Original Article

Evaluation Of Surgical Outcome In Anterior Versus Posterior Surgical Approaches In Management Of Cervical Spondylotic Myelopathy

Mohamed Elsayed Soliman, Mohamed Sherif Raslan, Saed Abdel Fattah Eissa, Mahmoud Mohamed Mousa

Neurosurgery Department, Faculty of Medicine, Helwan University, Egypt
*Corresponding Author: Mohamed Elsayed Soliman
E-mail: me.soliman@hotmail.com
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Abstract

Background: Intervertebral discs, uncovertebral joints, and longitudinal ligaments are all affected by the degenerative, age-related disorder known as cervical spondylosis, which can also damage the facet joints and ligamentum flavum. This can result in spinal canal stenosis.

Aim of the Work: To evaluate and compare the outcome of anterior and posterior decompressive approaches in treatment of spondylotic cervical myelopathy.

Patients and Methods: A prospective comparative study was conducted on 66 Cases with degenerative cervical myelopathy who had surgical decompression either through anterior or posterior approaches in Neurosurgery department, Helwan University and Dar Elsafwa Hospital after an informed consent was obtained from the patients.

Results: There is no significant difference between the studied groups as regard low pre and postoperative mJOA. However, there is a significant increase in mJOA from preoperative to postoperative in the three studied groups and subgroups.

Conclusion: With either anterior or posterior treatment, individuals with CSM exhibit notable improvements in a number of health-related outcome measures. It's significant to mention that individuals who underwent anterior procedures were younger, had less significant disability, and more focused disease.

Keywords: Cervical Spondylotic Myelopathy, Anterior, Posterior

INTRODUCTION

Spinal canal stenosis is a result of cervical spondylosis, a progressive, age-related disorder that affects the front (intervertebral discs, uncovertebral joints, and longitudinal ligament) and posterior (possible aspect joint capsules, and ligamentum) elements of the vertebral canal. The early symptoms of spinal cord pressure, also known as spondylotic spondylosis, are most frequently brought on by degeneration alterations [(1)]. These signs comprise sensory abnormalities, aberrant responses, sphincter disruption, gait disturbance, and movement deficiencies of the limbs. A radiological diagnosis is made for the majority of these degeneration alterations (approximately 85%) using conventional radiography, magnetic resonance imaging (MRI), and occasionally properly identifying [(2)].

The anterior techniques comprise anterior cervical discectomy with fusion (ACDF) and anterior cervical corpectomy with fusion (ACCF). To alleviate stress on the spinal cord, however, common posterior methods comprise laminoplasty and laminectomy even without fusing. Using ACCF/ACDF, reliable cervical stabilization is established. However, to repair the cervical spine, a surgeon must be proficient in technologies and use bone grafts [(1)].

Young patients frequently undergo anterior approaches, such as corpectomy or disk herniation, while elderly patients typically undergo posterior approaches, such as laminectomy with equipment or laminoplasty without electronic instruments [(1)].

The aim of the work was to evaluate and compare the outcome of anterior and posterior decompressive approaches in the treatment of spondylotic cervical myelopathy.

PATIENTS AND METHODS

This prospective randomized comparative study was conducted on 66 Cases with degenerative cervical myelopathy who had surgical decompression either anterior or posterior approach. The study was done at Neurosurgery department, Helwan University and Dar Elsafwa Hospital, Egypt from January 2021 to January 2022.

The study protocol was approved prior to conduction, by the Faculty of Medicine Helwan University, research ethics committee, Egypt. An informed consent was obtained from the patient. Confidentiality

Inclusion criteria were patients Above 18 years old, males and females, with apparent cervical myelopathy (motor deficits, Sensory deficits.

- Reflexes (Hyperreflexia, ± Clonus).
- Pain (Neck pain, Brachialgia).
- Spasticity.
- Sphincter disturbance.

o Apparent radiological compression signs**.**

Exclusion criteria were traumatic myelopathy, congenital cervical or brachial plexus injuries, infective myelopathy, neoplastic myelopathy and patients unfit for surgery.

A. Operative Design:

All patients were subjected to:

o **Preoperative assessment**

- History examination
- Clinical assessment:

a. General assessment.

b. Neurological assessment

b. 1: Preoperative and Postoperative to evaluate whether patients were neurologically intact or not.

