

OUTCOME IN PATIENTS OF CERVICAL SPONDYLOTIC MYELOPATHY, ANTERIOR VERSUS POSTERIOR APPROACH- A RETROSPECTIVE ANALYSIS

Jitendra Singh Shekhawat¹, Arvind Sharma², Mukesh Vij³

¹Associate Professor, Department of Neurosurgery, S. M. S. Medical College and Hospital, Jaipur, Rajasthan, India.

²Assistant Professor, Department of Neurosurgery, S. M. S. Medical College and Hospital, Jaipur, Rajasthan, India.

³Consultant Neurosurgeon, EMC Multi Speciality Hospital, Amritsar, Punjab.

ABSTRACT

BACKGROUND

Cervical spondylotic myelopathy is a complex multi-factorial disease process having both metabolic and biomechanical factors. The choice of the surgical approach, whether anterior or posterior, is determined by many factors. The objective of this study is to compare the surgical outcome and post-operative complications among both the surgical groups in patients with cervical CSM at a tertiary care centre.

MATERIALS AND METHODS

The study was conducted at tertiary care centre in Jaipur. Retrospective data of 70 patients was collected who were operated for cervical spondylotic myelopathy from Dec 2016-Jan 2018. The patients were divided into 2 groups (35 in each group) based on the approach used for surgery- anterior or posterior. The patients' demographics, MRI findings and pre-op neurological status were considered. Clinical outcome and incidence of complications were compared among both the groups. Follow-up was done at immediate post-op, 3 months and 6 months.

RESULTS

The mean age of the patients in anterior and posterior group was 50.54 and 57.5 years respectively. There were 22 and 48 females and males respectively. In anterior group, 13 patients had lesion on >1 level while in posterior group, all the patients had multi-segmental level involvement. Immediate clinical outcome was considered- whether patient improved, remained same as in pre-op state or deteriorated. In both anterior and posterior groups, 77.14% of patients improved. The incidence of immediate post-op complications was higher in anterior group.

CONCLUSION

No difference in outcome was seen among patients of both the groups. Incidence of post-op complications was higher in the anterior group. The choice of surgical approach is also affected by age and associated comorbidity. Posterior approach is preferable with increasing age, and associated comorbidity. With rising trends in anterior approach, posterior approach (decompressive laminectomy) is still the best armamentarium in selected patients.

KEYWORDS

Cervical, Spondylotic, Myelopathy.

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BACKGROUND

Cervical spondylotic myelopathy primarily affects middle aged people which can evolve acutely at any age. Aging leads to spondylotic changes in intervertebral discs, ligaments and vertebral bodies, facet joints. All these changes ultimately lead to canal stenosis and cord compression. After canal stenosis various factors like static, dynamic and biomolecular lead to myelopathic changes in cord parenchyma.^{1,2,3,4}

Clinically patients present with symptoms of long tract involvement with motor weakness, clumsiness, posterior column involvement, paraesthesia, sensory changes, bladder or bowel involvement.⁵ MRI is considered to be diagnostic modality of choice as it helps in outlining the cause of compression whether anterior or posterior, level (single or multiple) and any angulation in the spine and thus it helps in deciding the approach of surgery. Intensity changes at the site of compression further predicts clinical outcome after surgery.^{6,7,8}

Surgery is indicated when clinical sign and symptoms correlate with the radiological findings. The purpose of the surgery is to decompress the cord, maintain the stability of spine and preservation of neurological function. For better results, surgery should be performed within 6 months to 1 year after onset of symptoms.⁹ Patients of cervical myelopathy are approached anteriorly or posteriorly or combined. In this study, comparison of the clinical outcome

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Corresponding Author:

Dr. Arvind Sharma,

#22, Sunder Nagar, Civil Lines,

Ajmer Road, Jaipur- 302006.

E-mail: dr_arvindsharma@yahoo.com

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of patients operated for cervical spondylotic myelopathy- either anteriorly or posteriorly, has been done.

