

# Cervical spondylotic myelopathy: proposal of a surveillance algorithm

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**Abstract.** – The review of the publications concerning cervical spondylotic myelopathy (CSM) suggests that it has not been achieved a clear consensus about the treatment of this pathology. In this paper an algorithm of surveillance, conceived as an assistant tool to decide the best indications of treatment is presented. The algorithm permits a clear separation of the symptomatic patients on the base of the presence or the absence of neurologic damage resulting at the evoked potentials examination. The negativity of the evoked potentials, that means neurologic integrity, excludes any type of surgical treatment.

In case of proved neurologic damage, the algorithm permits a further differentiation in subgroups according to the degree of clinical disability.

If evoked potentials are positive, a surgical decompression should be always performed in patients affected by a severe clinical disability.

The group of patients affected by a mild degree of clinical disability but with positive evoked potentials represents the most challenging for the spinal surgeons. Actually, several studies support either surgical and non surgical treatment for these patients. Although the Authors think that a surgical decompression has to be always performed in case of proved neurologic damage, only further randomized studies based on accurate algorithms could elucidate the outcome of the CSM and could permit to choose the best treatment according to the degree of the disease.

## Key Words:

Cervical spondylotic myelopathy, Cord compression, Algorithm of treatment, Evoked potentials.

## Introduction

The surgical treatment of the cervical spondylotic myelopathy (CSM) is based on the principle that the decompression of the spinal cord is an

essential step to guarantee the recovery of the neurological damage or to avoid its worsening. Several scientific contributes in favour or against surgery with many kinds of motivations are present in Literature. In 1992, Rowland<sup>1</sup> stated that there were no scientific evidences of superior results in cases of CSM treated surgically compared with those treated conservatively. In the same paper, the Author affirmed the impossibility to identify clinical elements for the selection of patients who could benefit from the surgical decompression. He concluded invoking for further randomized clinical trials with the aim to better define the indications for the treatment and to better choose those patients that could have more benefit than others from an elective surgical treatment. Ten years later, Fouyas et al.<sup>2</sup> presented a review about the role of surgical treatment in the cervical radiculo-myelopathy<sup>2</sup>. Just two clinical trials out of 13.209 citations from the reviewed literature were believed to be eligible, according to the Cochrane rules, one for cervical radiculopathy<sup>3-5</sup> (81 patients) and one for cervical myelopathy<sup>6,7</sup> (49 patients). Given the small number of cases referred, it was not possible to draw conclusions about the balance between risks and benefits of the surgical treatment in the compressive pathology of the spine.

A very important aspect that arises from literature analysis is the lack of any diagnostic and prognostic trend guidelines.

Only few randomized, controlled clinical trials – level 1 evidence – have been conducted in patients with CSM. Observational studies and clinical experience do provide important, though by no means infallible, support for some recommendations.

Therefore, to date does not exist an agreement on the indications for surgical treatment of myelopathic patients, although numerous

tests and grading scales<sup>8-11</sup> (JOA, Walking test, NHPT), objective radiological parameters<sup>12</sup> (spine cord signals changing and the transverse area of the spinal cord at the level of maximum compression), and neurophysiologic tests<sup>13</sup> (evoked potentials) have been proposed to diagnose and to estimate the prognosis of the syndrome.

### ***Proposal of a Surveillance Algorithm for Cervical Spondylotic Myelopathy***

Since 1996 we have introduced in our daily practice a flowchart combining the results of various diagnostic tests in order to give an orientation about the best options of treatment.

In the present work we report the flowchart we have used in the past decade with the aim to suggest a reference algorithm of surveillance for the myelopathic patient.

To establish the more appropriate treatment of CSM, we have utilized the mJOA score as the reference “clinical” test and the Somatosensorial evoked potentials/Motor evoked potentials (Sep/Mep) as the reference instrumental tests of the neurophysiologic function of the cord. The mJOA system has been adopted by the Authors in the evaluation of the clinical disability because, actually, it is the most used score in literature despite of the scarce sensibility and specificity.

We currently use the mJOA scoring system to distinguish the myelopathic patients according to the grade of the functional disability<sup>14</sup>. A resulting score of 12 at the mJOA system has been chosen as the limit value to separate severe cases from mild and moderate cases.