➢ **Motor examination:**

1. **Muscle status:** The physical evaluation started with the assessment of the musculature.
2. **Muscle Tone:** The range of motion (ROM) was employed to evaluate muscle tone and to help pinpoint illness or condition to the affected joints.
3. **Muscle power and strength:** The evaluation of muscular strength was completed last. The manual muscle test yielded the following results:

0 - **None:** There is no audible or measurable expansion.

1 - **Trace:** constriction that can be seen or felt (only slight).

2 - **Poor:** full ROM when gravitation is absent.

3 - **Fair:** Complete resistance to gravity.

4 - **Good:** full ROM with light restriction against gravitation.

5 - **Normal:** Highest force with full ROM opposing gravitation.

- **Sensory system: Superficial and deep sensation**

The sensory examination entailed evaluating complaints listed by the sufferer, including a distorted or heightened sense of touch.

- **Visceral: Urine and stool continence**
- **Reflexes:**

On striking a particular tendon with a reflex hammer and watching for a reflex muscular contractions, the tendon responses were evaluated. These examine a particular spinal cord levels (biceps C5-C6, triceps C7, knees L3-L4, ankles S1-S2). The following scores were given for reaction times: 0 - absent, 1+ - trace, 2+ - normal, 3+ - brisk, 4+ - non-sustained clonus, and 5+ - sustained clonus.

- **Special tests:**

The Babinski Reflex test: The existence of an upward-pointing big toe suggested a successful Babinski reflexes, which included stimulating the lateral plantar part of the foot.

Hoffmann test: A Hoffman reflexes were performed on the upper extremities by flicked the middle finger's proximal digits; the positive reaction was the involuntary bending of the remaining fingers, such as the thumbs. Hoffman reflexes testing revealed cervical cord activation.

Gait: spastic gait, wide based gait

By observing the sufferer enter the room, the gait of the individual was evaluated. Identified gait disorders can indicate a particular disease phase or neural participation.

b. 2: Patients were assessed using mJOA score for cervical myelopathy:

A rating of 15 or more indicated mild myelopathy, a rating of 12 to 14 indicated moderate myelopathy, and a rating of less than 12 indicated serious illnesses.

c. Neck examination

c.1: Inspection: The neck was inspected from front and sides for detection of:

- Deformity (kyphosis, exaggerated lordosis, swan neck deformity)
- Neck and paravertebral muscle spasm

c.2: Palpation: the neck was evaluated by palpation the lymphatic chains as well as the presence of any masses in the neck. When evaluating lymph nodes, their size, shape, consistency, mobility, and tenderness were noted. The neck was also palpated for any:

- Cervical Tenderness
- Muscle atrophy

- **Operative technique:**

a. Anterior Surgical Approaches

i. <u>Anterior cervical discectomy and fusion (ACDF):</u>

Thirty individuals had ACDF procedures. A herniated or degenerative discs in the neck was surgically removed. To access and extract the disc, a cut is made near the throat.

Participants were intubated during this surgery using standard endotracheal procedures. On the surgical table, the individuals were lying supine.

The injury was cleaned and then closed as usual. In addition to receiving suitable analgesic medicine and deep vein thrombosis and stomach ulcers prophylaxis, participants also got routine postoperative treatment. Following surgery, individuals were put in collars.

ii. <u>Anterior cervical corpectomy and fusion (ACCF)</u>

Seven participants experienced ACCF. The massive, arthritic osteophytes (bone spurs) that were putting pressure on the spinal cord and spinal nerves had to be removed. **Figure (1)**

