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Original Research

Clinical Outcomes of Anterior and Posterior Cervical Decompression for Spondylotic Myelopathy: A Comparative Analysis

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Abstract

Background: Anterior and posterior cervical decompression approaches are utilized in cases of cervical spondylotic myelopathy (CSM). The choice of approach depends on patient-specific factors like spinal alignment and comorbidities. The current study aimed to compare the clinical outcomes of anterior and posterior cervical decompression for the treatment of CSM.

Methods: A total of 35 cases were included in the study. 15 underwent anterior decompression with corpectomy followed by placement of an expandable titanium cage to reconstruct the anterior column with the addition of an anterior cervical plate. 16 patients underwent a posterior decompression with laminectomy followed by posterior instrumentation with lateral mass screws and 4 patients with laminoplasty.

Results: Clinical evaluation revealed significant improvement in both groups following spinal cord decompression according to scores on the mJOA scale and Nurick ($p < 0.05$). The comparison between the anterior and posterior groups shows a statistical difference for the posterior approach. After the operations, according to the Nurick and mJOA scale score ($p < 0.05$) No complications, and deep venous were recorded in the cases.

Conclusion: The study examined the surgical treatment of degenerative cervical spinal canal stenosis with anterior and posterior approaches. We found significant changes in mJOA and Nurick grades in pre and post-surgeries in both groups. Posterior decompression surgery produced superior gains in mJOA scores. The anterior approach was found to have reduced hospital stay. Both procedures led to zero complications.

Keywords: Spondylotic Myelopathy, Anterior cervical Decompression, Posterior cervical Decompression.

Introduction

Cervical spondylotic myelopathy (CSM) is the leading cause of disability in the adult spinal cord worldwide because it progressively develops as a degenerative disorder. The condition develops from normal aging-related cervical spine deterioration, which involves disc destruction and osteophyte growth alongside ligament thickening and posterior longitudinal ligament ossification (OPLL) [1]. Depression of the cervical spinal canal due to age-related changes eventually compresses the spinal cord, causing neurological damage. Neck pain and stiffness are the leading clinical symptoms of this condition; however, patients develop additional motor sensory dysfunction and problems with gait and bladder functions that result in major reductions in quality of life [2]. Medical teams need to diagnose patients' conditions quickly and perform surgery because these steps deter disease evolution while creating better functionality results.The standard treatment of choice for CSM is surgical decompression, which strategically relieves cord compression to stop neurological decline while enhancing function [3]. The clinical practice currently uses two main surgical techniques to decompress the cervical spine: anterior cervical decompression and fusion (ACDF) and posterior cervical decompression approaches (laminoplasty or laminectomy with or without fusion). Healthcare professionals choose their intervention strategy based on the pathological distribution and extent, as well as cervical spinal alignment, patient health situations, and individual surgical experience

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[4]. The combination of specific indications with different advantages and complications from each procedure makes the surgical approach selection difficult.

When enhancing accessibility through the front of the neck, the anterior approach works best to treat patients with localized compression resulting from disc herniations or osteophytes. Through ACDF, surgeons gain access to decompress spinal cord tissue as they establish stable cervical lordosis contours and perform fusion procedures on compromised segments [5]. Surgeons have achieved promising results using this approach when treating single-stage as well as two-level degenerative conditions. The anterior surgical path presents healthcare risks, including swallowing problems and paralyzed vocal cords, together with adverse fusion consequences, such as fake arthritis and neighboring spinal degeneration.Surgeons use the posterior approach as their preferred technique to treat multilevel compression conditions, in which OPLL or ligamentous hypertrophy compromises the spinal canal.Laminoplasty and laminectomy allow for indirect decompression by expanding the spinal canal's posterior elements, preserving motion in laminoplasty, or stabilizing the spine with fusion in laminectomy [6]. The posterior approach is less invasive in certain scenarios and avoids the risks associated with anterior cervical dissection. Rerupture surgery for CSM produces potential issues, including axial neck pain and postoperative kyphosis, along with greater risks of C5 palsy development [7]. Studies comparing anterior and posterior cervical decompressive surgery for CSM exhibit differing results because of patient selection procedures, surgical methods, and postoperative observation periods. Neurological function and quality of life improvement are possible using both approaches; however, selecting the surgical method requires consideration of each patient's unique characteristics to obtain optimal results. This study compared the clinical results of posterior and anterior cervical surgeries used to treat patients with spondylotic myelopathy. The analysis of neurological recovery, complication rates, functional improvement, and radiological alignment helps to guide surgical choices that lead to better patient care. A complete understanding of both the positive and negative aspects of these approaches will advance treatment methods and result in improvements in patients with spondylotic myelopathy.

Material and methods

This prospective study was conducted in the Department of Neurosurgery, Gandhi Medical College and Hospital, Secunderabad, Telangana. Institutional Ethical approval was obtained by the institutional Ethical committee after duly following the protocol for human research. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language.

