

SPONDYLOTIC CERVICAL MYELOPATHY: WHAT IS THE BEST APPROACH TO TREATMENT?

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ABSTRACT

The authors address the daunting challenge of the treatment of patients with spondylotic cervical myelopathy (SCM). It is emphasised that clinical diagnosis must be made in the light of all available information from the history of the disease and from objective neurological investigation, and that everything must be done with reference to the paraclinical findings (imaging, electrophysiological, serological, etc.). Decision-making must then be based on evaluation of the cross-sectional transverse area of the compressed spinal cord, the number of compressed levels and its significance, hyperintensities in the spinal cord at the level of maximal compression, duration of symptoms, and the overall clinical status (including mental condition). Practical recommendations for the treatment of SCM conclude the article.

INTRODUCTION

Although a large amount of information has been published about spondylotic cervical myelopathy (SCM), in everyday clinical practice many doctors are still hesitant to commit themselves to a treatment regime. The radiological finding of a narrow spinal canal, or even spinal cord compression, often proves too strong a temptation to solve the problem radically "as soon as possible", "not wasting valuable time" regardless of any facts arising out of evidence-based medicine, or even of common sense. Overemphasis on one finding irrespective of a non-corresponding clinical picture often verges on desperate endeavour to disclose immediately the cause of the patient's signs and symptoms. How is this challenge best addressed?

The clinical diagnosis must take into full account all the information contained in the history of the disease and the objective neurological investigation, and everything must be done in concordance with the paraclinical findings (imaging, electrophysiological, serological, etc.). If this is done, however, other difficulties must be overcome in the process of making a decision as to which treatment to opt for. The following items should be evaluated:

1. The cross-sectional transverse area of the compressed spinal cord
2. The number of compressed levels and its significance
3. Hyperintensities versus normal MR spinal cord image at the level of maximum compression
4. Duration of symptoms
5. Overall clinical status (including mental condition)

Clinical features

Symptoms of spondylotic cervical myelopathy (SCM) most frequently begin in patients between 50 and 70 years of age, but may occur much earlier or in more advanced years. The patients tend to visit their doctor at 50–55 (1–4). Men are affected more frequently (2–3:1) than women [1,3,4].

Symptoms may develop progressively or in stepwise fashion, with remissions between periods of deterioration. Symptoms and signs may arise for the first time or be aggravated following injuries such as carrying an excessive weight, a fall on a slippery surface, a motor vehicle accident, or forced hyperextension of the neck.

The most frequent and characteristic symptoms are gait disorders (82 %), clumsy hands (84 %), and neck and back pain (95 %). Pain in the neck (67 %), shoulder, and arms is a common presenting complaint [1]. Pain may radiate in a radicular distribution and is usually dermatomic. However, it may occasionally occur in the distribution of the affected myotome. Paresthesias (78 %), fasciculations in the upper extremities (32 %), and muscle weakness in the distribution of the affected nerve roots (30%) are often encountered. Reduction in the reflexes may be observed in the upper extremities, but in the lower extremities it may be associated with hyperactive reflexes (60%) [1]. Although the patient may complain of only unilateral lower extremity symptoms, neurological examination usually reveals signs of bilateral disturbance of long tract function. Spasticity (62%) is one typical sign, and suddenly stretching legs may be reported. Sensory complaints, especially pain in the lower extremities, may be misleading. Lhermitte's sign is very specific, though of low sensitivity (14–27%) [5,1]. Disturbances of sphincter function (24%) are late phenomena; they are usually mild and generally do not occur in the absence of advanced spinal cord dysfunction, which manifests itself earlier by dysfunction of other modalities [1]. The duration of signs and symptoms varies considerably with personal history. It may last from several hours through many (25–35) years, but typically occurs over one or several years (1–4).

Hyperintensities

MRI is an excellent means to visualise the narrowed spinal canal associated with spinal cord compression due to degeneration of the spine (Figure 1). New technology, such as



Figure 1

An MR proton density image in the sagittal plane; spondylogenic multistage spinal cord compression of CD-7 by massive protrusion of intervertebral disc

multi-array coils, provides high-resolution sagittal images of the entire cord in a single scan and fast spin-echo sequences produce high-resolution T2WI within a short time [12].

MRI can reveal cord signal abnormalities on T2WI at (or near) the site of compression, which may signal evidence of oedema, demyelination, gliosis, or myelomalacia.

The clinical significance of **increased signal intensity on MR scans** is controversial. Some studies have found a negative correlation between the outcome of surgery or conservative treatment and increased signal intensity (6–9), but others have not [11], or have even noted a positive correlation (11). Some found this relation predictive only in cases with multilevel manifestation [13] or when a low signal on T1WI and a high signal on T2WI were combined [14]. Those that found no correlation consider the reason to be that hyperintensities chiefly indicate lesions in the grey matter that do not give rise to spastic paralysis and are, therefore, not significantly related to patients' disabilities. Decompressive surgery can result in rapid



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resolution of imaging abnormalities, but clinical improvement does not always accompany these changes [15]. In our studies comparing conservative treatment with surgery the appearance of increased signal intensity in the cervical spinal cord did not predict the outcome in either type of treatment [16, 17].

