



# Posterolateral Approach for Recurrent Multi-Level Ventral Intradural Extramedullary Cervical Spinal Meningioma

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## ABSTRACT

Spinal meningiomas are common intradural spinal tumors. Recurrent multilevel ventral intradural extramedullary spinal meningiomas, especially those presenting several years post-initial surgery is rare and can be particularly challenging to treat. We report two cases of such recurrent multilevel ventral tumors manifesting 7 and 20 years after the initial procedure. These patients were effectively managed through a posterolateral approach, encompassing laminectomy, facetectomy, division of dentate ligament with spinal cord rotation, and instrumented fusion. While the choice of surgical approach should be individualized based on the tumor and patient's characteristics and the surgeon's expertise, our experience with these cases continues to show the safety and efficacy of posterior-based approaches highlighting the additional and important surgical modifications for multilevel recurrent ventral intradural meningiomas.

**KEYWORDS:** Anterior approach, Intradural, Meningioma, Posterior approach, Spine, Surgery, Ventral

**ABBREVIATIONS:** CSF: Cerebrospinal Fluid, IDEM: intradural extramedullary, MRC: Medical Research Council, MRI: Magnetic resonance imaging

## INTRODUCTION

Meningiomas are benign, slow-growing tumors that account for 25% to 45% of all intradural extramedullary (IDEM) spinal tumors (9). Surgical resection remains the preferred treatment for patients with symptomatic IDEM meningiomas. The overall incidence of recurrence or progression of spinal meningiomas varies between studies, ranging from 0% to 17% (5). These tumors typically recur after a long period, often up to 12 years post-resection (5,10). The surgical approach for resecting an IDEM spinal meningioma depends on the tumor's location and dural attachment. There is a growing consensus that posterior-based approaches for resecting spinal meningiomas are safe and effective, regardless of the dural attachment location (5). However, when the tumor spreads en plaque over multiple levels without significantly displacing the spinal cord, a posterior approach, par-

ticularly a laminectomy, can be challenging due to the limited ability to retract the spinal cord (5-7,10). This report presents two rare cases of recurrent en-plaque multilevel ventral meningiomas that occurred 7 and 20 years after the initial surgery. These tumors were located truly ventral to the spinal cord and were treated using a posterolateral approach.

The authors obtained written informed consents from the patients included in the manuscript.

## CASE REPORT

### Case 1

A 73-year-old woman underwent a posterior cervical laminectomy over 20 years ago for resection of a ventral IDEM grade I meningioma (Figures 1A–C). She presented with chronic neck pain, slowly progressive left upper extremity weakness, and