A total of 35 cases were included in the study. 15 underwent anterior decompression with corpectomy followed by placement of an expandable titanium cage to reconstruct the anterior column with the addition of an anterior cervical plate. 16 patients underwent a posterior decompression with laminectomy followed by posterior instrumentation with lateral mass screws and 4 patients with laminoplasty. For accurate comparison with the anterior group, patients who underwent a laminectomy greater than 4 levels were excluded from the posterior group. Thus, a total of 35 cases were included in the study. 15 in the anterior group and 20 in the posterior group. These patients suffered from degenerative cervical spinal canal stenosis. They underwent decompressive surgery of the cervical spine.

The primary symptom in all patients was myelopathy (CSM). In total, there were 20 men (8 in the anterior group and 12 in the posterior group) and 15 women (7 in the anterior group, and 8 in the posterior group). The range of age of the cohort was from 62 – 80 years and the mean age of the patients was 72.5 ± 3.5 years. The posterior group was significantly older mean age of 74.10 ± 2.8 versus 69.55 ± 4.6 years in the anterior group. The p=0.03. The reasons for using the anterior approach in cases were spondylosis in 10 patients, ossification of the posterior ligament in 4 patients, and degenerative kyphosis in 1 patient. The reasons for using the posterior approach were spondylosis in 17 patients and ossification of the posterior longitudinal ligament in 3 patients. All these patients were refractory to conservative treatment. The decision to use the chosen procedure depended on the direction of spinal cord compression, preoperative cervical alignment, and several levels affected. Radiological examinations included pain radiography, MR imaging, and CT scan. Stability was assessed in the anterior and posterior groups.

The 15 patients in the anterior group were treated using a corpectomy followed by the placement of an expandable titanium cage to reconstruct the anterior column and a cervical plate was added in all. In the posterior group, a 2- to 4-level laminectomy followed by posterior instrumentation with lateral mass screws was performed in 17 cases and 3 with laminoplasty (open door with sutured to the spinous process to avoid closure). Clinical outcome was assessed before and after surgery using the Nurick score and the mJOA scale score. Follow-up was 1.4 years.

Statistical analysis: all the available data was refined segregated and uploaded to an MS Excel spreadsheet and analyzed by SPSS version 22 in Windows format. The continuous variables were represented as mean, standard deviation, and percentages, and the categorical variables were calculated using the Pearson Chi-square test for statistical significance the p values (<0.05) were considered significant.

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Results

A total of 35 cases were included in the study. 15 underwent anterior decompression with corpectomy followed by placement of an expandable titanium cage to reconstruct the anterior column with the addition of an anterior cervical plate. 16 patients underwent a posterior decompression with laminectomy followed by posterior instrumentation with lateral mass screws and 4 patients with laminoplasty. For accurate comparison with the anterior group, patients who underwent a laminectomy greater than 4 levels were excluded from the posterior group. Thus, a total of 35 cases were included in the study. 15 in the anterior group and 20 in the posterior group. These patients suffered from degenerative cervical spinal canal stenosis. They underwent decompressive surgery of the cervical spine.

Table 1: Distribution of cases included in the study

Gender	Frequency	Age in years
Females (n=15)		
Anterior Approach	7	68
Posterior Approach	8	73
Males (n=20)		
Anterior Approach	8	70
Posterior Approach	12	74

Table 1 shows the sample distribution of cases included in the study. This study includes twenty male patients who received surgical treatment alongside fifteen female patients who received surgical treatment. Both sexes within this study showed a comparable distribution, with 15 cases in the anterior group (pooled male/female ratio 3:2) and 20 patients admitted under the posterior approach (ratio 3:6). A significant correlation between group age profiles emerged as the posterior approach groups contained older participants, which led to p-values (0.05).

Table 2: Functional outcomes at follow-up in the cases of the study

Variable	Anterior (15)	Posterior (20)	P value
mJOA			
Pre	6.99	6.52	0.228
Post	15.84	17.99	0.012*
P value for pre/post-follow-up	0.002*	0.001*	
Nurick			
Pre	3.89	3.79	0.198
Post	0.67	0.29	0.041*
P value for pre/post-follow-up	0.034*	0.026*	

* Significant

Table 2 shows the outcomes measured in the cases of the study using the modified Japanese Orthopaedic Association (mJOA) score and the Nurick grade.

mJOA Scores:*Pre-operative (Pre)* The mean mJOA score for the Anterior group was 6.99, and for the Posterior group, it was 6.52. The p-value (0.228) indicates no statistically significant difference between the two groups before surgery.Post-operative (Post): The average mJOA score improved to 15.84 for the Anterior group and 17.99 for the Posterior group. The p-value (0.012*) suggests a statistically significant difference between the two groups after surgery, with the Posterior group showing better improvement.Pre/Post Follow-up Comparison: Both groups showed significant improvement from pre-operative to follow-up (Anterior: $p = 0.002$*, Posterior: $p = 0.001$*).

