

Clinical Improvement in Cervical Myelopathy Patients Following Anterior Cervical Discectomy and Fusion Assessed By Mjoa Score- A Single Centre Study from Karachi, Pakistan

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Abstract

Cervical myelopathy, primarily caused by degenerative conditions such as disc herniation, facet joint hypertrophy, spondylolysis, osteophyte formation, and ligamentous hypertrophy or calcification, is a prevalent diagnosis in spinal clinics, with an estimated incidence of approximately 4.04 per 100,000 person-years in an international study. However, there is a notable lack of data regarding this condition in Pakistan. Diagnosis typically involves a thorough patient history, clinical examination, and imaging, with common symptoms including neck pain, bilateral upper limb radiation, hyperreflexia, spasticity, and positive Hoffmann's sign. MRI is the preferred imaging modality.

Clinical severity is assessed using various scoring systems, including the Japanese Orthopaedic Association (JOA) scale, modified JOA (mJOA), JOACMEQ, SF-12, and the Neck Disability Index (NDI), with mJOA being the standard tool. Myelopathy is categorized into mild (mJOA 15-17), moderate (mJOA 12-14), and severe (mJOA 0-11) based on mJOA scores. Numerous studies worldwide have explored the correlation between improved surgical outcomes for cervical myelopathy and enhancements in mJOA scores.

This study aims to evaluate the improvement in clinical symptoms among patients undergoing anterior cervical discectomy and fusion (ACDF), the most common surgical intervention for cervical myelopathy. By comparing mJOA scores pre-operatively, three months post-operatively, and one year post-operatively, we found a mean improvement of three points in mJOA scores after ACDF. Additionally, a pre-operative mJOA score of less than 10 was associated with reduced postoperative improvement, while a duration of symptoms exceeding 12 months correlated with poorer outcomes.

Keywords: ACDF, CERVICAL MYELOPATHY, mJOA SCORE

1. INTRODUCTION

Cervical Myelopathy is a common diagnosis in spinal clinics with an estimated incidence of around 4.04/100,000 person-years.(2) The etiology is usually the compression of cervical spinal cord, secondary to degenerative causes like disc herniation, facet joint hypertrophy, spondylolysis, formation of osteophytes, hypertrophy or calcification of posterior longitudinal ligament and ligamentum flavum(1), Notably, in our part of the world, especially Pakistan, a third-world nation facing resource limitations, there exists a scarcity of comprehensive data and research initiatives pertaining to cervical myelopathy, hindering a

deeper understanding of optimal management strategies and their outcomes within this specific population. The diagnosis is usually based on history, clinical examination and imaging modalities i.e MRI and Ct Scan of cervical spine.

The severity of cervical myelopathy is graded by different scoring systems including JOA, mJOA (3), Japanese Orthopaedic Association Cervical Myelopathy Evaluation Questionnaire (JOACMEQ), the Short Form-12 (SF-12) and the Neck Disability Index (NDI). Currently, the standard tool used in mJOA(4) The modified Japanese Orthopaedic Association (mJOA) scoring system stands out as a preferred tool for assessing cervical myelopathy due to its well-

established reliability and validity. This system offers a comprehensive evaluation encompassing motor and sensory functions, bladder control, and typical spine-related signs and symptoms associated with cervical spinal cord compression.

Its specificity to cervical myelopathy makes it particularly valuable in clinical practice, aiding in consistent and standardized assessment. This standardized scoring system assists neurosurgeons in making informed decisions about patient care, allowing for a quantifiable measure of a patient's neurological status pre- and post-treatment, which is pivotal in monitoring disease progression and evaluating the effectiveness of interventions like surgery or conservative management. Myelopathy can be categorized as mild (mJOA 15-17), moderate (mJOA 12-14) and severe (mJOA 0-11) via mJOA.(5)

Different studies have been done in different parts of world to determine correlation between improved surgical outcomes after surgery for cervical myelopathy and improvement in mJOA. (6) In treating cervical spinal myelopathy, three primary surgical approaches—Anterior Cervical Discectomy and Fusion (ACDF), Posterior Cervical Laminectomy, and Cervical Laminoplasty—stand out with distinct characteristics and outcomes. ACDF involves

2. OBJECTIVE

To assess clinical improvement, as measured by mJOA, in patients of cervical Myelopathy who underwent anterior cervical discectomy and fusion at a tertiary care hospital in Karachi, Pakistan.

