with CSM include straightened spine or kyphotic spine with a compression level below three.

Recommendations for Comparison of Anterior Surgical Techniques for CSM

* There are many options for anterior decompression such as anterior cervical discectomy and fusion (ACDF), anterior cervical corpectomy and fusion (ACCF), oblique corpectomy, skip corpectomy and hybrid surgery.

* A corpectomy is a good option for a ventral compression of less than 3 vertebral segments where a single level disc and osteophyte excision are inadequate to decompress the cord in patients with CSM. In cases with a kyphotic deformity of the cervical spine, corpectomy can restore the normal lordotic curvature alignment.

* In cases of a multi-segment disease with contiguous multi-segment thecal compression, alternate segment discectomy/osteophyte removal while keeping the body of the intervening vertebra intact is biomechanically more stable than a complete corpectomy with contiguous segment discectomy.

Recommendations for Endoscopic and Partial Corpectomy Procedures

* An oblique partial corpectomy can improve the sagittal canal diameter substantially. However, this procedure may be difficult to perform in cases with bilateral radiculopathy. If there is significant instability, oblique corpectomy should not be chosen.

* The incidence of the Horner's syndrome due to unilateral disruption of the sympathetic chain has been decreased to less than 5% by some modifications in surgical technique.

Recommendations for CSM in Elderly

* In the elderly age groups with bony ankylosis due to osteophytes at C5-6-7, CSM may manifest at higher levels where motion segments are preserved, especially the C3-4 level and also at lower levels such as the C7-T1 level.

Recommendations for Complications of Anterior Surgeries for CSM

* Reported complications resulting from anterior surgeries for CSM are quite variable. Approach-related complications (dysphagia, dysphonia, esophageal injury, respiratory distress etc) are more often than neurologic, and implant-related complications. With appropriate choice of implants and meticulous surgical technique, the surgical complications should be seen only rarely.

Recommendations for Success Rate of Anterior Surgeries for CSM

* Improvement after anterior surgery for CSM has been reported in 70% to 80% of patients. JOA recovery rates are around 60% to 70%.

* There is no significant difference of success rates with ACDF, ACCF and oblique corpectomy.

* ACDF is generally associated with less intra-operative blood loss and less operative complications than ACCF. The functional outcomes, using Odom's criteria, JOA, neck disability index (NDI) are reported to be the same.

Recommendations for Selection of Surgical Approach

* There are several factors that should be considered for selection of surgical approach in patients with CSM: sagittal curvature, locations of the compressive pathology, number of levels involved, and patient comorbidities.

Recommendations for Posterior Surgical Approaches for CSM

* Posterior surgical decompression is an effective technique in improving the neurological function of patients with CSM.

* Posterior surgical techniques for CSM consist of laminectomy alone, laminectomy with fusion, and laminoplasty. These techniques are often used if there are three or more levels anterior compressions. But, in cases with significant posterior compression at 1 or 2 levels, posterior decompressive surgeries are mandatory.

* The relative merit of different posterior decompression techniques has not been well determined. In kyphotic cases, especially if it is a flexible kyphosis, laminectomy and posterior fixation with fusion should be chosen. However, in rigid kyphosis, an anterior surgery combined with a posterior decompression should be preferred. In cases with preserved lordosis, laminoplasty is a good option. Cases with severe axial neck pain should not be a candidate for laminoplasty. However, there are always gray zone cases such as straightened cervical spine that we do not know for sure which approach is better.

* Combined approach should be chosen in patients with significant ventral and dorsal osteophytic compression which cannot be handled holistically with a single anterior or posterior surgery.

* Multiple factors must be taken into account when deciding on the appropriate operation for a particular patient. Surgeons need to tailor their preoperative discussion to alert patients about these facts.

Recommendations for Complications of Posterior Surgeries for CSM

* Complications resulting from posterior surgeries for CSM include injury to spinal cord and nerve roots, implant related complications, C5 palsy, spring-back closure of lamina after laminoplasty, post-laminectomy kyphosis.

Recommendations for Success Rate of Posterior Surgeries for CSM

* In comparing laminectomy to laminoplasty, there is a trend towards laminoplasty being better than traditional laminectomy but relatively equivalent to newer techniques of minimally invasive skip laminectomies.

Recommendations for Future Directions About Surgical Approaches

* Current knowledge is deficient, especially considering the cost to benefit analysis of various surgical approaches, comparative efficacy of surgical approaches using various techniques, and

long term follow-up to determine outcomes. Therefore, continued research into outcomes of cervical spine surgery is essential.

* Since randomized controlled studies are very difficult to conduct in spine surgery, prospective registries with long term follow up will be important for our future decisions.

Recommendations for Outcome Measures for CSM

*There are a variety of outcome measures used for CSM. As functional measures we recommend modified Japanese Orthopedic Association scale (mJOA), Nurick's grade and Myelopathy Disability Index (MDI).

*Walking tests can be used for quantitative measurements and Short Form 36 (SF-36) is a good functional quality life measure.

Recommendations for Clinical Variables of Outcome

*Three clinical variables that are most commonly related with CSM are age, duration of symptoms and severity of the myelopathy at presentation. Greater the age, the longer the duration of symptoms and the more severe symptoms at presentation, the more adverse outcomes can be expected after surgery.

*However, examination findings require more detailed study to validate their effect on the outcomes of surgery. The predictive variables which were studied and seemed to affect the outcomes in CSM are hand atrophy, leg spasticity, clonus and Babinski's sign.

Recommendations for Radiological Variables on Outcomes

*Cervical alignment parameters are correlated with general health scores and myelopathy severity. The curvature of the cervical spine has been found one of the most important variables.

*Cervical spine kyphosis predicts worse outcomes. Neurological improvement is significant in patients with normal cervical lordosis.

*Instability of the cervical spine is predictive for outcomes. In patients with single segmental CSM with instability, longer duration of symptoms, lower preoperative JOA score, and more preoperative physical signs are highly predictive of a poor surgical outcome

* Spinal cord compression ratio is a critical factor for prognosis of CSM. However, AP diameter of the spinal canal has no clinical significance.

* Spinal cord atrophy cannot predict outcomes.

* High signal intensity on T2 weighted MR images is a negative predictor for prognosis.

Recommendations for Surgical Variables on Outcomes

* Surgery should be done from anterior or posterior if the disease is focal (one or two levels).

* If the anterior compression is more than 2 levels or if it is a diffuse narrowing, posterior decompression should better be chosen.

* The most important factor on decision making in cases with multilevel (more than 2) CSM is cervical sagittal vertical axis

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