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Original Article

The posterior surgical treatment and outcomes of cervical spondylotic myelopathy: Why not C5 nerve root palsy occur

Ismail Yuce[1], Okan Kahyaoglu[2], Muzeyyen Ataseven[3], Halit Cavusoglu[1], Yunus Aydin[2]

[1]Vocational School of Health Services, Acibadem Mehmet Ali Aydinlar University, Istanbul, Turkey
[2]Acibadem Healthcare Group, Fulya Hospital, Istanbul, Turkey
[3]Vocational School of Health Services, Istanbul Medipol University, Istanbul, Turkey

Abstract

Aim: Cervical spondylotic myelopathy is an age-related degenerative spinal pathology. Anterior or posterior approaches are preferred for surgical treatment. C5 palsy is a common complication after the posterior approach. The aim of our study is to describe the modified laminectomy technique, evaluate short-time surgical outcomes and comment on the C5 nerve root palsy formation.

Materials and Methods: 83 patients who had been treated by modified laminectomy for cervical spondylotic myelopathy between the years 2012 and 2017 in our clinic were undertaken in our study. We evaluated the preoperative and postoperative neurologic status of the patients with VAS and JOA scales, complications (C5 palsy) of surgical treatment. The posterior approach was not performed at patients with a >13 degree angle of cervical curvature.

Results: 61 of 83 patients were male and 22 were female. The mean age at the time of surgery was 57.8±8.3. The average JOA scale score was 9.4±0.9 preoperatively, 10.1±.0.9 early postoperatively and 15.1±1.0 during the late postoperative follow-up. The average angle of the cervical curvature preoperatively-postoperatively was 17.1±2.6 and 15.8±2.4 respectively. There weren't any symptoms for C5 nerve root palsy which is a common postoperative complication.

Conclusions: The cervical posterior laminectomy, which includes en-bloc laminectomy and preserving of the facet joint capsule, allows a sufficient and safe decompression of the neural structures for cervical spondylotic myelopathy.

Keywords: Cervical spondylosis; laminectomy; palsy

INTRODUCTION

Cervical spondylosis is an age-related degenerative spinal pathology which includes disc degeneration, osteophyte formation and hypertrophy of the ligamentum flavum (1). Because of this degenerative spine pathology, the spinal canal of the cervical spine gradually narrows and causes cervical myelopathy (2). Cervical spondylotic myelopathy (CSM) includes neck and arm pain, motor and sensory disturbances, spasticity, gait disturbances of the extremities (1). The aim of surgical treatment of cervical spondylosis is providing decompression and increasing the diameter of the cervical canal with protecting the spinal stability (3,4). The laminectomy or laminoplasty with or without fusion were preferred to posterior approach for surgery of CSM. C5 palsy is a common complication for posterior approaches and is a sensation disorder and/or persistent pain around the shoulder (5-14). The modified laminectomy was performed with a posterior approach in our clinic. The aim of our study is to describe the modified laminectomy technique, share our experiences and evaluate the short-time surgical outcomes and complications of our technique.

MATERIALS and METHODS

This retrospective design study was approved by the Ethical committee of İstanbul Medipol Universty. Approval No: 812-23102019. The eighty three patients who were operated with posterior laminectomy for CSM in our clinic between January 2012 and January 2017 were included in the present study. All of the patients presented myelopathy symptoms which were referable to cervical spondylosis and all the patients were operated by the senior author (Y.A.). Patients presenting with traumatic cervical myelopathy and who had >13 degree angle of cervical curvature were not included. The total cervical curvature was evaluated based on the tangent of C2

