

## A Retrospective Clinicoradiological Assessment Following Surgical Intervention in Patients of Cervical Spondylotic Myelopathy: An Observational Study

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### Abstract

**Aim:** The aim of the present study was to critically analyze the functional and radiological improvement in patients of cervical spondylotic myelopathy (CSM) who underwent surgical decompression by an anterior or posterior approach.

**Material& methods:** A retrospective hospital-based observational study was conducted at department of General Surgery within the duration of 18 months. A total of 200 patients of CSM who underwent surgical decompression were analysed. There were 150 males and 50 females. The mean age of patient was 52.9 years (range 30–74 years).

**Results:** A total of 100 patients underwent surgical decompression by an anterior approach, and the remaining 100 patients had a posterior approach. Both the subgroups within the anterior and posterior approach were comparable and had a male predominance. Follow-up averaged 38.4 months (range 4–54 months). In the posterior approach, an average of 4.4 levels (range 3–6 levels) was involved in the laminoplasty group and 4.2 levels (range 3–5 levels) in the laminectomy group. Patients who underwent single- or two-level anterior cervical discectomy and fusion (ACDF) had titanium/PEEK spacer insertion, while those with anterior cervical discectomy and fusion (ACCF) had expandable cage or Paramesh along with plating and screw fixation. In the posterior approach, laminoplasty was done by the standard Hirabayashi's technique, and fixation was done by laminoplasty plates and screws. There was increase in CD and CSA in patients of both anterior and posterior subgroups which was statistically significant.

**Conclusion:** A prompt surgical intervention in moderate-to-severe cases of CSM either by the anterior or the posterior approach is essential for good outcome.

**Keywords:** Cervical Spondylosis, Myelopathy, Laminoplasty

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### Introduction

Formulation of a surgical protocol in cervical spondylotic myelopathy (CSM) has been adversely influenced by the diversity in clinical and radiological presentation. This is evident from the lack of prospective data that help to assign a specific surgical procedure to a group of patients with identifiable similarities in clinico-radiological attributes. Surgical management has been divided into two schools of thought. Posterior decompression procedures are effective and have been rigidly applied to all cases with satisfying results. Anterior decompression has grown in popularity due to improvement in technology that allows direct decompression and reconstruction of the cervical spine with complication rate now

comparable to posterior surgery. Inability to assign superiority of one procedure over the other creates a dilemma in choosing an ideal procedure for an individual patient. [1]

CSMC is defined as spinal cord dysfunction secondary to extrinsic compression of the spinal cord and/or its vascular supply [2] from degenerative disease of the cervical spine. It is the most common cause of spinal cord dysfunction in patients who are older than fifty-five. [3,4] The pathology may be associated with congenital or developmental stenosis of the cervical canal. The pathogenesis begins with degenerative changes in the disc [2] and this causes changes in the osseous and soft tissue structures. Encroachment of the

available space in the spinal canal and spinal cord is caused by deformation of the facet and uncovertebral joints with associated osteophytic spurring. Soft tissue compression results from intervertebral disc herniation and invagination of the ligamentum flavum into the canal. This is thought to be due to decrease in disc space height and loss of elasticity of the ligamentum flavum. [5]

The most common clinical symptoms are gait disturbance, upper limb paresthesias or sensory disturbance and clumsy hands. Intramedullary signal changes (ISCs) in the spinal cord on magnetic resonance imaging (MRI) in cervical compression myelopathy are deemed to reflect pathologic changes in the spinal cord and are regarded as an indicator of the prognosis. [6-11] The diagnosis of cervical spondylotic myelopathy (CSM) can be difficult due to its insidious onset, tendency to remaining stationary or at times marred by episodic worsening. Formulation of a surgical protocol in cervical spondylotic myelopathy (CSM) has been adversely influenced by the diversity in clinical and radiological presentation. Surgical management has been divided into two schools of thought.

Posterior decompression procedures are effective and have been rigidly applied to all cases with satisfying results. Anterior decompression has grown in popularity due to improvement in technology that allows direct decompression and reconstruction of the cervical spine with complication rate now comparable to posterior surgery. Inability to assign superiority of one procedure over the other creates a dilemma in choosing an ideal procedure for an individual patient. Combining the advantages of these two procedures, to arrive at a rational surgical protocol is the need of the hour.

The purpose of this study was to identify clinical and radiological patterns of compression (POC) and to formulate a treatment strategy based on these patterns.

### Material & Methods

A retrospective hospital-based observational study was conducted at department of General Surgery, Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India within the duration of 18 months. A total of 200 patients of CSM who underwent surgical decompression were analysed.