MATERIALS AND METHODS

The study was conducted at tertiary care centre at Jaipur. Retrospective data of 70 patients have been collected who were operated for cervical spondylotic myelopathy from Dec 2016-Jan 2018. The patients were divided into 2 groups based on which approach they were operated- anterior or posterior.

Inclusion Criteria

Patients having clinical and radiological findings (MRI) suggestive of cervical spondylotic myelopathy.

Exclusion Criteria

- a. Patients with traumatic cervical spine injury and occipito-atlanto-axial pathologies were excluded.
- b. Cervical spine tumours and Pott’s spine were also excluded.

Age, duration of symptoms, motor and sensory symptoms and MRI findings were noted among all patients. Pre-operative and post-operative neurological status of patients of both the groups were noted. Functional disability was calculated using Nurick grade. The choice of surgical approach was based on the age, clinical presentation, Nurick grading, site of compression (anterior or posterior), level (single/multiple) and any comorbidity.

Demographic Tables

Age	Ant		Lamino		Total		p Value LS
	No.	%	No.	%	No.	%	
<50	18	51.43	6	17.14	24	34.29	0.010 S
50 to 65	14	40.00	25	71.43	39	55.71	
>65	3	8.57	4	11.43	7	10.00	
Sex							
F	14	40.00	8	22.86	22	31.43	0.19 NS
M	21	60.00	27	77.14	48	68.57	

Table 1

Among anterior group, 51.43% (18/35) of patients were <50 years of age while in posterior group 71.43% (25/35) of patients were between 50-65 years of age. In anterior group, mean age came out to be 50.5 years while in posterior group, mean age was 58 years. Out of 70 patients, females and males were 31.6% and 68.4% respectively. (Table no. 1)

Duration of Symptoms							
<12	12	34.29	8	22.86	20	28.57	0.42 NS
≥12	23	65.71	27	77.14	50	71.43	

Table 2

In anterior group, 65.7% (23/35) of patients presented clinically within 12 months while in posterior group 77% (27/35) of patients presented clinically =>12 months. Mean of duration of symptoms in anterior group were 13.4 months and in posterior group was 14.3 months. (Table no. 2)

Patient’s clinical neurological outcome and Nurick grading of severity of walking was calculated first at the time of discharge, at 3 months and 6 months of follow-up. Neurological outcome could be categorised as improved, same as in pre-operative period or the deteriorated.

Mean of pre-operative and post-operative Nurick grading were calculated and post-operative complications were noted, if any. Both the groups were compared on the basis of Nurick grading of severity and the incidence of complications in either group. P-value <0.05 was considered significant.

RESULTS

The patients were divided into 2 groups based on which approach they were operated- anterior or posterior. Following factors were considered among each group:

- a. Age.
- b. Duration of symptoms.
- c. Single/ multiple level.
- d. Co-morbid condition, if any.
- e. Pre-operative Nurick grading.
- f. Post-operative Nurick grading.
- g. Clinical outcome as Improved/Same/Deteriorated.
- h. Complications, if any.

Level of Involvement							
Multiple	13	37.14	35	100.00	48	68.57	<0.001 S
Single	22	62.86	0	0.00	22	31.43	

Table 3

In anterior group, 62.86% of patients (22/35) were having single site of lesion while in posterior group, all the patients were having multiple level of lesion. P-value came out to be significant in terms of choice of levels of lesion. (Table no. 3)

In anterior group, only 8/35 were found to have co-morbidity in form mild to moderate restrictive lung disease detected on pulmonary function tests. Amongst posterior group, 12/35 were having moderate and 8/35 were having severe restriction on pulmonary function tests. All of these had age more than >50 years.

