

Evaluation of Treatment Results of Posterior Approach Surgery in Patients with Cervical Spondylotic Myelopathy

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ABSTRACT

BACKGROUND AND OBJECTIVE: The most common cause of spinal cord disorder in adults is cervical spondylotic myelopathy. Surgical treatment of cervical spondylotic myelopathy prevents neurological disorders. The surgical procedure of choice should have the least complications with the best results. Therefore, this study was performed to evaluate the treatment outcomes of posterior approach surgery in patients with cervical spondylotic myelopathy.

METHODS: This cross-sectional study was performed on 93 patients with cervical spondylotic myelopathy for two years in Al-Zahra Hospital in Isfahan without a history of cervical spine surgery and spinal stenosis who underwent laminectomy. The criterion for measuring the severity of the disease was the Modified Japanese Orthopedic Association (MJOA) index to determine the severity of myelopathy (condition of the upper and lower limbs and sphincter condition). The studied variables included age, gender, disease severity and surgical complications including hematoma, infection, neurological symptoms and dura injury. Patients were evaluated before surgery and 6 months and 12 months later in the spine clinic.

FINDINGS: In this study, 27 men and 66 women with a mean age of 60.06 ± 10.35 years participated. The severity of myelopathy increased from 10.11 ± 3.78 at the beginning of the study to 13.46 ± 2.9 and 13.88 ± 2.7 at six months and twelve months after surgery. In the upper, lower extremities and sensory disorders, a significant improvement was observed in patients in the sixth and twelfth months ($p < 0.001$). Infection was observed in a small number of patients.

CONCLUSION: Based on the results of this study, the use of elective surgery improved the symptoms of patients with cervical spondylotic myelopathy in six months and one year follow-up.

KEY WORDS: *Cervical Spondylotic Myelopathy, Cervical Spondylosis, Modified Japanese Orthopedic Association (MJOA) Index.*

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Introduction

The most common cause of spinal cord disorder in adults is cervical spondylotic myelopathy (CSM) (1). Cervical myelopathy occurs due to three causes: static, dynamic, and ischemic. Cervical degeneration or spondylosis, traumatic injury to the spinal cord during flexion and extension movements, and pressure on the spinal arteries leading to ischemia are static, dynamic, and ischemic causes, respectively (2). Symptoms of root involvement include localized stabbing pain to the affected root and upper limbs or chest, and muscle weakness. Symptoms of pressure on the spinal cord or myelopathy are less localized in the form of pain and weakness and in the form of weakness in walking. On examination, due to involvement of the corticospinal tract and the effect of pressure on the posterior pathways of the spinal cord, hyperreflexia, clonus, Babinski, and Hoffman are positive (3).

Cervical spondylosis is the main cause of cervical spinal cord disease and spinal cord dysfunction (4). Chronic cervical spinal stenosis can lead to chronic swelling, cellular apoptosis, and microvascular dysfunction, which may be the biological basis of cervical spondylosis myelopathy (5, 6). Kadanka's study showed that 20 to 60 percent of patients develop neurological disorders after two to six years without surgery, and their daily activities decline. 6.3% of patients after one year, 27.3% after three years and 56% after ten years of treatment worsened compared to the first day, but the operated patients were in a better condition than the non-operated patients (7).

Posterior resection is a laminectomy with or without fusion and laminoplasty. The most important limitation of posterior laminectomy is late kyphosis, and about 5 to 10% of laminectomy cases have evidence of kyphosis on radiology. This complication is more severe in younger patients (8-11). The anterior method, especially in old age, during the surgical procedure with the possibility of pressure on the carotid artery, in the presence of plaque, may lead to embolism in the brain. The need for braces after dysphagia surgery and speech disorders due to laryngeal recurrent nerve damage, disease in the adjacent segment, pseudoarthrosis in cases of osteoporosis are complications of this operation (12, 13). The posterior approach is usually suitable for patients with multilevel cervical spondylotic myelopathy or cervical lordosis (13, 14). However, in studies such as Shamji et al., there was no difference in surgery with posterior and anterior approach as well as their complications, and only in posterior approach, the

rate of infection is higher and therefore surgical contraction is considered in these patients (8). Since the selected surgical procedure should have the least complication, the present study was performed to evaluate the treatment outcomes of posterior approach in patients with cervical spondylotic myelopathy.

Methods

This cross-sectional study was performed on 93 patients in Al-Zahra Hospital of Isfahan from 2016 to 2018 after approval by the Ethics Committee of Isfahan University of Medical Sciences with the code IR.MUI.RESEARCH.REC.1397.416. Inclusion criteria were patients 18 years and older, confirmation and diagnosis of cervical spondylotic myelopathy by MRI imaging and clinical evidence, no history of cervical spine surgery, no history of stroke and no signs of spinal stenosis. Exclusion criteria were non-cooperation of patients and patient death.