### Inclusion Criteria

- Patients of CSM or myeloradiculopathy.

- Patients of OPLL.
- Bowel and bladder involvement.
- Failure of conservative management.
- Worsening quality of life.

### Exclusion Criteria

- Neoplastic conditions.
- Posttraumatic cases.
- Systemic disorders such as rheumatoid arthritis.
- Metabolic disorders.
- Previous history of surgery.

Preoperative assessment included a thorough clinical examination, and functional assessment was done by using Nurick grade and modified Japanese Orthopaedic Association (mJOA) score. Radiological assessment was done through digital X-ray, CT, and MRI of cervical spine. A glass marking pencil was used to mark well-defined points on the X ray. These parameters were assessed postoperatively with patient's improvement in functional status, increase in CSA, and CD.

The patients were assessed postoperatively at 48 hours, 1, 3 and 6 months and annually thereafter. The CT scan was done within a fortnight; MRI when clinically indicated or usually by 3 to 4 months. Neck was immobilized with hard cervical collar for 3 to 6 months. Anterior and posterior approaches were decided based on number of cervical levels involved, patient's age and general condition, comorbidities, and radiological findings. In general, the posterior approach was taken for  $\geq 3$  levels and anterior approach for single and two level (s); seldom, it was at the discretion of senior most surgeon.

### Statistical Analysis

Radiant software for CT scan and Canvas Workstation Software for MRI was used to assess sagittal canal diameter (CD) and cross-sectional area (CSA). This data was recorded and analyzed using Microsoft Excel spreadsheet. Quantitative variables were described using mean and standard deviation (SD), while qualitative variables were described using numbers and percentages. "t" test was used to find out the difference between subgroups for quantitative variable. Chi-square test was used for comparing qualitative variables in the group. Repeated measure analysis was used for repeated values over a period of time. p value of  $< 0.05$  was taken as significant. Statistical analysis was done using STATA 13 Version I/C.

### Results

**Table 1: Pre-op comparison of anterior approach**

	ACDF (n = 50)	ACCF (n = 50)	p-Value
Age (years)	47.3 (8.2)	53.6 (7.3)	0.07
Sex			
Males	44 (88%)	40 (80%)	0.5
Females	6 (12%)	10 (20%)	
CSA (mm <sup>3</sup> )	1.6 (0.5)	1.8 (0.6)	0.03
CD (mm)	10.5 (3.2)	11 (1.4)	0.5

**Table 2: Pre-op comparison of posterior approach A total of 100 patients underwent surgical decompression by an anterior approach, and the remaining**

	Laminoplasty (n = 50)	Laminectomy (n = 50)	p-Value
Age (years)	53.7 (7.3)	55.5 (8.2)	0.05
Sex			
Males	40 (80%)	42 (84%)	0.7
Females	10 (20%)	8 (16%)	
CSA (mm <sup>3</sup> )	1.07 (0.4)	1.1 (0.3)	0.3
CD (mm)	8.82 (1.4)	9.89 (1.4)	0.01

100 patients had a posterior approach. Both the subgroups within the anterior and posterior approach were comparable and had a male predominance. Follow-up averaged 38.4 months (range 4–54 months). In the posterior approach, an average of 4.4 levels (range 3–6 levels) was involved in the laminoplasty group and 4.2 levels (range 3–5 levels) in the laminectomy group. Patients who underwent

single- or two-level anterior cervical discectomy and fusion (ACDF) had titanium/PEEK spacer insertion, while those with anterior cervical discectomy and fusion (ACCF) had expandable cage or Paramesh along with plating and screw fixation. In the posterior approach, laminoplasty was done by the standard Hirabayashi’s technique, and fixation was done by laminoplasty plates and screws.

**Table 3: Functional improvement**

Approach	Scale	Group	Preop	At 1 mo	At 6 mo	At 12 mo	p-Value
Anterior	Nurick	ACDF	2.4(1)	1.7 (0.8)	1.5 (0.7)	1.4 (0.6)	< 0.0001
		ACCF	2.7 (0.9)	2.5 (0.8)	1.8 (0.8)	1.2 (0.7)	
Posterior	Nurick	Laminoplasty	3.7 (0.9)	2.4 (0.9)	2.2 (0.7)	1.4 (0.7)	< 0.0001
		Laminectomy	3.5 (1.1)	2.6 (1.3)	2.2 (1.4)	1.8 (1.1)	
Anterior	mJOA	ACDF	11.5 (2.8)	14.6 (1.5)	14.4 (1.4)	14.7 (1.1)	< 0.0001
		ACCF	8.3 (2)	13.7 (1.6)	13.6 (1.5)	14.6 (1.2)	
Posterior	mJOA	Laminoplasty	7.3 (2.5)	11.9 (2)	12.8 (1.8)	13.5 (1.8)	< 0.0001
		Laminectomy	8.6 (2.7)	12.6 (2.2)	13.2 (2.2)	13.7 (1.9)	