An important role in the diagnosis of the syndrome must be credited to the neurophysiologic investigation. Neurophysiology in the last years introduced the study of the evoked potentials methods that are not invasive, highly sensitive and capable of giving objective results on the spine cord functionality. Somato-sensorial evoked potentials and motor evoked potentials show high sensitivity in documenting spine cord compression even if they don't have a high specificity in case of cervical spondylotic myelopathy<sup>15</sup>. Moreover, the repeatability of these procedures let to follow up the pathology from the diagnostic phase to the eventual clinical progression of the pathology,

On the base of the electrophysiologic evaluation through evoked potentials only two grades are possible: negative or positive.

**Negative grade** (Figure 1). The negativity of the neuro-physiological examination in a patient suspected to be affected by cervical myelopathy, should advice against any surgical solution. Obviously, at the same time, a careful clinical surveillance of the patient is necessary. Particularly advisable is the monitoring of those patients with a diagnostic imaging showing signs of spine stenosis and/or spots of modified signal of the cord. Only the re-evaluation of the patient and the periodical repetition of the neuro-physiological exam allows to get ultimately the eventuality of an anatomic-pathological worsening of the spine cord condition, requiring a different more appropriate therapeutic option. Thus, if the neuro-physiological examination becomes positive during the follow-up, it must induce to a re-evaluation of the clinical syndrome, and, depending on the grade of severity, to advice the best indication for early treatment.

**Positive grade** (Figure 2). The positivity of the examination obliges a careful evaluation of the clinical case based on the characteristics of the specificity of the exam.

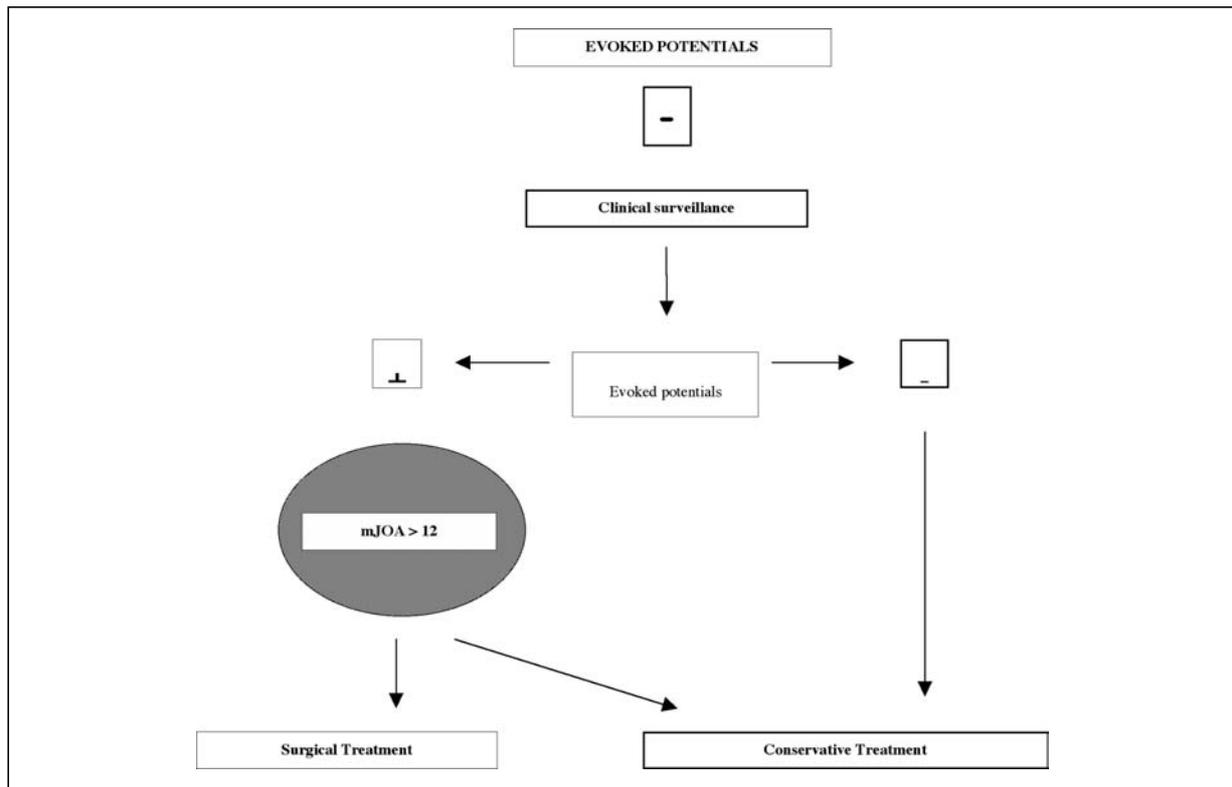
In case of a non-specific pattern for compressive spinal cord damage further investigation for a neurological differential diagnosis becomes essential<sup>15</sup>.