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Corresponding Author: Ismail Yuce, Vocational School of Health Services, Acibadem Mehmet Ali Aydinlar University, Istanbul, Turkey
E-mail: dr.ismailyuce@gmail.com

and C7 posterior bodies via cervical lateral X-ray. The posterior approach was not performed on patients with a >13 degree angle of cervical curvature in our clinic. The assessment of the neurological status of the patients was done preoperatively, ten days postoperative and at 6 months after the operation with the Visual Analogue Scale (VAS) and the Japanese Orthopedic Association (JOA) scale. Then they were evaluated with magnetic resonance images (MRI) (Figure 1) or cervical tomography images at the 6-month follow-up. The JOA scoring system was used to measure the severity of the myelopathy. We evaluated the surgical improvement of the patients between preoperative and 6-month postoperative period with JOA. The postoperative improvement rate was calculated as follows: postoperative improvement rate = (follow-up JOA score – preoperative JOA score) / (17 – preoperative JOA score) ×100%. The concept of postoperative C5 palsy in our study was defined as paresis of the deltoid muscle and/or sensory deficits with persistent pain in the C5 dermatome area which appears after the surgery without deterioration of the myelopathy.

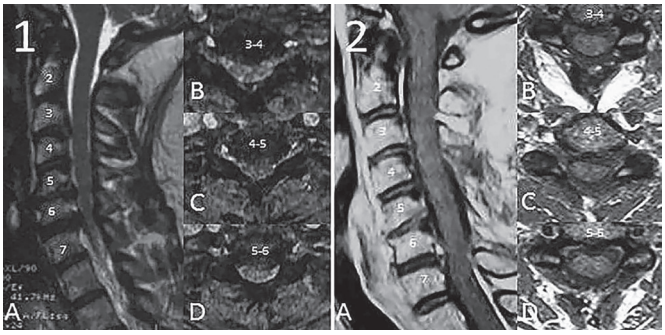

Figure 1. Preoperative (1) and postoperative (2) cervical spondylotic myelopathy T2-weighted magnetic resonance images, A: Sagittal images, B,C,D: Axial images

Surgical Procedures

The laminectomy is performed on the levels of compression of cervical spine. The patient is positioned prone with their head immobilized by a three-point head holder (Figure 2A). A standard (3-5 cm) midline incision is made to expose the spinous processes (Figure 2D). A subperiosteal dissection of the muscles from the spinous processes to the end of the lamina is performed. The microscope is brought into the surgical area. The junction of the facet and the lamina are identified. The posterior column of the cervical spine is preserved. A drill is used to drill a gutter at the junction of the facet and the lamina bilaterally, and then a flavectomy is done in the gutter area. The supraspinous and interspinous ligaments, which are localized at the proximal and distal end point of the preferred levels of spinal processes, are dissected. The block of laminas and spinal processes with supraspinous-interspinous ligament are elevated and are removed (Figure 2C). Foraminotomy on all of the levels is done and with that, the decompression is completed. The decompressed levels are confirmed by a C-arm scopy (Figure 2B). Suction drains are not routinely placed. The patient is usually discharged after 24 hours.

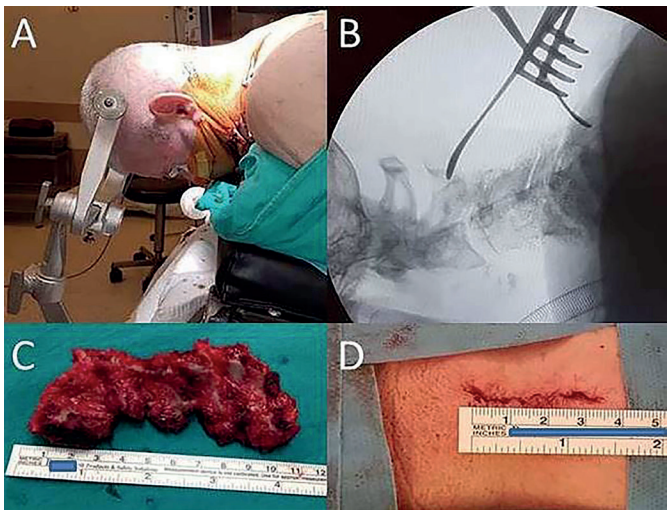

Figure 2. A: Operative position of patients; B:C-arm scopy image of decompressed level; C: Removed material of en-bloc laminectomy; D: Scin incision after surgery

Statistical Analysis

The data obtained from the cases were recorded using Microsoft Excel-2013. SPSS 21 (Statistical Package for Social Sciences) for Windows Software was used for the evaluation of the findings (mean and standard deviation). Statistical significance was set at a probability value of less than 0.05 (CI: Confidence Interval 95 %). The statistical analysis was performed with T tests.

