Anterior decompression and fusion in cervical spondylosis

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Abstract. Cervical spondylosis is the most frequent reason for progressive impairment of spinal cord and nerve roots, which is clinically manifested as cervical spondylotic myelopathy (CSM), cervical radiculopathy, or both. Eighty operated patients are presented (49 men and 31 women), who had evidence of CSM and/or radiculopathy. Age ranged from 26 to 80 years (mean 50 years). Depending on the predominating clinical symptoms the patients were divided as follows: 30 patients (25 men and 5 women) with CSM, 28 patients (7 men and 21 women) – with radiculopathy, and 22 patients (17 men and 5 women) – with myeloradiculopathy. The clinical evaluation in each patient was performed by the Nurick classification scale. All patients were operated through an anterior approach at different levels, and the following surgical procedures were applied: discectomy and/or osteophitectomy, followed by fusion by a carbon fiber cage, with or without anterior stabilization by a titanium plate. The post-operative evaluation and follow-up were performed in 71 patients (89%). In 64 of them (90%) progressive clinical improvement was observed. 7 of them had no change (10%). Early or late complications related to the surgical approach and the heterologic implants have not been detected so far. The choice of surgical approach in cervical spondylosis is still controversial, nevertheless, the anterior decompression and fusion have been considered appropriate in many clinical cases over the last years. Based on the results analyzed so far we advocate the anterior surgical approach and fusion by carbon fiber cage with or without titanium plaque for stabilization.

Key words: Cervical spondylosis, anterior decompression, anterior fusion, anterior fixation.

Cervical spondylosis is the most frequent reason for spinal cord and root impairment in the cervical spine. There are two main mechanisms for the occurrence of myelopathy: direct compression of the medulla and ischemic vascular lesions [1]. Since they are predominantly caused by anterior compression, logically the anterior approach is the main surgical method for treatment. The clinical state includes two main syndromes: cervical myelopathy and cervical radiculopathy, however quite often a combination of both is observed. Patients’ complaints include: neck pain and stiffness, pains irradiating to the arms, numbness and muscle weakness in the arms and legs, difficulty in walking etc. The diagnosis of disease requires cervical spondylographies, CT and MRI of the cervical spine [2-5]. The surgical treatment of the disease includes anterior discectomy and osteophitectomy, and stabilization with carbon fiber “spacers” (cages) and titanium plaque [1,6-8,9]. This method has been applied at the Clinic of Neurosurgery of the Military Medical Academy for 4 years.

The objective of our study is to analyze the cases we have treated so far by anterior approach, fusion by carbon fiber cages and stabilization by a titanium plaque.

Materials and methods

The study includes 80 patients with cervical spondylosis, who underwent surgical treatment at the Clinic of Neurosurgery over the period from 2003 until 2006. The patient distribution by sex is as follows: 31 women vs. 49 men (1:1.6). Mean age was 51 ± 10 years (Figure 1).

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According to the clinical symptoms, all patients were separated in 3 groups (Figure 2) as radiculopathy, myelopathy and myeloradiculopathy.

Figure 2. Distribution of patients according to clinical symptoms.

The patients’ clinical condition was assessed by Nurick Classification Scale (Table 1).

<table>
<thead>
<tr>
<th>Grade</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Signs or symptoms of root involvement, no evidence of spinal cord disease</td>
</tr>
<tr>
<td>1</td>
<td>Signs of spinal cord disease, no difficulty in walking</td>
</tr>
<tr>
<td>2</td>
<td>Slight difficulty in walking, does not allow full-time employment</td>
</tr>
<tr>
<td>3</td>
<td>Difficulty in walking, does not allow full-time employment, does not require help in walking</td>
</tr>
<tr>
<td>4</td>
<td>Able to walk only with someone’s help or with the aid of a frame</td>
</tr>
<tr>
<td>5</td>
<td>Chair bound or bedridden</td>
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</tbody>
</table>

Table 2. Distribution of patients by clinical symptoms, impaired spine levels and applied surgical techniques

<table>
<thead>
<tr>
<th>Levels</th>
<th>n</th>
<th>Fusion/Type</th>
<th>Radiculopathy</th>
<th>Myelopathy</th>
<th>Myeloradiculopathy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>25</td>
<td>Cage</td>
<td>21</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>2 cages</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>2 cages + Titanium plate</td>
<td>2</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>3 cages + Titanium plate</td>
<td>0</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>

On early post-operative results evaluation, 64 patients (80%) experienced relief of their clinical symptoms. No perioperative complications were observed in any of our patients. The catamnesis follow-up was achieved in 71 patients (89%), whereby the neurological status, control X-ray at 5-th post-operative week and the CT and MRI results were recorded 2 months after the surgical treatment. Nine patients (11%) dropped off from the follow up (Figure 3).

In all patients X-ray control through a C-arm was used. The surgical techniques included:

- Excision of the fragmented disc with end-plate preservation;
- Osteophiectomy;
- Posterior longitudinal ligamentotomy and revision of the epidural space;
- Decompression of nerve structures by a high speed burr, Kerison rongeurs and curettes;
- Placement of carbon fiber cages through moderate head traction;
- Anterior fixation by a titanium plate and locking screws;
- Closing the soft tissues by layers and insertion of aspiration drainage for 24 hours.