In case of compressive spine cord damage, it becomes mandatory a careful evaluation of the diagnostic imaging and the grading of the functional disability of the patient to confirm the option of a surgical treatment.

According to the clinical disability based on the mJOA scoring system, we can further differentiate patients affected by a high grade of neuro-physiological dysfunction (mJOA < 12) from those affected by a lesser degree of disability (mJOA > 12). The first group of patients represents the best candidate to a surgical spine cord decompression while a matter of discussion exists about the real indication for surgical procedure in the second group. We called this group as “grey area” that means a substantial uncertainty in indicating the best way to treat.

## **Discussion**

It is still debated, who is the patient affected by CSM that could benefit from surgical approach and when surgery should be performed.



**Figure 1.** Negative evoked potentials examination, excluding the damage of the spine cord, does not suggest any indication for treatment. A surgical decompression or conservative treatment has to be recommended every time the evoked potentials examination becomes positive in the follow up of a patient enrolled in a protocol of clinical surveillance for cervical myelopathy. The grey area in the figure, embraces patients affected by less severe grade of disability (mJOA > 12) with proved neurophysiologic damage of the cord for whom any kind of indication for treatment exists.

Many factors could influence the diagnostic procedure of the syndrome.

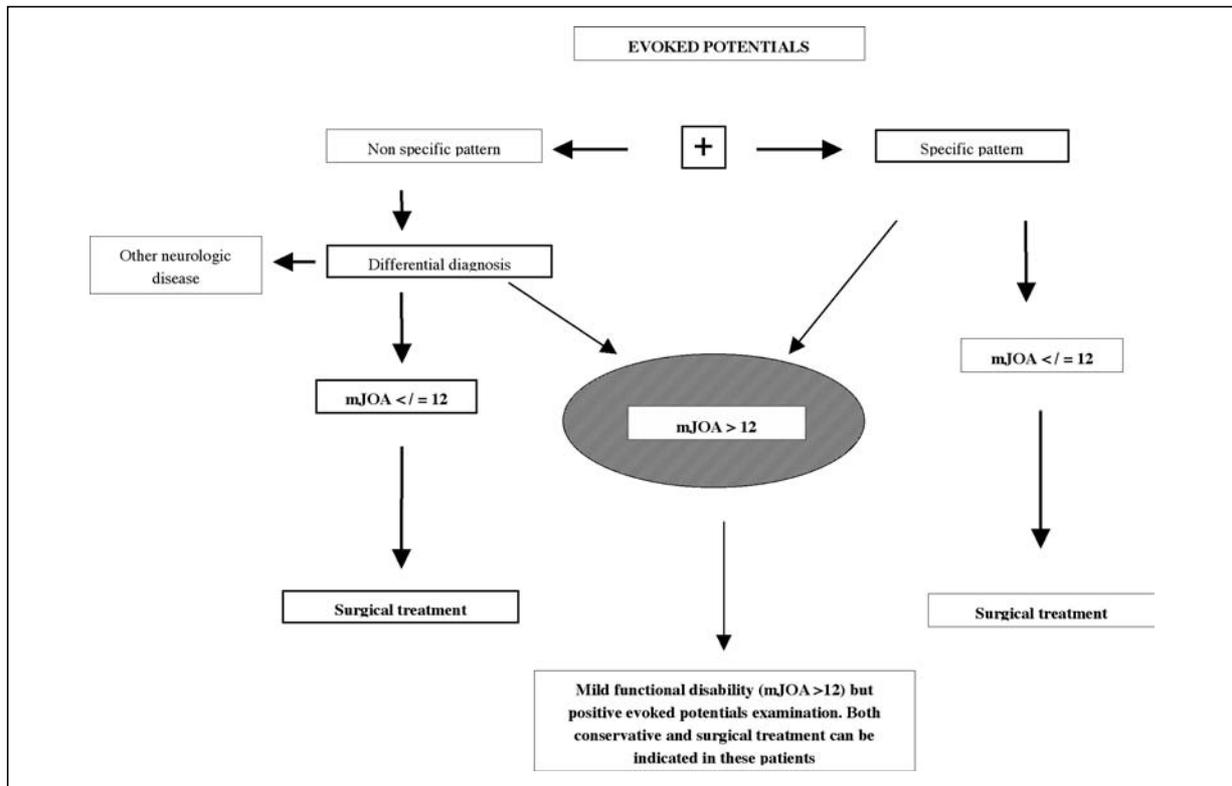
Therefore, since a few years we have adopted a therapeutic protocol that is based on the diagnostic evaluation performed, overall, on the evaluation of the cord damage by neuro-physiologic examinations. Although many clinical tests are largely used to grossly characterize the disability, all of them have low specificity and sensitivity to exactly define the average of neurological cord damage. For this reason we strongly believe that a more accurate evaluation of the neurological dysfunction is obligatory when approaching a patient with signs and symptoms of myelopathy, and an electrophysiologic evaluation through the evoked potentials should never be forgotten.