Duration of stay in the hospital for patients, who underwent anterior surgery, was on average 3.5 days shorter than those who underwent posterior surgery 6.5 days ($p < 0.05$).In this study, the anterior corpectomies were performed at the C-5 level in 11 patients and at the C-4 level in 4 patients. The mean duration of follow-up of this group was done for a period of 1.2 years. The height adjustment of the implanted expandable cage was carried out successfully without any complications there were no surgical complications, infections, dysphagia, or cage migration found in this study during the follow-up period.

In the posterior group, laminoplasties, laminectomies, and instrumentation were performed across different levels. This included 2 levels in 1 case (C3–4), 3 levels in 4 cases (C3–5 in 4 cases and C4–6 in 14 cases), and 3 levels in 2 cases (C4–7 in 1 case and C1–4 in 1 case). The mean follow-up duration for this group was 1.2 years. There were no cases of thrombosis, surgical site infections, or implant loosening in our cases during the follow-up period. We also found that the patients in the posterior group demonstrated a greater improvement in JOA scores

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compared to the anterior group in the follow-up assessments.

Clinical evaluation revealed significant improvement in both groups following spinal cord decompression according to scores on the mJOA scale and Nurick ($p < 0.05$). The comparison between the anterior and posterior groups shows a statistical difference for the posterior approach. After the operations, according to the Nurick and mJOA scale score ($p < 0.05$) No complications, and deep venous were recorded in the cases.

Discussion

Multiple invasive treatment options exist for cervical spondylotic myelopathy (CSM), but there is a lack of consensus on the most effective strategy between anterior, posterior, and combined procedures. Research shows that anterior decompression corrects kyphotic deformities and improves sagittal balance, especially in patients with one or two affected spinal segments[8, 9]. The posterior spinal approach is preferable for cases exceeding three vertebrae because non-union risks increase significantly during the procedure. Posterior decompression surgery becomes the preferred option if three or more segments need treatment or when patients have OPLL or ossification of the posterior longitudinal ligament[10, 11]. Single-level laminectomy works well as a treatment, but surgeons must add instrumentation and fusion procedures because laminectomy alone fails to protect patients from potential postoperative kyphosis development. Cervical posterior decompression surgery has generated axial cervical pain reports while delivering functional results equal to those of anterior decompression procedures. Patients requiring multilevel involvement treatment (more than three segments) and displaying kyphotic deformities achieved the best results through combined surgical intervention[12-16]. Selecting a surgical approach for cervical decompression surgery requires consideration of individual spinal conditions along with patient-specific spinal alignment because each procedure has different technical benefits and constraints.Clinical outcomes, as demonstrated in the present study. An anterior approach is typically preferred for pathologies affecting one or two vertebral levels, whereas cases involving more than two levels are better managed with a posterior approach because of the risk of swallowing difficulties and construct failure[17-19]. However, the combined approach provides superior results in cases involving multilevel diseases with kyphotic deformity, in which the spinal cord is compressed by anterior osteophytes. The combined approach starts with anterior release and lordosis reconstruction first, then proceeds with posterior decompression utilizing instrumentation to achieve maxima spinal stability and functional results[16, 20]. Due to posterior osteophytes and sometimes both levels, herniation patients most frequently experience problems at the C5-C6 segment. An anterior approach was the preferred method when disc herniation stood as the main compression cause since surgeons performed discectomies in combination with prosthetic disc implant procedures to enhance spinal stability and functionality [21].

The treatment approach must individualize each case by combining medical scan results with segment quantification, lesion size, and ratio to balance spinal curves and treatment experience [21]. Follow-up assessments conducted after one year qualify as short-term assessments because patients may develop new complications at this time. Patients who undergo anterior surgery are at risk of implant failure and the movement of cervical expandable cages. The risks associated with the posterior approach involve screw loosening along with recurrent myelopathy from fibrous tissue formation and incomplete laminoplasty opening when buttress plates are omitted. The short-term results after posterior decompression surgery demonstrate superior outcomes when compared to anterior decompression although subsequent long-term investigations find no substantial distinction between these methods [22, 23].

Conclusion

The study examined the surgical treatment of degenerative cervical spinal canal stenosis with anterior and posterior approaches. We found significant changes in mJOA and Nurick grades in pre and post-surgeries in both groups. Posterior decompression surgery produced superior gains in mJOA scores. The anterior approach was found to have reduced hospital stay. Both procedures led to zero complications. The results show neurological recovery supports the posterior approach yet postoperative recovery enhances through anterior procedure utilization. More detailed research must be conducted in this field to develop better surgical protocols.

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