	Ant		Lamino		Total		Odds Ratio (95% Confidence Interval)	p Value LS
	No.	%	No.	%	No.	%		
MRI DSH	33	94.29	28	80.00	61	87.14	4.125 (0.792 to 21.483)	0.15 NS
LFH*	24	68.57	29	82.86	53	75.71	0.451 (0.145 to 1.401)	0.26 NS
OPLL**	17	48.57	31	88.57	35	50.00	0.122 (0.035 to 0.419)	<0.001 S
CORD COMP***	35	100.00	35	100.00		0.00	NA	
MYELOMM****	7	20.00	7	20.00	14	20.00	1.000 (0.310 to 3.226)	0.76 NS
ANGULATION	4	11.43	1	2.86	5	7.14	4.387 (0.465 to 41.406)	0.35

Table 4

- *LFH – Lamina Flavum Hypertrophy.
- **OPLL – Ossification of Posterior Longitudinal Ligament.
- ***Cord Comp – Cord Compression.
- ****Myelomm – Myelomalacia.

Among MRI findings of both the groups, spondylotic changes, ligamentum flavum hypertrophy and cord compression were seen more or less among all the patients of both the groups. Ossified posterior longitudinal ligament (OPLL) was seen in 88% (31/35) of patients in posterior group while it was seen in 48.5% (17/35) of patients of anterior group. Statistically significant (p-value< 0.001) correlation was seen in patients operated through posterior approach that in multi-segment OPLL multi-level laminectomy is the treatment of choice. Spine angulation deformity was seen among 4 patients of anterior group and only in 1 patient of posterior group. (Table no. 4)

Pre-Op Nurick Grading	Anterior		Posterior		Total		p Value LS
	No.	%	No.	%	No.	%	
≤2	25	71.43	15	42.86	42	60.00	0.052 NS
3	8	22.86	15	42.86	21	30.00	
≥4	2	5.71	5	14.29	7	10.00	
Neck Pain	13	37.14	25	71.43	38	54.29	0.008 S

Table 5

Group	Age	Duration of Symptoms	Preop Nurick Grading	Post-Op Nurick Grading
Anteri	N	35	35	35
	Mean	50.54	13.43	2.31
	SD	12.081	3.583	0.676
Poster	N	35	35	35
	Mean	57.57	14.37	2.71
	SD	7.366	3.001	0.825
Total	N	70	70	70
	Mean	54.06	13.90	2.51
	SD	10.544	3.315	0.775
p Value LS		.004	0.237	0.030

Table 6

Mean of pre-operative Nurick grading in anterior group was 2.31 and in posterior group was 2.71. Mean of post-operative Nurick grading in anterior and posterior group was 1.63 and 2.06 respectively. (Table no. 5, 6)

Outcome	Anterior		Posterior		Total	
	No.	%	No.	%	No.	%
Deteriorated	2	5.71	3	8.57	5	7.14
Improved	27	77.14	27	77.14	54	77.14
Same	6	17.14	5	14.29	11	15.71

Table 7

Chi-square = 0.291 with 2 degrees of freedom; P = 0.865

The patient’s clinical outcome was categorised as whether patient improved, remained same as in pre-op state or got deteriorated. In both the groups, 77.14% of patients (27/35) improved. The number of patients who deteriorated in post-op period in anterior and posterior groups were 2 and 3 respectively. The number of patients who remained same as in pre-operative state among anterior and posterior groups were 6 and 5 respectively. The patients who deteriorated in both the groups recovered later on to pre-operative status after follow-up of 6 months. (Table no. 7)

Factors Affecting the Outcome and Comparison of the Approach

	Comorbidity							
	Absent				Present			
	Anterior		Posterior		Anterior		Posterior	
	No.	%	No.	%	No.	%	No.	%
Deteriorated	2	7.41	1	6.67	0	0	2	10
Improved	24	88.89	13	86.67	3	37.5	14	70
Same	1	3.70	1	6.67	5	62.5	4	20
	27	100.00	15	100.00	8	100	20	100
p Value	0.992 NS				0.08 NS			