In cases with clear clinical disability (mJOA < 12) the functional cord damage (Mep/Sep proved) assumes a value of confirmation of the syndrome, but above all, it assumes an indisputable prognostic-diagnostic significance in the cases where the clinical disability is mild/moderate.

Different therapeutic and sometimes diametrically opposed solutions have been proposed in patients affected by CSM of mild or moderate entity. In these cases, belonging to the “grey area” according with the proposal algorithm, the neurophysiologic evaluation assumes great importance since it is the only exam able to reveal the spinal cord damage and to define the best option of treatment (surgical treatment or conservative treatment). The consequence of such an orientation involves both diagnostic and prognostic aspects.

A more scrupulous diagnostic pathway would allow a more strict selection of the surgical patient and also could allow to avoid unnecessary surgical procedures or procedures of doubtful effectiveness, mainly if compared to the results of conservative treatment.

Second, the availability of objective diagnostic elements would consent a more accurate comparison of the clinical series than those at present published in literature.



**Figure 2.** Positive evoked potentials let a clear identification of the patients affected by cervical cord damage. Surgical treatment is strongly recommended in case of severe functional disability ( $mJOA \leq 12$ ). The grey area identifies patients with mild functional disability ( $mJOA > 12$ ) even in the presence of positive evoked potentials examination. According to the preferences and knowledge of the physician, both conservative and surgical treatment can be indicated in these patients.

This aspect is particularly relevant because most of the papers on the CSM are based only on the evaluation of the grade of disability before and after the surgical decompression. It's well known that the reliability of every clinical tests is limited being them operator-biased. The m-JOA scoring system, as other clinical tests, resulted a quite simple method to diagnose a high grade of disability but it is much less reliable in mild and moderate disability. As the most of the Authors agree with the indication of a surgical decompression in high grade of disability, there is a field of discussion on the need of a surgical procedure in the less severe cases. One of the advantages of using a more objective flowchart, as that proposed in this paper, is to suggest a common diagnostic pathway and, in second instance, to use it as the base for a randomized polycentric protocol of the treatment. Particularly desirable should be a prospective randomized study on surgical decompression versus conservative therapy in the patients belonging to the "grey area".

## Conclusion

The lack of a common view in diagnosing and treating the CSM is an indirect confirmation of the complexity of the pathology.

The main question that arises every time approaching the patient affected by CSM is what is the best therapeutic option. In choosing the treatment we believe that the priority must be reserved to the evaluation of the neurological damage of the cord rather than the clinical disability alone.

Our current view is that the surgical indication must be always recommended in patients with a cord damage proved by neurophysiologic tests. It is well known, even though there are not certain and manifest rules, that the reversibility of the neurological damage is directly influenced by the entity of the compression and the delay of the decompression when required. Therefore we think that a demonstrated compressive damage of the spinal cord, independently from the entity of the

clinical disability, is sufficient to strongly recommend the decompression of the medulla in order to promote the biological recovery.