RESULTS

The average clinical postoperative follow-up period was 14,1 months (13 to 25 months). 61 patients were male and 22 were female. The mean age at the time of surgery was 57.8±8.3 years (43 to 84 years). 44 patients were operated for three-level cervical spondylosis, 32 were operated for four-level and 7 were for two-level cervical spondylosis (Table 1). The average JOA scale score was 9.4±0.9 (7 to 11) preoperatively, 10.1±.0.9 (7 to 12) early postoperatively and 15.1±1.0 (13 to 17) during the late postoperative follow-up (statistically significant p=.001) (Table 1). None of the patients had a worse JOA scale score after the operation. The mean improvement rate of JOA was 66.1%. The average VAS was 2.72±0.8 preoperatively, 1.4±0.6 early postoperatively and 1.1±0.5 during the late postoperative follow-up (statistically significant p=.001) (Table 1). The average angle of cervical curvature preoperatively and postoperatively was 17.1±2.6 (range 14 to 22) and 15.8±2.4 (range 13 to 21) respectively. The differences in the cervical curvature angle were not more than 3 degrees in all patients pre-postoperatively (Table 1). The average difference of cervical curvature angle was 1.54±0.6 (Table 1). Temporary C5 nerve root palsy was not observed in any of the patients after operation. In our clinic, the patients were generally discharged one day after the operation, but one patient was discharged after three days due to incisional problems. Dural tears and wound infection were not observed. Furthermore, all patients were examined for C5 nerve root palsy during the early follow-up (ten days after the operation). There weren't any symptoms related to C5 nerve root palsy.

Table 1. Demography of patients				
Mean Age (years)		57.8±8.3		
Parameters	**n**	**%**	**Avarage**	**p**
Gender				
Female	22	26.5		
Male	61	73.5		
Level of decompression				
Two level	7	8.4		
Three level	44	53.0		
Four level	32	38.6		
JOA				
preoperatively			9.4±0.9	0.001
early postoperatively			10.1±.0.9	
late postoperatively			15.1±1.0	
VAS				
preoperatively			2.72±0.8	0.001
early postoperatively			1.4±0.6	
late postoperatively			1.1±0.5	
Difference of cervical curvature angle			1.54±0.59	

DISCUSSION

Cervical spinal stenosis is defined as a reduction in the volume of the cervical spinal canal. Symptoms of the patients occur due to the impingement of the spinal cord. The etiology of CSM is multifactorial: likely including ossification of the posterior longitudinal ligament (OPLL), a degenerative disc, uncovertebral joint osteophytes, hypertrophied ligamentum flavum, and degenerative facet joints (15). The narrowing of the spinal canal causes ischemia by compression of the arterial blood supply to the spinal cord. The neurological symptoms of the patients occur due to this process (15).

The Nurick classification and the Japanese Orthopedic Association (JOA) scale have been developed for the treatment of CSM (16,17,18). We prefer JOA preoperatively and during follow-up for CSM in our clinic. The improvement of JOA in our study shows the good surgical outcomes with the modified laminectomy.

The surgical treatment of CSM is performed by a posterior, anterior or combined approach. The neurosurgeons prefer the posterior approach to avoid complications of the anterior approach (19). The posterior approach is preferred in cervical curvature angles that measure less than 13 degrees for favorable outcomes (20). We also preferred laminectomy for surgical approach through the angle of regional kyphosis. The preoperative angle of cervical curvature in all of the patients was greater than 13 degrees in our study. The posterior approach normally includes the removal of the facet capsule without fusion, which may cause cervical kyphosis. The laminectomy by preserving the facet capsule, as done in our surgery, prevents postoperative progressive kyphosis (< 3 degrees). The differences in the angle measurement of the cervical curvature between preoperative and during follow-up period were not significant in any of the patients.