3. MATERIALS AND METHODS

Setting

The study was conducted at Liaquat National Hospital, Karachi, Pakistan

Type of Study

This is a ambispective study where the data collected retrospectively, is followed prospectively for outcomes at 3 month and 6 month intervals.

Study Duration

Data is collected from September 2021 to February 2022 and patients were followed 6 months post operatively till August 2022.

Inclusion Criteria

- Patients older than 18 years

disc removal and fusion of adjacent vertebrae, offering stability but potentially restricting movement at the operated levels, increasing the risk of adjacent segment degeneration. Conversely, Posterior Cervical Laminectomy aims to alleviate spinal cord or nerve pressure by removing a portion of the bony arch, retaining mobility but sometimes causing instability due to posterior structure removal. In additions, sometimes it is supplemented with lateral mass screws for instability and curvature correction. Cervical Laminoplasty preserves stability without fusion by creating a hinge in the lamina, maintaining segmental motion and potentially lowering the risk of adjacent segment disease. However, it carries a risk of hinge fracture and re-stenosis. The selection of the optimal surgical procedure relies on factors like the patient's specific condition, desired outcomes, and the balance between stability and mobility. Understanding these procedures' nuances is crucial for tailored treatment planning and ensuring informed decisions regarding patient care. In our study, the aim is to establish improvement in clinical symptoms of patients undergoing anterior cervical discectomy and fusion only; the most commonly performed and recommended surgery for cervical Myelopathy; using m JOA scores assessed preoperatively, at 3 months and 6 months postoperatively.

- Patients with cervical myelopathy, with mJOA score of mild, moderate or severe category
- Patients undergoing ACDF procedure with the cage placement for fusion and fixation with cervical plate

Exclusion Criteria

- Patients with previous history of ACDF procedure (Redo surgeries)
- Patients undergoing cervical laminectomy with or without lateral mass screws and cervic laminoplasty
- Patients with past history of malignancy
- Patients with symptoms and examination suggesting radiculopathy only

4. RESULTS

A total of 98 patients were enrolled in the study. The mean age of participants was 47 years. 22 patients were lost to postoperative follow up and were removed from final data evaluation. Demographically, 60 patients were male and 16 female. On analysis, it was found that most

common indication of surgery was C5/C6 disc osteophyte complex causing cord compression.

The mean pre op mJOA score was 12.7105 and the mean post op mJOA score was 15.841. Paired

sample T test was run and T score was -7.006. With a 95% confidence interval, the difference was 4.026 at upper level and 2.242 at lower level with a mean of 3.13.

Table 1. Showing demographics

Variable	Frequency	Mean \pm SD	Percentage
Age		47.5 \pm 13.2	
Gender			
Female	16		21.1
Male	60		78.9
Duration		14.2 \pm 27.1	
ACDF LEVEL			
C5/C6 PID	16		21.1
C4/C5 C5/C6 PID	5		6.6
C6/C7 PID	4		5.3
C5/C6 C6/C7 PID	4		5.3
C3/C4 C4/C5 PID	4		5.3
Complication	1		1.3

Table 2. Showing pre op and post op mJOA

	mean	N	Standard deviation	Std error mean
Pre op mJOA	12.7015	76	3.683	.422
Post op mJOA	15.8421	76	2.4113	.276

5. DISCUSSION

Cervical myelopathy is a degenerative disease affecting the cervical spine, leading to a range of neurological symptoms. To address this condition, a frequently employed surgical approach is anterior cervical discectomy and fusion (ACDF), it is recognized for its effectiveness in enhancing the clinical well-being of individuals with cervical myelopathy. One of the most commonly used tool to assess clinical enhancement after ACDF is the modified Japanese Orthopedic Association (mJOA) score.

The Modified Japanese Orthopedic Association (mJOA) score serves as a crucial tool in evaluating cervical myelopathy, a condition characterized by compression of the spinal cord in the neck region. This scoring system encompasses various domains such as motor function, sensory function, urinary bladder function, and gait disturbance, providing a comprehensive assessment of the patient's neurological status. By assigning scores to different parameters, clinicians can quantify the severity of cervical myelopathy and monitor changes over time.

This study compared the clinical outcomes using the modified JOA score following ACDF, revealing significant improvements in both short-term and long-term follow-ups. The utility

of this score extends to myelopathic patients of varying ages, encompassing both the elderly and the young, as a valuable tool for assessing surgical outcomes (7). Literature showed that from the perspective of a patient in achieving satisfactory result after the surgery, JOA of 14.25 is the threshold observed by clinician (8).