Eligible patients were examined and operated on in the specialized spine clinic of Al-Zahra Hospital. Cases that underwent laminectomy on more than two levels underwent infusion to prevent late kyphosis and cervical instability. The Modified Japanese Orthopedic Association (MJOA) index (15) was used to determine the severity of myelopathy (sensory motor status of the upper and lower limbs and sphincter position). Patients were evaluated before surgery, and 6 and 12 months later in the spine clinic. Age, gender, severity of disease and surgical complications including hematoma, infection, neurological symptoms and dura injury were assessed. The severity of myelopathy was categorized based on MJOA score as 1-11 (severe), 12-14 (moderate), 15-17 (mild), and 18 (normal). In telephone interview or face-to-face examination, the ethical principles of confidentiality were observed. Data were analyzed using SPSS-25 software. Quantitative variables were presented as mean and standard deviation and qualitative variables as percentage. To compare the mean MOJA before and after the intervention, paired t-test was used and to examine the trend of changes in the studied variables during the study, measurement analysis was used to repeat the observations and $p < 0.05$ was considered significant.

Results

Out of 93 participating patients, one patient died at home one week after surgery due to unknown reasons

and the data of 92 patients were included in the final analysis. The mean age of patients was 60.06 ± 10.35 years. 71% of patients (66 patients) were female. In the follow-up, the mean MJOA increased from 10.11 ± 3.78 to 13.46 ± 2.9 in the sixth month and 13.88 ± 2.7 in the twelfth month, which was significantly different from the mean MJOA before surgery and 6 months after surgery ($p < 0.001$) (Figure 1). Comparison of the mean total score of MJOA separately showed that in the upper, lower extremities and sensory disorders, significant improvement was in patients participating in the study in the sixth month compared to the time before surgery and in the twelfth month compared to the sixth month and before the operation. In the sphincter disorders section, in the sixth and twelfth months after surgery, there was a significant improvement compared to before the operation, although the changes in the twelfth month compared to the sixth month were not significant (Table 1). At the beginning of the study, 57 patients (62%) had severe myelopathy, and at the end of

the twelfth month, 8 patients (10%) were in the normal group (Figure 2). The most common complication was infection (4 cases). Other complications included one case of pressure ulcers, 2 cases of surgical suture loosening and one case of hematoma, two cases of dura injury and one case of fifth nerve palpation.

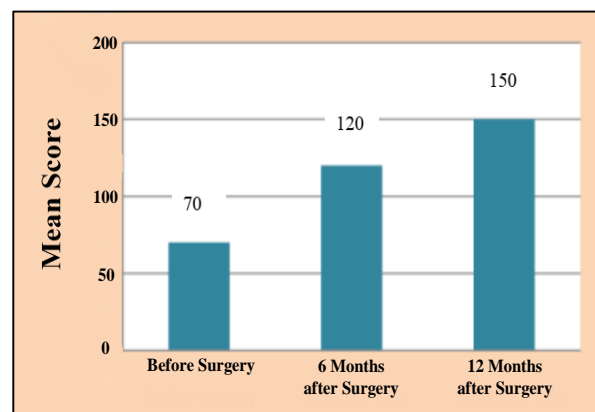


Figure 1. Distribution of mean MJOA score in patients at different times before and after surgery

Table 1. Comparative distribution of mean MJOA scores at different times

Variable	Time	At the beginning of the study Mean±SD	6 months after surgery Mean±SD	12 months after surgery Mean±SD
The upper limb	At the beginning of the study	2.77±1.39	3.83±1.25	3.87±1.15
	6 months after surgery	p= 0.001	p= 0.001	p= 0.001
	12 months after surgery	p= 0.001	p= 0.001	-
The lower limb	At the beginning of the study	3.55±1.89	4.79±1.59	4.99±1.41
	6 months after surgery	p= 0.001	p= 0.001	p= 0.001
	12 months after surgery	p= 0.001	p= 0.001	-
Sensory disorders	At the beginning of the study	1.79±0.74	2.26±0.60	2.46±0.61
	6 months after surgery	p= 0.001	p= 0.001	p= 0.001
	12 months after surgery	p= 0.001	p= 0.004	p= 0.004
Sphincter disorders	At the beginning of the study	2.00±1.08	2.48±0.74	2.50±0.76
	6 months after surgery	p= 0.001	p= 0.001	p= 0.001
	12 months after surgery	p= 0.001	p= 0.103	-