Results

On the base of the pre-operative clinical symptoms, and the X-ray and MRI results defining the impaired cervical levels, we divided the patients in 4 main groups (Table 2). Patients who had lesion at 1 level only, were placed only a carbon fiber cage, without additional titanium plate anterior stabilization. Patients with spondylotic lesions at 2 levels were divided into 2 groups, depending on the performance/non-performance of anterior metal stabilization. All patients with 3 level lesions underwent titanium plate stabilization. Totally, we implanted 149 carbon fiber cages and 39 titanium plates.
Clinical Case No. 1
We present a 41 year-old patient with clinical symptoms of radiculopathy and MRI evidence of spondylotic lesions at C₅-C₆ level and compression of the anterior subarachnoid space (Figure 4a). Operative intervention was performed through anterior approach and a carbon fiber cage was placed (Figure 4b). The control X-ray at 5-th week displays restoration of the cervical lordosis without compromising the implant position (Figure 4c). The radicular symptoms showed fast and definitive regress.

Figure 4. Preoperative MRI (a), early cervical spondylography (b) and control spondylography at 5th week (c)

Clinical Case No. 2
We present a 34 year-old woman with symptoms of myelopathy and MRI evidence of pronounced spondylosis at C₃-C₄ and C₅-C₆ levels (Figure 5a). The patient underwent operation through anterior approach and 2 carbon fiber cages were placed, without titanium plate stabilization (Figure 5b and 5c). Significant improvement of the myelopathy symptoms was observed at the control clinical examination on the 30-th postoperative day.

Figure 5. Preoperative MRI (a), postoperative MRI at 2nd month (b) and carbon fiber cage position (c)

Clinical Case No. 3
We present a 46 year-old woman, with spondylotic myelopathy at two adjacent levels (Figure 6a). Anterior approach was applied. Two carbon fiber cages were placed with stabilizing titanium plate (Figure 6b). The control MRI examination at the 2nd month showed a good result regarding the anterior decompression (Figure 6c). The clinical symptoms have had a consistent regress.

Figure 6. Preoperative MRI (a), early spondylography (b) and postoperative MRI at 2nd month (c)

Clinical Case No. 4:
A 48 year-old man with cervical myelopathy and MRI evidence of pronounced spondylotic lesions at C₃-C₄, C₄-C₅ and C₅-C₆ levels, with anterior compression of the neural structures (Figure 7a). Decompression was performed through anterior approach. Three carbon fiber cages and stabilizing titanium plate were placed; through the bending of which improvement of the cervical lordosis was achieved (Figure 7b, 7c and 7d).

Figure 7. Preoperative MRI (a), placement of 3 carbon fiber cages (b) and titanium plate (c) and early X-ray control on 1st postoperative day (d)

Discussion
The anterior decompression, fusion and stabilization methods are still controversial. Undoubtedly, patients’ clinical status improves after anterior decompression and stabilization [4,10-13]. However, some authors report 50% improvement and less than 5% complications [14]. In long-term follow-ups some good surgical results are reported, but the results concerning function vary. The latter is explained by some authors with the physiologi-
cal changes pertaining to age and leading to spinal cord dysfunction [6,7,15,16]. The surgical outcome in anterior decompression is rather predictable regarding myelopathy [14]. When multisegment procedures are concerned the fusion rate is high and in 4-6% pseudoarthroses are observed [6]. In multilevel fusion the pseudoarthrosis rate increases due to the greater number of surfaces involved [17].

There is much controversy in literature regarding the advantages of different operative techniques for anterior approach and fusion with stabilization. Some authors report better results in using spacers for corporodesis at one level, and worse in two or more levels [1,6,7,17]. There is a non-significant difference between the results in fusion by bone graft and carbon fiber cages, however, certain complications have been reported in literature, related to the use of iliac bone graft, which according to different authors, might vary from 3% to 54% [6,7].

Currently, we would give advantage to the presented above operative technique due to:
- Shortened operating time;
- Reduced postoperative stay and possibility for early rehabilitation;
- Early restoration of ability to work within 1-2 months;
- Shortened period of external immobilization;
- Virtual lack of complications.

Overall, our major argument for the use of stabilizing titanium plates is the presumption of impaired stability of the anterior support columns in surgical procedures at several cervical levels. Irrespective of the fact that choosing appropriate neurosurgical treatment in cervical spondylosis is still controversial, we are of the opinion that the anterior nerve structure compression demands the use of anterior approach with implantation of carbon fiber cages and stabilization by a titanium plate when lesions at two or more levels are concerned. The follow-up period, as well as the relatively restricted number of patients, does not allow us for the time being to come up with a definitive conclusion on the advantages of the presented operative techniques. In addition, the question of changing the cervical spine biomechanics due to the post surgical changes at adjacent levels is still a subject of serious discussion.

References