In terms of technical variation in surgical decompression for myelopathy, Wang et al. demonstrated substantial post-operative mJOA score enhancements in patients undergoing multilevel ACDF with PEEK cages (9). Furthermore, research has underscored the importance of the mJOA score as a prognostic indicator for surgical outcomes in posterior decompression plus fusion and cervical arthroplasty for cervical myelopathy (10).

To identify significant clinical factors influencing surgical outcomes in patients diagnosed with cervical spondylotic myelopathy (CSM), studies revealed that age and initial mJOA scores emerged as robust predictors of post-surgical results (12). Additionally, while the degree of spinal cord compression and patterns of signal intensity changes on T1/T2 weighted images were not found to independently forecast outcomes, they did exhibit correlations with the patient's functional status at presentation and their age (13). Moreover, the duration of symptoms exhibited a strong correlation with

preoperative functional status but did not appear to influence postoperative outcomes (14).

In our study focusing on patients with myelopathy undergoing anterior cervical discectomy and fusion (ACDF), we observed a significant mean improvement of 3 points in the Modified Japanese Orthopedic Association (mJOA) score post-operatively. The observed improvement in the mJOA score highlights the efficacy of ACDF in relieving symptoms and restoring neurological function in these patients. However, our study also revealed important factors influencing outcomes following ACDF. Notably, patients with a duration of symptoms exceeding 12 months tended to have worse post-operative outcomes. This finding underscores the importance of timely intervention in patients with cervical myelopathy to prevent further neurological deterioration and optimize surgical outcomes.

Early recognition and management of myelopathic symptoms are crucial in improving long-term prognosis and minimizing disability.

Furthermore, our study identified preoperative mJOA score as a predictive factor for postoperative improvement. Specifically, patients with a preoperative mJOA score of less than 10 demonstrated decreased improvement in the postoperative period compared to those with higher preoperative scores. This suggests that the severity of neurological impairment at the time of surgery influences the extent of recovery following ACDF. Patients with more advanced myelopathy may have limited potential for neurological improvement despite surgical intervention, emphasizing the importance of individualized treatment approaches and realistic expectations for outcomes.

Category	Score	Description
Upper Extremity Motor Subscore (/5)	0	Unable to move hands
	1	Unable to eat with a spoon but able to move hands
	2	Unable to button a shirt but able to eat with a spoon
	3	Able to button a shirt with great difficulty
	4	Able to button a shirt with mild difficult OR other mild fine motor dysfunction (marked handwriting change, frequent dropping of objects, difficult clasping jewelry, etc.)
	5	Normal hand coordination
Lower Extremity Subscore (/7)	0	Complete loss of movement and sensation
	1	Complete loss of movement, some sensation present
	2	Inability to walk but some movement
	3	Able to walk on flat ground with walking aid
	4	Able to walk without walking aid, but must hold a handrail on stairs
	5	Moderate to severe walking imbalance but able to perform stairs without handrail
	6	Mild imbalance when standing OR walking
7	Normal walking	
Upper Extremity Sensory Subscore (/3)	0	Complete loss of hand sensation
	1	Severe loss of hand sensation OR pain
	2	Mild loss of hand sensation
	3	Normal hand sensation
Urinary Function Subscore (/3)	0	Inability to urinate voluntarily (requiring catheterization)
	1	Frequent urinary incontinence (more than once per month)
	2	Urinary urgency OR occasional stress incontinence (less than once per month)
	3	Normal urinary function

Figure 1. Showing m JOA score

There are few limitations in our study related to follow-up duration with post-operative complications, complexity of patient

presentation and control group. Kim et al had a follow up of more than two years in his study showing subsidence of implant in around 40

percent in long term follow-up, using standalone PEEK cages (15). Although our study used similar implants for

ACDF with standard plates, we observed only single implant breakage in 6 months follow-up post-operatively. We would advise longer follow-up with similar technique in surgery as complications may vary from surgeon to surgeon. Secondly, a diverse group of patients should be evaluated with or without radiculopathy in cervical myelopathy for surgical outcome scores.

Also, a comparative group with other conventional surgery for cervical myelopathy is lacking. Author's suggestion for further studies is to evaluate outcome in younger patients with short term symptoms and old age patients with chronic myelopathy for ACDF via mJOA score and other related tools.

6. CONCLUSION

The mean improvement in mJOA score was of 3 points after ACDF in myelopathy patients in our study. A duration of more than 12 months was associated with worse outcome. This study also showed that pre op mJOA of less than 10 predicted decreased improvement in post op period as compared to higher pre op scores.

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