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expandable cage or Paramesh along with plating and screw fixation. In the posterior approach, laminoplasty was done by the standard Hirabayashi’s technique, and fixation was done by laminoplasty plates and screws. Patients who underwent laminoplasty showed functional improvement in Nurick grade and mJOA score at the end of 1 year which was statistically significant (p < 0.0001). Similarly, in patients who underwent laminectomy ± fusion, there was functional improvement in Nurick grade and mJOA score at the end of 1 year, which was statistically significant (p < 0.0001).

**Table 4: Radiological improvement in anterior and posterior group**

Type of Surgery	Characteristics	Preop	Postop	p-Value
<b>Anterior group</b>				
ACDF	CD	10.5 (3.2)	12.8 (2.8)	<0.0001
	CSA	1.5 (0.5)	1.8 (0.2)	<0.0001
ACCF	CD	11.0 (1.29)	12.8 (1.2)	<0.0001
	CSA	1.6 (0.4)	2.16 (0.4)	<0.0001
<b>Type of surgery</b>				
<b>Posterior group</b>				
Laminoplasty	CD	8.2 (1.8)	12.4 (0.98)	<0.0001
	CSA	1.1 (0.3)	1.5 (0.5)	<0.0001
Laminectomy	CD	9.9 (1.5)	11.5 (1.5)	<0.0001
	CSA	1.17 (0.3)	1.5 (0.3)	<0.0001

There was increase in CD and CSA in patients of both anterior and posterior subgroups which was statistically significant.

### Discussion

Compressive cervical myelopathy (CCM) is a common cause of spinal cord dysfunction worldwide. It encompasses a wide variety of etiologies, the most common being spondylotic myelopathy. The other causes include disc herniation, congenital stenosis, PLL hypertrophy and ossification, ligamentum flavum thickening, and ossification. Emerging evidences suggest that patients improve after surgical decompression; however, the clinical and radiological parameters that predict the outcome are still uncertain. [12] Formulation of a surgical protocol in cervical spondylotic myelopathy (CSM) has been adversely influenced by the diversity in clinical and radiological presentation. This is evident from the lack of prospective data that help to assign a specific surgical procedure to a group of patients with identifiable similarities in clinico-radiological attributes. Surgical management has been divided into two schools of thought. Posterior decompression procedures are effective and have been rigidly applied to all cases with satisfying results. Anterior decompression has grown in popularity due to improvement in technology that allows direct decompression and reconstruction of the cervical spine with complication rate now comparable to posterior surgery. Inability to assign superiority of one procedure over the other creates a dilemma in choosing an ideal procedure for an individual patient. [13]

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Numerous studies have already proven that the preoperative severity of myelopathy adjudged by mJOA (or JOA) score is the best and most important predictor of the surgical outcome. [14-16]

Hu et al [17] studied data of eight prospective randomized control trials (RCT) investigating the

outcome of ACDF and cervical disc arthroplasty for treatment of 1- to 2-level CSM. They concluded that cervical arthroplasty be reserved for patients with acute neurological deficits (herniated disc), and ACDF is better suited for degenerative/myelopathic changes of the cervical spine. Higher quality clinical studies with longer follow-up are needed to confirm the superiority of arthroplasty over ACDF in cases of cervical myelopathy. The posterior approach procedure (laminoplasty or laminectomy + fusion) allows for a wider decompression. If there is focal kyphosis and the compressive pathology is posterior, then a combined approach should be considered. The current evidence in literature is not clear as to which particular approach is superior for multilevel ( $\geq 3$  levels) cervical myelopathy cases. Gupta et al [18] report a good functional outcome following three level cervical corpectomy with uninstrumented fusion. Luo et al [19] after studying 10 high quality comparative studies concluded that there was no apparent difference in neurological recovery at 24 months. These findings were consistent with earlier studies. [20,21] Our study too shows that though there is marginal improvement initially between the two subgroups, but there is no apparent difference at 12 to 14 months.

### Conclusion

An early diagnosis and prompt surgical intervention before the spinal cord dysfunction sets in is essential for good outcome. Surgical intervention either by the anterior or the posterior approach aims to decompress the cord, restore cervical lordosis, and prevent further kyphosis by stabilization procedures. Further high-quality RCTs with long-term follow-up are required to assess the etiopathogenesis of CSM and in formulation of an ideal surgical procedure.

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