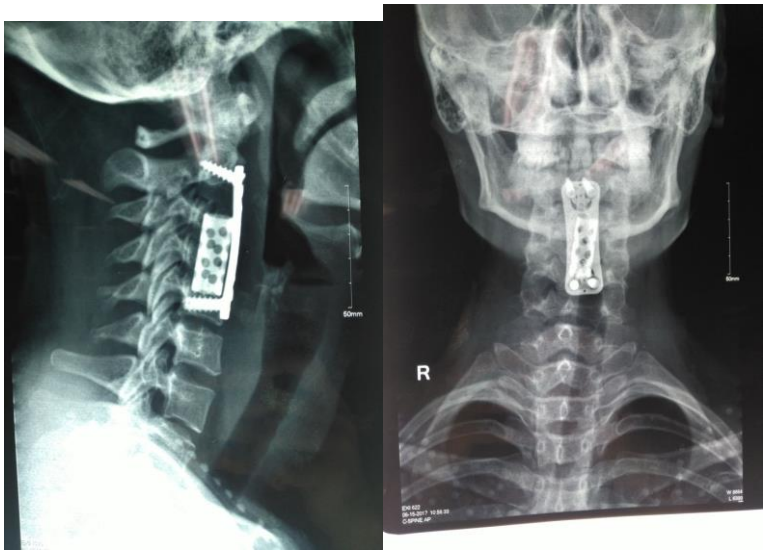

Figure (1): Plain X-ray of a patient who underwent double level ACCF with pyramesh cage insertion and anterior cervical plate.

b. Posterior approach

i. <u>Laminectomy with fusion</u>

Laminectomy with fusion was performed for 21 patients. To establish hemostasis, a 1: 100,000 epinephrine sample was injected into the skin and underlying. A C-arm was used to locate the incisions precisely, and it was recorded. Over the affected region, a midline skin incisions were created. **Figure (2)**

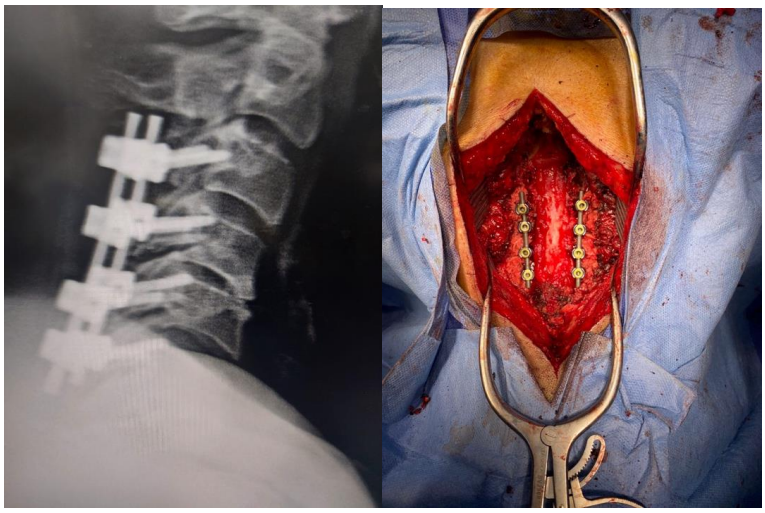

Figure (2): Intraoperative radiograph and intraoperative image of a patient who underwent Laminectomy with fusion showing placement of lateral mass screws.

ii. <u>Laminectomy without fusion</u>

Performed for 1 patient. Technique used is the same as the decompression in laminectomy with fusion but without placement of fusion system.

iii. <u>Laminoplasty</u>

- Procedure was performed on 2 patients. A Mayfield heads catcher with its head and neck considerably flexed is secured to the board, and the case is lying on his or her back with the chest rolled up.
- Physical examination is used to locate the spinous processes and mark a transverse skin puncture.

- Over through the surgical cervical areas, a longitudinal transverse cut is created. To reach the spinous processes, incision is advanced through a largely vascularized zone.
- For its unusual aspect, working on C7 preservation of life. **Figure (3)**

Figure (3): Intraoperative image of a patient who underwent laminoplasty after placement of straight craniofacial fixation plate in position connecting the lateral mass, graft, and lamina.

c. Combined approach (Circumferential)

Combined approach was performed on 5 patients. Combination of both anterior (ACDF) approach and Post (Laminectomy with fusion) done accordingly in cases with evident compressive pathology both anteriorly and posteriorly, also in high risk of hardware failure (as in elderly with osteoporosis). **Figure (4)**

Figure (4): Post-operative X-ray of a patient who underwent combined ACDF (C4-5 and C5-6) and Posterior laminectomy with fusion (C3-C6).

- **Follow up:** three follow up visits in the first 3 months postoperative (week one, six, and twelve). Longer follow-up period may be required up to 9 months.
- **Imaging:** was done one in the preoperative period, in the early postoperative period, and after three months.
  a. Static and dynamic Plain X-rays.
  b. Multislice CT scan (MSCT)
  c. Magnetic resonance imaging (MRI) only in cases of obvious complications.