The extensive laminectomy which includes removing of ¼ part of facet capsules purposes large nerv root and spinal cord decompression. In this part of the surgery, the spinal cord drift-back and subsequent stretching of the C5 nerve root which is more vulnerable than the other roots consists. Xiaotao Z. et al. were reported 2.4% C5 nerve root palsy in their study which performed extensive laminectomy (21).

Liu FY et al. reported laminoplasty versus laminectomy and fusion in their meta-analysis. Their study shows that there was no significant difference in the total complications and axial pain between 2 groups (22). However, compared with laminectomy followed by fusion, laminoplasty showed fewer C5 palsy in their meta-analysis. The excessive cervical lordosis and more decompression in laminectomy followed by the fusion increase the tethering effect of the nerve roots (23-26). Their idea that the improving the cervical lordosis and more decompression may lead to a high incidence of C5 palsy.

The surgical outcomes for spinal pathologies which include cervical spondylosis with ıntraoperative neuromonitoring were reported in literature (27). Musluman et al reported the usage of ıntraoperative neuromonitoring at spinal surgery in their review (28). The ıntraoperative neuromonitoring will be useful for surgical treatment at neurosurgery if the regional condition is suitable.

A common postoperative complication is the paresis of the upper extremities after posterior laminectomy. The C5 palsy is the most frequent of them. Most of the C5 palsy have been shown to occur unilaterally (9,29,30). The incidence of C5 palsy after posterior decompressive laminectomy is reported as 4.6% (0-30%) in the literature (31). Generally, C5 palsy occurs in one week after surgery (6,32). The patho-mechanism of the C5 palsy after a posterior surgical treatment is unknown and some theories include;(6,11) likely 1) accidental injury to the nerve root peroperatively; (12) 2) shifting of the spinal cord which causes nerve root traction postoperatively; (33) 3) spinal cord ischemia caused by decreased blood supply;(34) 4) segmental spinal cord disorder; (8) and 5) reperfusion which makes regional edema of the spinal cord (35). In our study, we did not detect C5 palsy in any of our patients. We are uncertain about the reason behind it. But our possible explanations are as follows: 1) We performed the laminectomy by microsurgery and did not detect any nerve injuries that could cause C5 palsy. 2) The preserving of the facet capsule as done in our modified laminectomy and preventing aggressive opening of the lamina and paravertebral muscles during surgery limit the shifting of the posterior section of the spinal cord, which mostly causes C5 nerve palsy (11,36). This is the technique without posterior stabilization which is well known. The neurosurgeon used this technique level to level namely step by step. They make laminectomy at first proximally or distally and continue level to level. In our technique, at first, all level laminas were dissected by high speed drill and kerrison, secondly, en-block laminas were removed

with ligamentum flavum. The difference of our technique is this step of operation. 3) We suppose that the spinal cord ischemia happens due to postoperative progressive kyphosis. We did not detect postoperative progressive kyphosis in any of our patients. 4) We did not observe any additional segmental spinal cord disorder after the surgery. 5) En-bloc laminectomy protects from a segmental spinal cord edema because of removing laminectomy material and ligamentum flavum totally, not step by step. In conclusion, our surgical technique includes preserving the facet capsule, precluding aggressive opening of the lamina to prevent progressive cervical kyphosis and does not cause shifting of the spinal cord and it protect from a segmental spinal cord edema. This reason may elucidate why C5 nerve root palsy did not occur after the cervical laminectomy by our modified posterior approach.

CONCLUSION

C5 palsy, which is the most common complication of surgery for CSM, did not occur after the modified cervical laminectomy which is described in the present study. The cervical posterior laminectomy, which includes en-bloc laminectomy and preserving of the facet joint capsule, allows a sufficient and safe decompression of the neural structures for CSM. Therefore, the modified cervical laminectomy is a preferable approach to decrease C5 palsy complication after surgery of CSM.

Competing interests: The authors declare that they have no competing interest.

Financial Disclosure: There are no financial supports.

Ethical approval: This retrospective design study was approved by the Ethical committee of Istanbul Medipol Universty. Approvel No: 812-23102019.

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