






## Personalized Surgical Strategy in Cervical Myelopathy: Case Series with Anterior and Posterior Approaches

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### Keywords

cervical myelopathy, surgical decompression, anterior approach, posterior approach, cervical spine surgery

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### Abstract

**Introduction:** Cervical myelopathy is a progressive condition that often requires surgical decompression. The anterior and posterior approaches are the most commonly used. The choice should be individualized, based on the number of affected levels, presence of ossification of the posterior longitudinal ligament (OPLL), cervical alignment, and bone quality. **Case Series:** Three patients underwent posterior approach due to multilevel stenosis, OPLL, and preserved alignment. Laminectomies, with or without fusion, were safe and effective. The other three patients were treated via anterior approach. In cases with soft disc herniation, localized anterior compression, or osteoporosis, anterior cervical discectomy and fusion (ACDF) was chosen, resulting in good functional recovery. **Discussion:** Surgical decisions must consider the location of compression, disease extent, sagittal alignment, and comorbidities. The posterior approach is preferred in multilevel stenosis with ossification. The anterior approach allows direct decompression in localized compression. Both approaches show similar long-term outcomes when properly indicated. Intraoperative monitoring contributes to surgical safety, as demonstrated in one case. **Conclusion:** The choice of surgical approach in cervical myelopathy must be individualized. Detailed anatomical and clinical evaluation guides the optimal strategy, aiming for safety and favorable functional outcomes.

### Introduction

Degenerative cervical myelopathy is a progressive condition that often requires surgical decompression to prevent neurological decline. The two most commonly employed surgical approaches are anterior and posterior. Current literature often favors the anterior approach, which is associated with lower complication rates, better postoperative tolerance, and reduced pain levels [1,2].

However, the choice of surgical approach should be carefully individualized. Clinical and radiological factors, such as the number of involved levels, presence of calcified discs or ligaments, cervical alignment, and bone quality, directly influence the decision between anterior or posterior access [3,4].

This study presents a case series of six patients surgically treated for cervical myelopathy, with three undergoing posterior and three anterior approaches. The aim is not to numerically compare outcomes, but to illustrate the reasoning behind each surgical decision and emphasize the importance of personalized therapeutic strategies.

### Case Series

#### Case 1

A 63-year-old male with no prior comorbidities presented with upper limb weakness and heaviness. Despite symptoms, he remained active and functional. Imaging revealed severe cervical stenosis at C3, C4, and C5, with extensive ossification of the anterior and posterior longitudinal ligaments, preserved cervical lordosis, and signs of cervical myelopathy (Figure 1).

Due to extensive ossification and multilevel stenosis, a posterior approach was chosen. The procedure was uneventful, and the patient recovered completely within three days without new neurological deficits or significant postoperative pain.

The decision for posterior approach was based on multilevel stenosis with anterior and posterior compression, associated with OPLL and ligamentum flavum ossification. The spinal canal was significantly narrowed (>60%). Anterior decompression would pose high technical risk due to spinal cord proximity and limited visualization. As supported in the

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**Figure 1.** Sagittal MRI of the cervical spine showing significant cervical stenosis at levels C3–C4, C4–C5, and C5–C6, highlighted by red arrows. There is evident spinal cord compression with reduced anterior and posterior cerebrospinal fluid (CSF) spaces. Findings are consistent with compressive cervical myelopathy.

literature, laminectomy with lateral mass screw fixation is often preferred in OPLL cases with preserved cervical alignment.

## Case 2

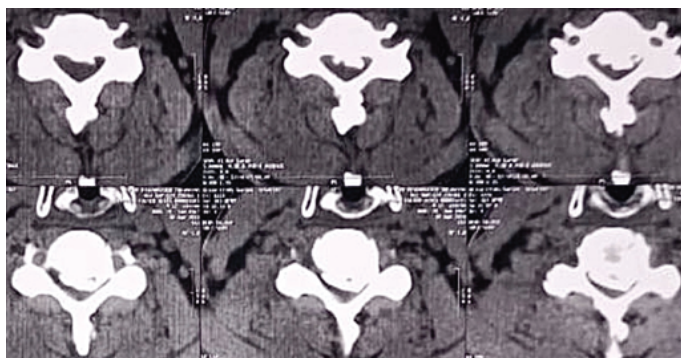
A 57-year-old male with controlled diabetes mellitus presented with progressive upper limb motor deficit, more pronounced on the left. Cervical CT (Figure 2) and MRI revealed multilevel stenosis from C4 to C7 (Figure 3).

Posterior approach with intraoperative neurophysiological monitoring was chosen. During surgery, there was transient drop in motor evoked potentials, promptly resolved with warm saline irrigation and increasing mean arterial pressure to 90 mmHg. After decompressive laminectomy, signals returned to baseline. Postoperative course was uneventful, with preserved preoperative neurological function.