Such orientation is certainly open to discussion and modification on the base of future scientific evidences. As we are convinced to indicate surgical treatment every time we face a cord damage, we also believe that there could be arguments for further discussion about the best therapeutic solution for those patients whose clinical impairment is less severe (mJOA > 12). This represents in some way the biggest controversy since in Literature are present results in favour of both the surgical and the non-surgical approach to treat these patients. Only prospective randomized studies on large series could permit a better definition of the surgical indications. At the moment, however, given the lack of homogeneity about the best therapeutic procedure in CSM, we have assumed the present diagnostic orientation algorithm. The purpose is to improve outcomes for individuals with cervical spondylotic myelopathy by stimulating future research to fill gaps in knowledge regarding treatment of the disease and providing a rationale for the best treatment options.

### References

- 1) ROWLAND LP. Surgical treatment of cervical spondylotic myelopathy: time for a controlled trial. *Neurology* 1992; 42: 5-13.
- 2) FOUYAS I, STATHAM P, SANDERCOCK P. Cochrane review on the role of surgery in cervical spondylotic radiculomyelopathy. *Spine* 2002; 27: 736-747.
- 3) PERSSON LC, MORITZ U, BRANDT L, CARLSSON CA. Cervical radiculopathy: pain, muscle weakness and sensory loss in patients with cervical radiculopathy treated with surgery, physiotherapy or cervical collar. A prospective, controlled study. *Eur Spine J* 1997; 6: 256-266.
- 4) PERSSON LC, CARLSSON CA, CARLSSON JY. Long-lasting cervical radicular pain managed with surgery, physiotherapy, or a cervical collar. A prospective, randomized study. *Spine* 1997; 22: 751-758.
- 5) PERSSON LC, LILJA A. Pain, coping, emotional state and physical function in patients with chronic radicular neck pain. A comparison between patients treated with surgery, physiotherapy or neck collar—a blinded, prospective randomized study. *Disabil Rehabil* 2001; 23: 325-335.
- 6) BEDNARIK J, KADANKA Z, VOHANKA S, STEJSKAL L, VLACH O, SCHRODER R. The value of somatosensory and the motor evoked potentials in predicting and monitoring the effect of therapy in spondylotic cervical myelopathy: prospective randomized study. *Spine* 1999; 24: 1593-1598.
- 7) KADANKA Z, BEDNARIK J, VOHANKA S, VLACH O. Spondylotic cervical myelopathy. Conservative vs surgical treatment. *Scripta Medica (BRNO)* 1997; 70: 317-327.
- 8) HIRABAYASHI K, WATANABE K, WAKANO K, SUZUKI N, SATOMI K, ISHII Y. Expansive open-door laminoplasty for cervical spinal stenotic myelopathy. *Spine* 1983; 8: 693-699.
- 9) MATHIOWEZ V, VOLLAND G, KASHMAN N, WEBER K, WADE DT. *Nine Hole Peg Test: measurement in neurological rehabilitation*. New York: Oxford University Press 1992; pp. 171.
- 10) SINGH A, CROCKARD HA. Quantitative assessment of cervical spondylotic myelopathy by a simple walking test. *Lancet* 1999; 354: 370-373.
- 11) VERNON H, MIOR S. The Neck Disability Index: a study of reliability and validity. *J Manipulative Physiol Ther* 1991; 14: 409-415.
- 12) WADA E, YONENOBU K, SUZUKI S, KANAZAWA A, OCHI T. Can intramedullary signal change on magnetic resonance imaging predict surgical outcome in cervical spondylotic myelopathy? *Spine* 1999; 24: 455-461.
- 13) BEDNARIK, J, KADANKA Z, DUSEK L, NOVOTNY O, SURELOVA D, URBANEK I, PROKES B. Presymptomatic spondylotic cervical cord compression. *Spine* 2004; 29: 2260-2269.
- 14) BENZEL EC, LANCON J, KESTERSON L, HADDEN T. Cervical laminectomy and dentate ligament section for cervical spondylotic myelopathy. *J Spinal Disorder* 1991; 4: 286-295.
- 15) DI LAZZARO V, OLIVIERO A, PROFICE P, FERRARA L, SATURNO E, PILATO F, TONALI P. The diagnostic value of motor evoked potentials. *Clin Neurophysiol* 1999; 110: 1297-1307.