Sample Size Calculation:

Through using Epi-Info statistical program developed by the World Health Organization and the Centers for Disease Prevention and Control, Atlanta, Georgia, USA, version 2002, the sample size and power analysis were computed. To account for possible dropouts, the sample size was expanded to 66.

Statistical Analysis

SPSS version 22 was used for data acquisition, checking, entering, and analysis. The outcomes of the current investigation were analyzed using the following statistical techniques. For numerical variables, the values were processed as average + standard deviation (SD), and for qualitative data as frequency and percentage.

RESULTS

There is significant difference between the studied groups regarding age only. Sex, BMI, motor and sensory system affection were insignificantly different. There is significant difference between the studied groups regarding abnormal gait only. **Table (1)**

Table (1): Demographic data of the studied groups

Variable		**Anterior** (n=37)	**Posterior** (n=24)	**Circum.** (n=5)	**F / χ^2**	**P**
Age (years) Mean ± SD		52.59 ± 10.29	60.79 ± 5.04	60.6 ± 2.51	**7.72**	**<0.001**
Sex	**Male**	25 (67.6%)	19 (79.2%)	5 (100%)	2.9	.234
	Female	12 (32.4%)	5 (20.8%)	0		
BMI (kg/m^2) Mean ± SD		24.82 ± 2.77	25.66 ± 2.83	25.13 ± 2.35	.671	.515
Motor system affection	**Affected**	30 (81.1%)	24 (100%)	5 (100%)	**6.14**	**<0.05**
	Intact	7 (18.9%)	0	0		
Sensory system affection	**Affected**	16 (43.2%)	9 (37.5%)	3 (60%)	.881	.644
	Intact	21 (56.8%)	15 (62.5%)	2 (40%)		
Clinical presentation	**Urine incontinence**	9 (24.3%)	9 (37.5%)	2 (60%)	.993	.609
	Stool incontinence	0	0	0	--	1
	Abnormal gait	17 (45.9%)	24 (100%)	5 (100%)	**22**	**<0.001**
	Neck pain	37 (100%)	24 (100%)	5 (100%)	--	1
	Exaggerated reflexes	37 (100%)	24 (100%)	5 (100%)	--	1

There is no significant difference between the studied groups as regard pre and postoperative mJOA. However, there is a significant increase in mJOA from preoperative to postoperative in the three studied groups. There is no significant difference between the studied groups as regard pre and postoperative Nurick score. However, there is a significant decrease in Nurick score from preoperative to postoperative in the three studied groups. **Table (2)**

Table (2): Modified Japanese Orthopedic Association and Nurick score among the studied groups

		Anterior (n=37)	**Posterior** (n=24)	**Circum.** (n=5)	**F**	**p**
mJOA						
Preoperative Mean ± SD		9.59 ± 2.34	9.29 ± 1.73	8.4 ± 1.14	.776	.464
Postoperative Mean ± SD		13.16 ± 2.15	13.13 ± 1.39	12.6 ± 1.14	.204	.816
Paired t test	**t**	**18.2**	**16.6**	**11.2**		
	P	**<0.001**	**<0.001**	**<0.001**		
Nurick score						
Preoperative Mean ± SD		3.62 ± 1.06	3.29 ± 0.859	3.8 ± 0.837	1.05	.354
Postoperative Mean ± SD		2.7 ± 0.702	2.63 ± 0.711	2.6 ± 0.548	.115	.891
Paired t test	**t**	**5.78**	**8.19**	2.45		
	P	**<0.001**	**<0.001**	.070		

There is no significant difference between the studied groups regarding intraoperative complications. **Table (3)**

Table (3): Intraoperative complications distribution among the studied groups

	Anterior (n=37)	**Posterior** (n=24)	**Circum.** (n=5)	χ^2	**p**
No complication	36 (97.3%)	24 (100%)	4 (80%)	5.66	.059
Dural tear	1 (2.7%)	0	1 (20%)		

There is a significant difference between the studied subgroups regarding age, and HTN. **Table (4)**