Table 8

Age	Total	Posterior						p Value LS
		Deteriorated		Improved		Same		
		3	%	27	%	5	%	
<50	6	0	0.00	5	83.33	1	20	0.79 NS
50 to 65	25	3	12.00	19	76.00	3	60	
>65	4	0	0.00	3	75.00	1	20	
Duration of Symptoms								
<12	8	0	0.00	6	75.00	2	40	0.42 NS
≥12	27	3	11.11	21	77.78	3	60	
Preop Nurick Grading								
≤2	15	1	6.67	13	86.67	1	20	0.018 S
3	15	1	6.67	13	86.67	1	20	
≥4	5	1	20.00	1	20.00	3	60	

Table 9

	Total	Anterior						p Value LS
		Deteriorated		Improved		Same		
		3	%	27	%	5	%	
Age								
<50	18	0	0.00	18	100.00	0	0	<0.001 S
50 to 65	14	0	0.00	9	64.29	5	100	
>65	3	2	66.67	0	0.00	1	20	
Duration of Symptoms	0							
<12	12	0	0.00	9	75.00	3	60	0.43 NS
≥12	23	2	8.70	18	78.26	3	60	
Preop Nurick Grading	0							
≤2	25	0	0.00	22	88.00	3	60	0.01 S
3	8	1	12.50	5	62.50	2	40	
≥4	2	1	50.00	0	0.00	1	20	

Table 10

Age and associated comorbidity affect the outcome as whole and helps deciding the approach in patients with CSM. In the posterior group, 29/35 (82.8%) patients were having age > 50 years with 75% (22/29) improved in immediate post-op period. (Table no. 8, 9) On the contrary, in the anterior group, 48.6% (17/35) presented at age >50 years with 51.3% (9/17) improved in the immediate post op period. Out of 20 patients in posterior group presenting with associated comorbidity (restrictive or obstructive lung disease), 70%(14/20) of patients improved while among 8 patients of anterior group presenting with comorbidity, only 37.5% improved in the immediate post-op period. (Table no. 8, 10)

Association of Outcome with Myelomalacia on MRI								
	Deteriorated		Improved		Same		Total	
	No.	%	No.	%	No.	%	No.	%
Anterior	1	14.29	1	14.29	5	71.43	7	0.348 NS
Posterior	3	42.86	0	0.00	4	57.14	7	

Table 11

Among patients (14/70) with MRI finding suggestive of changes in cord parenchyma (myelomalacia) only 1 patient showed improvement in post-operative period. (Table no. 11)

Association of Outcome with Pre-Op Nurick Grade								
Nurick Grade	Deteriorated		Improved		Same		Total	
	No.	%	No.	%	No.	%	No.	%
≤2	1	2.50	35	87.50	4	10.00	40	57.14
3	2	8.70	18	78.26	3	13.04	23	32.86
≥4	2	28.57	1	14.29	4	57.14	7	10.00
Chi-Square = 18.511 with 4 Degrees of Freedom; P <0.001 S							70	100.00

Table 12

Out of 70, patients with Pre-op Nurick grade ≤3, 84% (53/63) of patients showed improvement while patients with pre-op Nurick grade ≥4 (Table No. 7), only 1 patient showed improvement. (Table no. 12)

Complications

In the anterior group, 10/35 (28.5%) had dysphagia and 2 patients had CSF leak. Dysphagia improved itself after 5-7 days while CSF leak recovered after lumbar drain insertion. In the posterior group, only 2 patients had minor wound complications.

There was no significant difference in the outcome, and recovery rate between the two groups. There was no mortality in either group.

DISCUSSION

Cervical spondylotic myelopathy refers to multiple age-related changes occurring in the vertebral column and surrounding ligaments leading to cervical canal narrowing that ultimately leads to degenerative changes in the cord parenchyma. Spondylotic changes are seen in almost every individual after 60 years of age while only less than one-third present clinically with features suggestive of myelopathy.¹⁰

Once diagnosed clinically and radiologically, such patients are managed by surgical treatment. The goal of surgery is to preserve the neurological function, maintain stability of the spine and adequate decompression of the cord.⁹ In the present study, patients have been grouped into two based on the surgical approach-anterior or posterior.