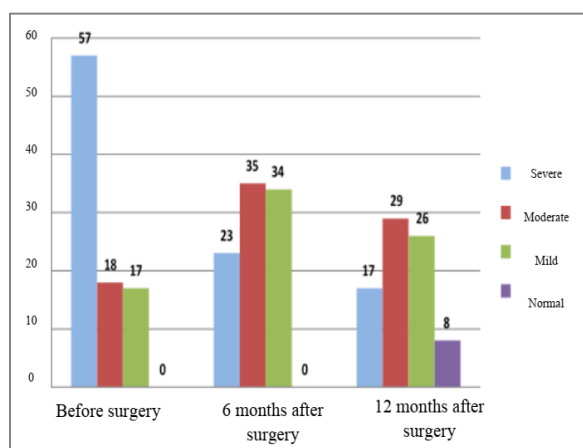


Figure 2. Frequency distribution of different myelopathy severities in patients participating in the study

Discussion

The present study showed that the selection of posterior approach in the treatment of cervical spondylotic myelopathy had satisfactory results, 6 months and 12 months after surgery. The posterior approach is ideally suited for patients with cervical spondylotic myelopathy, and patients with cervical lordosis (7, 8). In some studies, there was no difference between posterior and anterior approach (9, 10). In some studies, posterior method showed higher evidence of wound infection (11). In the present study, wound infection was observed in 43% of patients. In the study of Audat et al. (16) with at least 5 years of follow-up, there was no significant difference between the clinical

and radiological results in posterior and anterior approach (laminectomy and fusion) and only better results were observed in neck disability index score (NDIs) in anterior approach, which as they stated was not clinically significant. Karadimas et al. (10) stated that 20 to 60% of patients with cervical spondylotic myelopathy become neurologically disabled within 3 to 6 years if no surgical intervention is done.

In the study of Fehlings (9), 278 participants from 12 locations in North America were evaluated based on the results of posterior or anterior or combined approach surgery with MJOA, Nurick, neck disability index, and SF-36 scales. 169 patients were treated anteriorly and 95 patients were treated posteriorly. Patients undergoing anterior surgery were younger and had less severe myelopathy, as indicated by MJOA and Nurick scores, there was no baseline difference in neck disability index, or SF-36 between posterior and anterior cases, and more importantly, patients treated with the anterior technique were younger and the injury was less severe, but the improvement in MJOA was significantly lower in the anterior group compared the posterior group, indicating that the posterior approach method was more effective. In the present study, patients showed a significant improvement in MJOA index at 6 months and 12 months after surgery.

In a study by Matsunaga et al., they compared 37 patients treated with laminectomy with 64 patients who had experienced laminoplasty, and their mean follow-up of more than 5 years showed that 35% of postoperative kyphosis was in the laminectomy group and only 7% was in the laminoplasty group (13). Manzano et al. (14) randomly selected 16 patients for laminoplasty, or laminectomy and posterior fusion with 12 months follow-up. Data collected about MJOA scores and neck disability index, reported similar results in both groups. However, the laminoplasty group reported a significant improvement in Nurick scores over one year. The laminectomy and fusion groups had a 75% reduction in cervical range of motion between C2 and C7, while the laminoplasty group experienced only a 20% reduction. In a cohort study of 121 patients over

5 years, Woods et al. examined 39 patients with laminoplasty and 82 with laminectomy and fusion after 24 months of treatment. The results and complications were similar between the two groups and 2% and 5% of patients in the laminoplasty and fusion laminectomy groups needed reoperation, respectively (17). In one study, Highsmith et al. compared the results of a history analysis of 56 patients, 30 of whom underwent laminoplasty and 26 underwent laminectomy and fusion, and found that both groups had similar improvements in Nurick, MJOA, and Odom scores. Patients who underwent laminectomy and fusion had significant improvements in postoperative pain scores compared to laminoplasty patients, and this study showed that posterior fusion versus laminoplasty had a significant effect on improving neck pain, but implant costs in the group laminectomy and fusion were approximately three times more common than in laminectomy (18).

Karpova et al.'s study showed that MJOA score and age are the most reliable indicators in predicting postoperative outcomes in these patients, but the status of cord signal in MRI, duration of preoperative symptoms and spinal stenosis are not desirable indicators to predict postoperative outcomes (19).

The limitation of the present study was the lack of a control group to compare the results with it. It is suggested to use the control group in future studies. The results of the present study showed that the use of posterior approach surgery with laminectomy with or without fusion in cervical spondylotic myelopathy can improve patients' symptoms based on MJOA index. Based on the results of this study, better results were obtained in one-year follow-up than in 6-month follow-up. Complications such as infection were also observed in a small percentage of patients.