Table (4): Demographic data and comorbidities among the studied subgroups

Variable	**Age** (years) Mean ± SD	**Sex**		**DM**	**HTN**	**Smoking**
		Male	Female			
Ant. ACCF (n=7)	59.57 ± 7.21	5 (71.4%)	2 (28.6%)	4 (57.1%)	6 (85.7%)	3 (42.9%)
Ant. ACDF (n=30)	50.97 ± 10.31	20 (66.7%)	10 (33.3%)	6 (20%)	14 (46.7%)	18 (60%)
Posterior laminectomy with fusion (n=21)	61.52 ± 4.43	16 (76.2%)	5 (23.8%)	5 (23.8%)	18 (85.7%)	12 (57.1%)
Post. Laminoplasty (n=2)	55.0 ± 9.9	2 (100%)	0	1 (50%)	0	2 (100%)
Post laminectomy (n=1)	57	1 (100%)	0	1 (100%)	0	0
Circum. (n=5)	60.6 ± 2.51	5 (100%)	0	2 (40%)	3 (60%)	4 (80%)
P	**<0.001**	.586		.196	**<0.05**	.475

There is a significant increase in mJOA from preoperative to postoperative in Ant. ACCF group, Ant. ACDF group, posterior group, and Circum. group. However, there is no significant difference between the subgroups regarding preoperative and postoperative mJOA. **Table (5)**

Table (5): Modified Japanese Orthopedic Association among the studied subgroups

Variable	**mJOA** Mean ± SD		**P**
	Preoperative	**Postoperative**	
Ant. ACCF (n=7)	8.43 ± 2.23	12.29 ± 2.43	**<0.001**

Ant. ACDF (n=30)	9.87 ± 2.32	13.37 ± 2.08	**<0.001**
Posterior laminectomy with fusion (n=21)	9.52 ± 1.72	13.24 ± 1.45	**<0.001**
Post. Laminoplasty (n=2)	7.5 ± 0.707	12.5 ± 0.707	--
Post laminectomy (n=1)	8	12	--
Circum. (n=5)	8.4 ± 1.14	12.6 ± 1.14	**<0.001**
P	.265	.702	

There is a significant decrease in Nurick score from preoperative to postoperative in Ant. ACCF group, Ant. ACDF group, and posterior group. However, there is no significant difference between the subgroups regarding preoperative and postoperative Nurick score. **Table (6)**

Table (6): Nurick score among the studied subgroups

Variable	**Nurick score** Mean ± SD		**P**
	Preoperative	**Postoperative**	
Ant. ACCF (n=7)	3.57 ± 1.4	2.71 ± 0.756	**<0.05**
Ant. ACDF (n=30)	3.63 ± 0.999	2.7 ± 0.702	**<0.001**
Posterior laminectomy with fusion (n=21)	3.19 ± 0.873	2.57 ± 0.746	**<0.001**
Post. Laminoplasty (n=2)	4	3	--
Post laminectomy (n=1)	4	3	--
Circum. (n=5)	3.8 ±.837	2.6 ± 0.548	.070
P	.575	.944	

DISCUSSION

A neurologic disorder known as cervical spondylotic myelopathy (CSM) develops slowly over time when the cord and surrounding elements become compressed due to progressive degeneration in the spine. Although it is the most frequent type of spinal cord damage in adulthood, identification is frequently postponed **[5-9].**

In the current thesis our results in studying the basal characteristics of included subjects in study groups showed that, there was no significant difference between the studied group regarding Gender, BMI, Smoking, DM and HTN (p >0.05). However, only age that was statistically significant (p<0.001). The mean age were 52.59 ± 10.29 years in anterior group, 60.79 ± 5.04 years in posterior group and 60.6 ± 2.51 years in circumferential.

In agreement, a Non-randomized Prospective Controlled study done by **Liu et al. [10]** among 52 cases included in the study, there were in 25 patients in anterior group and 27 patients in posterior group, the mean age were 54.64 ± 11.49 years in anterior group, 57.33 ± 10.09 years in posterior group, there was no significant difference among the studied groups regarding age and Gender (p >0.05).

In a previous study by **Cabraja et al. [11]** there were 24 individuals in the front cohort and 24 individuals in the posterior category out of the 48 participants with CSM who were included in the research. These patients received cervical spine decompressive operation because they had degenerative cervical spinal canal constriction. All told, 19 female (12 in the anterior grouping, 7 in the posterior grouping) and 29 males (12 in the anterior grouping, 17 in the posterior grouping) underwent surgery.

Along with our results was **Ghogawala et al. [12] , Lawrence et al. [14] and Hirai et al. [13]** · **Hirai et al. [13]** showed that, among 86 patients (39 in the anterior surgery group and 47 in the posterior surgery group) Follow-up time was 5 years. The mean age was 59.2 ± 10.7 years in anterior group, 61.2 ± 10.1 years in posterior group, there were no significant differences between the two studied groups regarding sex or age (p >0.05).