The decision for anterior or posterior was taken depending on the basis of age of the patient, duration of

symptoms, pre-operative Nurick grading, level of compression (single or multiple), site of compression (anterior or posterior), angulation of spine or any comorbidity.

Anterior approach was preferred in young age group, single level and anterior compression and avoided in patients with associated comorbidity. Smith and Robinson procedure was performed in anterior approach. Either of the following procedure was performed

- a. Anterior cervical discectomy with fusion using titanium spacer with screws or carbon made PEEK cage filled with autologous bone.
- b. Anterior cervical corpectomy with fusion using titanium cage with plate and screws or expandable cage filled with autologous bone graft.

Posterior approach was considered among the elderly patients with multilevel compression or compression mostly posterior. 4-5 level cervical laminectomy without fusion was performed among all the patients in posterior group.

The study has been carried out to compare the post-operative neurological outcome and incidence of complications among both the groups. In this era, when there is increasing trend towards anterior approach, the study reveals that there is no statistical difference between the neurological outcome among both the groups. Rather

operative time, incidence of complications and post-operative cervical immobilisation were more among the anteriorly operated group.

Jain SK, et al¹¹ conducted study at SGPGIMS Lucknow, to compare anterior vs posterior approach in 27 patients of multi-segmental OPLL. 14 patients were operated through anterior and 13 patients were operated through posterior approach. The surgical outcome of patients with multi-segmental cervical OPLL who had undergone anterior and posterior approach-Good outcome was observed in 71 and 61% of the patients who had undergone anterior and posterior approach, respectively. The mean recovery rate was 63.27 (± 20.21) and 58.85 (± 15.38) in patients with anterior and posterior approach, respectively. There was no statistical difference in number of patients with good outcome ($P = 0.09$), and recovery rate ($P = 1.3$) between the two groups. The results of our studies were slightly better than this study as 77.14% of patients improved among both the groups but no statistical difference can be seen among the outcome of both the groups.

The postoperative complications in patients who had undergone a posterior approach were less frequent as compared to those with anterior approach. In the study by Vijender et al, three patients had CSF leak from the anterior wound and one patient had graft extrusion. One patient each had respiratory distress and dysphagia following surgery. In the present study, among the patients operated through anterior approach, 8/35 had dysphagia and 2 patients had CSF leak while 2/35 operated through posterior approach had minor wound complications. They concluded that in patients with multi-segmental cervical OPLL, there was no significant difference in the short-term recovery rate and outcome between two groups. The immediate postoperative complications were less in patients who had undergone posterior approach. According to their analysis, posterior approach is probably the preferred method of treatment in multi-segmental OPLL in absence of preoperative kyphosis. A statistically significant difference was seen in our study, patients operated through posterior and anterior approach had OPLL in 88% and 48% respectively (p value < 0.001).

The results of our study were found to be concurrent with the findings of the study done by Sahu et al¹² at NIMS, Hyderabad. They took 63 patients; 14 patients underwent surgery by anterior approach (corpectomy and fusion). 49 patients underwent surgery by posterior approach where decompressive laminectomy was performed in 40, laminectomy with instrumentation was done in 5, laminoplasty was done in 3 and 1 patient underwent both anterior and posterior surgeries. All the patients were followed up for 24 months. The mean pre-operative Nurick grade was 2.82 which later on improved to 2.03 post-surgery ($P < 0.05$). In our study, the mean of pre-op Nurick grading was 2.51 which improved to 1.84 in post-op period. The postoperative complications in patients who had undergone a posterior approach were less frequent as compared to those with anterior approach.