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References

- 1.Rao R Neck pain, cervical radiculopathy, and cervical myelopathy: pathophysiology, natural history, and clinical evaluation *J Bone Joint Surg Am* 2002; 84-A(10): 1872-81.
- 2.Donnelly DJ, Longbrake EE, Shawler TM, et al Deficient CX3CR1 signaling promotes recovery after mouse spinal cord injury by limiting the recruitment and activation of Ly6Clo/ iNOS+ macrophages *J Neurosci* 2011; 31(27): 9910-22.
- 3.Sekhon LH Posterior cervical decompression and fusion for circumferential spondylotic cervical stenosis: review of 50 consecutive cases *J Clin Neurosci* 2006; 13(1): 23-30.
- 4.Takenouchi T, Setoguchi T, Yone K, et al Expression of apoptosis signal-regulating kinase 1 in mouse spinal cord under chronic mechanical compression: possible involvement of the stress-activated mitogen-activated protein kinase pathways in spinal cord cell apoptosis *Spine* 2008; 33 (18): 1943-50.
- 5.Yu WR, Baptiste DC, Liu T, et al Molecular mechanisms of spinal cord dysfunction and cell death in the spinal hyperostotic mouse: implications for the pathophysiology of human cervical spondylotic myelopathy *Neurobiol Dis* 2009; 33(2): 149-63.
- 6.Yu WR, Liu T, Fehlings TK, et al Involvement of mitochondrial signaling pathways in the mechanism of Fas-mediated apoptosis after spinal cord injury *Eur J Neurosci* 2009; 29(1): 114-31.
- 7.Kadanka Z, Mares M, Bednarík J, Smrcka V, Krbec M, Chaloupka R, Dusek L. Predictive factors for mild forms of spondylotic cervical myelopathy treated conservatively or surgically. *Eur J Neurol*. 2005 Jan;12(1):16-24.
- 8.Shamji MF, Cook C, Tackett S, et al Impact of preoperative neurological status on perioperative morbidity associated with anterior and posterior cervical fusion *J Neurosurg Spine* 2008; 9(1): 10-6.
- 9.Fehlings MG, Smith JS, Kopjar B, et al Perioperative and delayed complications associated with the surgical treatment of cervical spondylotic myelopathy based on 302 patients from the AOSpine North America Cervical Spondylotic Myelopathy Study *J Neurosurg Spine* 2012; 16(5): 425-32.
- 10.Karadimas SK, Moon ES, Yu WR, et al A novel experimental model of cervical spondylotic myelopathy (CSM) to facilitate translational research. *Neurobiol Dis* 2013; 54: 43-58.
- 11.Zhu B, Xu Y, Liu X, Liu Z, Dang G Anterior approach versus posterior approach for the treatment of multilevel cervical spondylotic myelopathy: a systemic review and meta-analysis *Eur Spine J* 2013 Jul;22(7):1583-93.
- 12.Klineberg E Cervical spondylotic myelopathy: a review of the evidence *Orthop Clin North Am* 2010; 41(2): 193-202.
- 13.Matsunaga S, Sakou T, Nakanisi K Analysis of the cervical spine alignment following laminoplasty and laminectomy *Spinal Cord* 1999; 37(1): 20-4.
- 14.Manzano GR, Casella G, Wang MY, et al A prospective, randomized trial comparing expansile cervical laminoplasty and cervical laminectomy and fusion for multilevel cervical myelopathy *Neurosurgery* 2012; 70(2): 264-77.
- 15.Pratali RR, Smith JS, Rocha RD, Matos TD, Defino HLA, Herrero CFPS. Reliability of a brazilian portuguese translated and cross-culturally adapted version of the mjoa scale. *Acta ortop bras*. 2018;26(5):335-7.
- 16.Audat ZA, Fawareh MD, Radydeh AM, Obeidat MM, Odat MA, Bashaireh KM, Barbarawi MM, Nusairat MT, Ibraheem AB, Audat MZ. Anterior versus posterior approach to treat cervical spondylotic myelopathy, clinical and radiological results with long period of follow-up. *SAGE Open Med*. 2018 Apr 10;6:205031.
- 17.Woods BI, Hohl J, Lee J, et al Laminoplasty versus laminectomy and fusion for multilevel cervical spondylotic myelopathy *Clin Orthop Relat Res* 2011; 469(3): 688-95.

18.Highsmith JM, Dhall SS, Haid RW Jr, Rodts GE Jr, Mummaneni PV Treatment of cervical stenotic myelopathy: a cost and outcome comparison of laminoplasty versus laminectomy and lateral mass fusion J Neurosurg Spine 2011 May;14(5):619-25.

19.Karpova A, Arun R, Davis AM, Kulkarni AV, Massicotte EM, Mikulis DJ, Lubina ZI, Fehlings MG Predictors of surgical outcome in cervical spondylotic myelopathy Spine 2013 Mar 1;38(5):392-400.