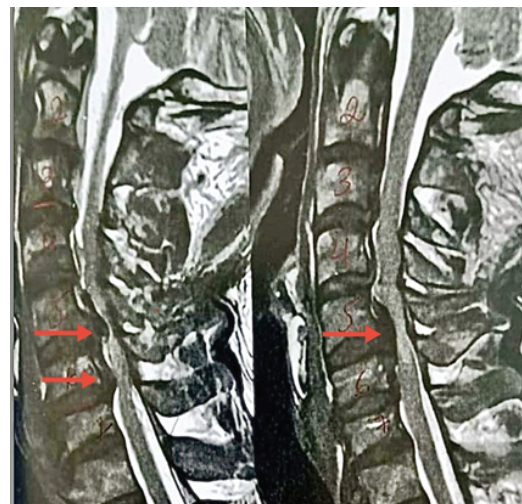
## Case 3

A 58-year-old female presented with upper limb weakness and gait difficulty. She had a minor fall a week prior, worsening her symptoms. At evaluation, she required assistance for ambulation.

Imaging showed significant stenosis at C4–C5 and C5–C6, with preserved lordosis and posterior disc protrusions without relevant calcification (Figure 4).



**Figure 1.** Axial CT scan sequence of the cervical spine revealing multilevel posterior vertebral body linear hyperdensities and thickening, compatible with ossification of the posterior longitudinal ligament (OPLL). The bony canal is visibly narrowed with central predominant stenosis, suggesting high risk for compressive myelopathy.



**Figure 3.** Sagittal T2-weighted MRI of the cervical spine showing multilevel degenerative changes. Red arrows indicate significant spinal cord compression at C4–C5, C5–C6, and C6–C7. There is no table reduction of the CSF space both anteriorly and posteriorly, with anterior spinal cord deformation, indicating severe cervical stenosis mainly of discogenic origin, associated with posterior disc protrusion or herniation and signs of myelopathy. Straightening of the cervical lordosis and disc degeneration are also observed.



**Figure 4.** Sagittal T2-weighted MRI of the cervical spine showing moderate to severe central stenosis at C4–C5 and C5–C6, marked by red arrows. Posterior disc protrusion causes clear anterior spinal cord compression, with reduction of the perimedullary CSF space. A discrete intramedullary T2 hyperintensity is noted at C5–C6, suggesting early myelopathy. Lordosis is preserved, and adjacent structures show mild disc dehydration and height loss.

Anterior approach was chosen for direct decompression and herniated material removal (Figure 5). ACDF is considered the most effective and less invasive technique in such cases, with lower postoperative axial pain and better functional recovery. Surgery was uneventful, and within two days, the patient was walking unaided with improved limb strength.





**Figure 5.** Postoperative sagittal MRI after anterior cervical decompression with interbody fusion. Cervical lordosis and vertebral alignment are preserved. The operated intervertebral spaces (C4–C5 and C5–C6) show expected changes due to interbody cage placement. Reduced spinal cord compression is evident, with re-expansion of CSF spaces and no signs of residual compression.



**Figure 7.** Postoperative MRI following cervical interbody fusion. The yellow arrow indicates a fracture of the C6 vertebral body, seen as irregularity and partial collapse of the vertebral endplate just above the interbody cage. Findings are compatible with a stress fracture related to the implant.

#### Case 4

A 75-year-old female with severe bilateral brachialgia (worse on the left) and neurogenic claudication presented after six months of ineffective conservative treatment. In the last two months, she experienced recurrent pain crises refractory to physical therapy, injectable corticosteroids, and opioids.

MRI revealed severe compressive myelopathy at C3–C4, C4–C5, and C6–C7 (Figure 6).

The patient had osteoporosis and bisegmental stenosis caused by calcified disc herniation, osteophytes, and posterior longitudinal ligament calcification. Despite technical challenges, the anterior approach was chosen for targeted decompression and to avoid risks associated with posterior instrumentation in osteoporotic bone. A vertebral body fracture occurred during surgery, requiring replacement of the first interbody spacer (Figure 7).

Postoperatively, she had neuropathic pain controlled with medication. Literature supports the anterior approach in osteoporotic patients when limitations are anticipated and managed intraoperatively.

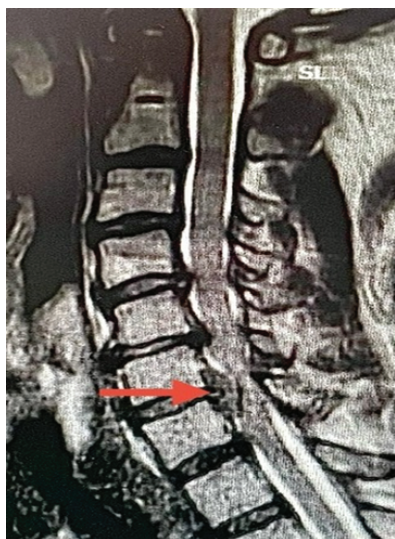
#### Case 5

A 49-year-old male presented with progressive limb weakness. One week before admission, he fell and symptoms worsened. He had tetraparesis: no voluntary lower limb movement and minimal upper limb movement.