In support of our study, we here highlight the findings of Fehlings et al,¹³ who performed a prospective observational multicenter study of 264 patients comparing the anterior and posterior surgical approaches to treat DCM (degenerative cervical myelopathy). The choice of each approach was at the discretion of the surgeon and a follow-up rate of 87% was obtained. A total of 169 patients were treated anteriorly and 95 received a posterior cervical surgery. DCM patients who underwent anteriorly cervical surgery were younger and had less severe myelopathy (as defined by the MJOA and Nurick scores). The extent of improvement in the Nurick scale, Neck Disability Index and SF-36 version 2 Physical Component Score although the MJOA improvement was lower in the anterior group (2.47 vs. 3.62, respectively, $p < 0.01$). They concluded that, although patients who underwent anterior cervical approach were younger and had less severe DCM, both treatments had similar efficacy in the treatment of DCM. In the present study, mean of pre-operative Nurick grade in anterior group was 2.31 and in posterior group were 2.71. Mean of post-operative Nurick grade in anterior and posterior group was 1.63 and 2.06 respectively and the difference of Nurick grade among both the groups was not statistically significant.

Fehlings MG et al,¹³ Gao R et al,¹⁴ Liu X et al¹⁵ and Yonenobu et al¹⁶ reported a higher rate of adjacent segment degeneration in the anterior cervical corpectomy fusion compared to laminectomy in comparative studies. This complication was not reported in our study may be because of shorter follow-up.

Kato et al¹⁷ reported the largest series of patients treated with cervical laminectomy for OPLL. In their series, 52 patients underwent cervical laminectomy with a mean follow-up of 14.1 years. The neurological recovery rate of 44.2% at 1 year after laminectomy was maintained at 5 years but worsened to 32.8% at last follow-up. The earliest deterioration occurred at 1 year and the latest was at 17 years after surgery. Postoperative expansion of the OPLL was noted in 70%, and progression of kyphotic deformity was observed in 47% of patients. This series was consistent with other reports that have demonstrated a high incidence of post-laminectomy kyphosis, although the statistical significance of this with regard to clinical outcome was not clear. Nakano et al¹⁸ did laminectomy and laminoplasty in 14 and 75 patients respectively and did follow up for 10.7 years. No neurological deterioration was noted even after progression of kyphosis. Because of short follow up, no neurological deterioration was seen among the laminectomy group. Both of the studies also concluded that even post laminectomy kyphotic deformity did not affect the neurological outcome. The follow-up in present study was not long enough to see this complication.

Through our study, we also tried to highlight the factors affecting the outcome and that helps in deciding the appropriate surgical approach. Age and associated comorbidity affect the outcome as shown in table no. 8-10. Studies done by Jain et al,¹⁹ Jain et al,²⁰ Sahu et al¹² and Epstein et al²¹ showed in their studies that age and co-

morbidity affects the clinical outcome and posterior approach for patients of CSM is preferable as operative time is less (reduced anaesthesia dose), straight forward technique and less of peri-op blood loss.

In the present study, we found that among patients of both the groups having cord parenchymal changes (myelomalacia) on MRI, has direct impact on clinical outcome. It was found that these patients were less likely to improve. Similar findings were noticed by Jain et al,¹⁹ Muthu Kumar et al⁹ and Gabor et al.¹

In the present study, we also determined the role of pre-operative Nurick grade (neurological status) on the clinical outcome. It clearly showed better the neurological status in pre-op better the outcome. The results were concurrent with studies done by Sahu et al,¹² Gabor et al,¹ Muthukumar et al,⁹ Lindsay et al²² and Hassen et al.²³

CONCLUSION

Cervical spondylotic myelopathy is a degenerative spine conditio. Patients' demographics, clinical and radiological correlation, any comorbidity helps in deciding appropriate surgical approach- anterior or posterior. In the present study, we have analysed the results of anterior and posterior approach. We found no statistically significant difference in outcome among both the approaches. We also found that immediate post-op complications and post-op cervical immobilisation were more in the anterior group.

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