Cross-sectional transverse area at the level of maximal compression

In some cases, the spinal cord does not lose its function even under severe compression. It has been well known from animal experiments that spinal cord function may be considerably resistant to compression [18]. Moreover, the critical degree of spinal cord compression required to induce pathological changes in clinical practice remains unknown [19]. This renders matters difficult, since radiological findings for spinal cord compression, particularly if mild, may be clinically relevant or merely a coincidental anomaly that has little or nothing to do with the symptoms reported by the individual patient. This situation is far from unfamiliar in healthy subjects aged 18 to 72 years; degenerative changes, especially in the cervical region, are present on MRI in 64% of them and

are associated with cord impingement in only 11% [12]. If only subjects aged 64 or more are taken into account, cord impingement has been observed in 26%, and cord compression in 7% [12]. The percentage of cord area reduction, however, has never exceeded 16%. No significant difference in cord cross-sectional areas between those with degenerative changes and those without them has been observed. This could mean that direct and pronounced compression is necessary to evoke signs of spinal cord dysfunction [12].

To identify a clinically significant degree of compression, already associated with corresponding clinical symptoms or for the identification of patients suitable for active treatment, it is essential to establish the critical value of such compression, or other circumstances such as hyperintensities, number of compressed levels, etc.

Although in population studies there exists a correlation between a narrow sagittal diameter of the spinal canal and SCM, there is a considerable degree of overlap between the frequency histograms for the minimum anteroposterior diameter of the asymptomatic population and those with SCM [21]. An acquired anteroposterior diameter of the spinal

canal of less than 11–12 mm results in deformation of the cord (the normal sagittal diameter of the spinal cord at C5 segment is around $x = 9.6$ mm (range 8.5–11) taken from myelograms and from cadaver cord specimens). A more versatile measurement is, however, the cross-sectional area of the cord. The spinal cord is reported to lose its functional tolerance if the transverse area, as measured by computed tomographic myelography and MRI, is less than 55–75 % of the normal value [22,23]. These studies were first performed in 12 post-mortem specimens and then in animal models. However, a minimum spinal cord cross-sectional area of 0.44 cm^2 in a non-myelopathic group and a maximum measurement of 0.86 cm^2 in a myelopathic group (20 patients with cervical spondylosis) has been demonstrated [24]. The cross-sectional area at the level of maximum compression is not the only factor in the estimation of myelopathy, but is very important and easy to measure. In one group of 20 patients it has been demonstrated that narrowness of the cross-sectional area of the spinal cord was an independent prognosticator for the severity of myelopathy ($p < 0.05$), accounting for 63 % of the variations in the myelopathy score [24].

We studied the impact of the degree of spinal cord compression on clinical picture in a group of 246 patients with spondylogenic cervical cord compression. A significant difference in mJOA score was found in those with a transverse spinal cord area of below 50 mm^2 in comparison with patients with a transverse spinal cord area of above 60 mm^2 . The critical degree of spinal cord compression needed to induce clinically pathological changes is between 50 and 60 mm^2 . This relationship is valid for compression accompanied by the presence of hyperintensities on MR T2WI and was not found in patients with small cross-sectional area lacking hyperintensities in the spinal cord.

The **duration of symptoms** is frequently considered a significant factor with predictive value for long-term results [25–27]. However, it is necessary to approach the evaluation of this factor with care, because recognition of the precise onset of the disease may prove to be a difficult task.

The **number of compression levels** can affect the outcome of treatment or the natural history. A single compression level produces a mild functional deficit in comparison with multiple compression, as has been shown experimentally [28]. According to some studies, the results of surgery are better in single-level than in multilevel compressions [29–30].

The overall clinical status (including mental condition)

For surgical treatment to be indicated, the patient must be of a status that allows such an approach, i.e. normal internal (cardiopulmonary and metabolic) condition combined with a good mental approach to co-operation and the willpower necessary for rehabilitation in the postoperative period. Psychological condition is important and it is necessary to be

aware of the fact that depression is not a significant factor in the pathogenesis of the neurological clinical picture. Patients must be informed that, often contrary to expectations, surgery may stop the progression of the disease but not actually ameliorate their symptoms.

Conclusions for clinical practice

The crucial question in the treatment of mild and moderate non-progressing SCM is not “to operate or not to operate”, because both the conservative and the surgical approaches are potentially useful. Considering the results of our studies of SCM and taking the relevant literature into account, we feel that we can recommend the following guidelines:

1. Surgery is indicated in patients with clinically severe (mJOA -modified Japanese Orthopaedic Association- score less than 12 points -Score) or progressing clinical compressive spondylosis cervical myelopathy (a minority of the patients).
2. Surgery is indicated in patients with severe spinal cord compression (50 % or more) in spite of minimal symptoms and signs.
3. Conservative treatment is appropriate for patients with a stable, non-progressing, mild-to-moderate clinical picture (mJOA score > 12 points) and mild spinal cord compression (30 % or less), regardless of the presence of hyperintensities at the level of maximum compression. It is, however, necessary to check them at regular intervals (6–12 months), both clinically and with imaging (MR every 3–4 years) and electrophysiological approaches (every 3–4 years), and to reconsider indications for surgery in the event of progression.

Our results may serve as a contribution to the theory that conservative treatment has some advantages over surgery in a carefully selected group of patients. The most promising candidates for high predictive values for good results in either conservative treatment or surgery could be the transverse area of the stenotic cord, duration of the disease [30], the osseous or cartilaginous compression, the developmental diameter of the canal, positivity of electrophysiological findings, low-signal intensity changes on T1-weighted sequences [18], and severity of the neurological deficit and its dynamics.

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