Our results showed that, concerning motor control affection and sensory systems affection, there was no significant disparity between the studied traits. The relative P-values were 0.046 and 0.644. However, only the aberrant gait was significantly different across the study groups (p< 0.001). However, there was no statistically significant difference between the enrolled participants in terms of neck pain, leakage of the urine or faeces, leakage of the stools, or excessive responses (p > 0.05).

Harrop et al. [15] conducted 103 participants were retrospectively analysed to establish the usefulness of different physical assessment results in CSM. These individuals were being assessed for cervical deterioration. They

discovered the clinical manifestations were present in CSM patients: Gait abnormalities (91%) Hoffman sign (83%), upper extremity hyperreflexia (67%), lower extremity hyperreflexia (81%) and Babinski reflex (67%). (44 percent).

Crandall and Batzdorf [16] reported that, Neck pain (50%) and radicular pain (38%), as well as a positive L hermitte indication, are specific sensory abnormalities in the upper extremity and chest in individuals with CSM (27 percent).

Regarding the Clinical characteristics between the studied groups our results showed that, number of fused levels was significantly lower in anterior group. However, operative time and blood loss were significantly lower in posterior group compared to anterior and circumferential group ($p< 0.001$).

In a previous study, **Cabraja et al. [11]** reported that, Epidural haemorrhage required rapid surgery revisions in one case involving a 2-level decompress and one case involving a 3-level decompression in the posterior grouping. Additional 2 instances needed treatment for a wound infection and a CSF fistula.

The present study observed that, regarding low pre- and postoperatively mJOA, there was no statistically significant difference between the analysed categories. ($p >0.05$). But in the three categories under study, there was a substantial rise in mJOA from preoperatively to postoperatively ($p< 0.001$)..

In agreement **Cabraja et al. [11]** reported that, according to the VAS scoring and mJOA scale scoring, there were no appreciable changes among the anterior and posterior groupings before or after the surgeries.

The current study showed that, regarding pre and postoperatively Nurick scores, there was no statistically significant difference between the tested groups. But in the three categories under study, there was a substantial decline in Nurick score from preoperatively to postoperatively ($p< 0.001$).

According to the present results, we found that, there was no significant difference between the studied groups regarding intraoperative complications and postoperative complications p-values were 0.059 and 0.401 respectively. In our study we had intraoperative complication of dural tear in 1 patient (2.7%) in the anterior group and 1 patient (20%) in the circumferential group, while regarding the postoperative complication, we had 2 patients (8.3%) in the posterior group with transient C5 paresis and 1 patient in the posterior group (4.2%) with T1 radiculitis. However, in the anterior group 1 patient (2.7%) complicated with wound seroma.

In a previous systematic review, **Luo et al. [9],** noted that, data analysis were consequences from nine trials involving a total of 809 participants (435 for anterior operation and 374 for posterior operation). The primary bone grafting-related problems for CSM participants' anterior grouping led to significant postoperatively concerns such dysphagia and dysphonia. This suggests that a higher prevalence of problems is linked to anterior techniques for the management of multilevel CSM.

Our results in the current study subgroups showed that, there was a significant difference between the studied subgroups regarding age, HTN, sensory system affection, urine incontinence, abnormal gait. Also, there was a significant increase in mJOA score from preoperative to postoperative in Ant. Corp group, Ant. ACDF group, posterior group, Post. Laminoplasty group, and Circum. group. There was a significant decrease in Nurick score from preoperative to postoperative in Ant. Corp group, Ant. ACDF group, and posterior group ($p <0.05$).

These findings are in line with previous investigations **Klineberg [7], Ghogawala et al. [12]** whenever the outcomes of a current multi-institutional randomized clinical study are revealed, this could be confirmed.

CONCLUSION

Either anterior or posterior operation significantly improves numerous health-related outcomes markers in individuals with CSM. It's significant that individuals managed with anterior procedures tended to be younger, to have less significant disability, and to have more focused pathology. In contrast, posterior techniques have a stronger emphasis on multilayer CSM, resulting in quicker operations and reduced intraoperative blood loss. We show that anterior and posterior surgery approaches are equally effective in treating CSM when individual and condition characteristics are taken into consideration.

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