MRI showed a large disc herniation and severe stenosis at C6–C7 with anterior spinal cord compression (Figures 8 and 9). Emergency anterior decompression and interbody fusion were performed.

Surgery was successful, and within 2–3 days, the patient showed neurological improvement. However, he developed a urinary tract infection and pneumonia, extending hospitalization to about a month before transfer to rehabilitation.

**Figure 5.** Sagittal T2-weighted MRI of the cervical spine showing multilevel stenosis. Red arrows highlight C3–C4, C4–C5, and C6–C7 levels, with posterior disc protrusions causing anterior spinal cord deformation and significant reduction of the perimedullary CSF space, consistent with moderate to severe cord compression and myelopathy. Straightening of cervical curvature and disc degeneration with reduced height and signal are present.



**Figure 8.** Sagittal T2-weighted MRI of the cervical spine. The red arrow points to a marked degenerative change at C6–C7 with posterior disc protrusion causing anterior spinal cord compression. There is narrowing of both anterior and posterior CSF spaces, characterizing moderate to severe spinal canal stenosis.



**Figure 10.** Sagittal T2-weighted MRI of the cervical spine showing severe central stenosis at C3–C4, C4–C5, and C5–C6, with red arrows indicating areas of significant anterior cord compression due to posterior disc protrusions, disc degeneration, and possible posterior ligament hypertrophy. There is marked reduction in CSF space and spinal cord deformation, with discrete intramedullary hyperintensity suggesting cervical myelopathy. Straightening of the cervical lordosis is also noted, often associated with chronic muscular spasm or pain.



**Figure 9.** Axial T2-weighted MRI of the cervical spine at C6–C7 level. The red arrow highlights a posterior disc protrusion that significantly reduces the spinal canal diameter; directly compressing the anterior spinal cord. The protrusion occupies more than 50% of the anteroposterior diameter of the canal, consistent with severe central stenosis.

## Case 6

A 65-year-old male with tetraparesis was admitted unable to walk independently, with generalized weakness and significant fine motor impairment in the hands.

MRI revealed multilevel cervical stenosis with anterior and posterior cord compression and preserved lordosis (Figure 10).

He underwent simple laminectomy without fusion due to preserved alignment and absence of instability. Despite >60% stenosis, the compression was symmetric, making posterior approach less complex and safer. In elderly patients with preserved lordosis and multiple level involvement, posterior laminectomy is supported as a safe option.

## Discussion

Surgical intervention remains the only effective treatment to halt progression of severe cervical myelopathy. Conservative measures usually fail against persistent cord compression, and delayed decompression may lead to irreversible neurological deficits [5,6].

The primary surgical goal is to prevent neurological worsening, and functional recovery depends on the degree and duration of pre-existing cord injury. Choice between anterior and posterior approaches must consider anatomical and clinical factors: compression site, disease extent, sagittal alignment, bone quality, and presence of calcified structures or soft disc herniations [7,8].

Multicenter studies suggest long-term efficacy is similar between anterior and posterior approaches when specific anatomical indications are respected [3,6]. Decision-making should be guided by technical safety and feasibility of complete decompression. In multilevel cases with preserved alignment, posterior approach is preferred, especially with significant ossification. In cases with soft disc herniation and anterior compression at one or two levels, anterior approach offers advantages like lower postoperative pain and faster recovery [6,10].

Bone quality (e.g., osteoporosis) must be evaluated to avoid instrumentation failure, particularly in posterior fusions. Though technically demanding in some situations, the anterior approach may be preferable in osteoporotic patients due to less need for robust fixation [9,11].

Intraoperative monitoring, as seen in Case 2, is valuable: evoked potential changes indicated immediate spinal cord distress, quickly reversed with decompression, highlighting severity of stenosis and the benefit of proactive management [12].



This study reinforces the importance of tailoring the surgical strategy to the patient's specific anatomy, systemic conditions, comorbidities, surgeon expertise, and available resources.

## Conclusion

The choice of surgical approach in cervical myelopathy should always be individualized, considering anatomical, pathological, and systemic factors. Although literature shows that both anterior and posterior approaches yield similar neurological outcomes long-term, details such as compression type and location, spinal alignment, comorbidities, and technical feasibility are decisive.

In this case series, posterior approach was preferred in multilevel stenosis with ossified structures and preserved alignment, usually with associated fusion. Anterior approach was indicated for soft disc herniations and in cases where it provided safer and more direct access for spinal cord decompression.

## Conflict of Interest

The authors have no conflict of interests to declare.

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