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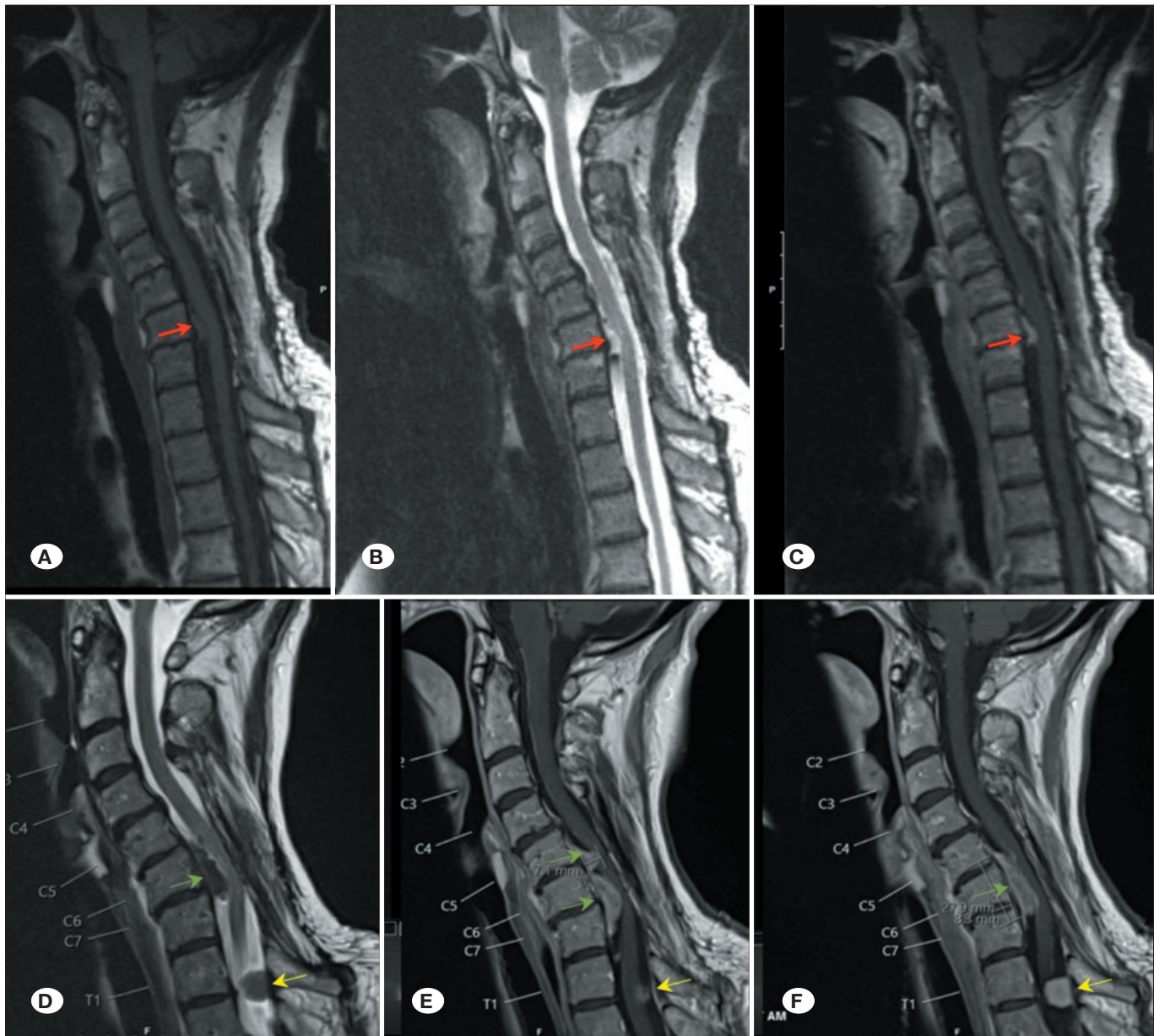
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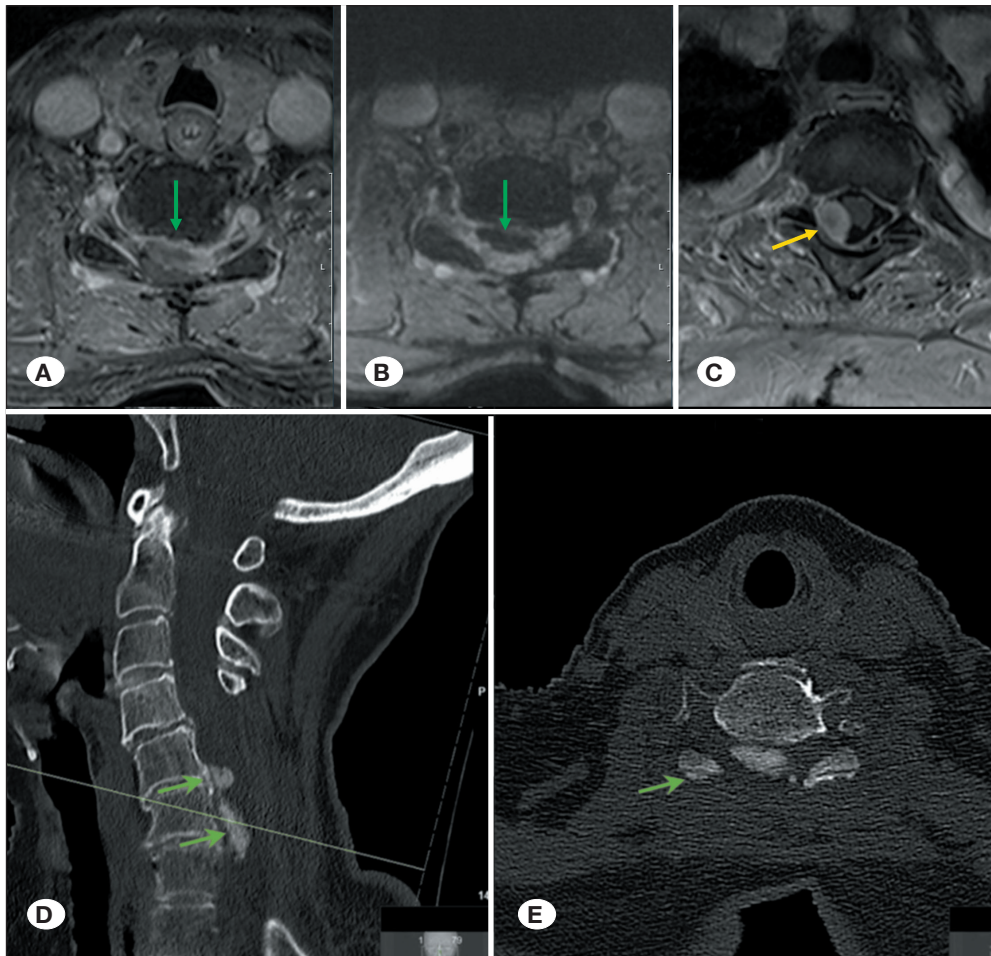
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numbness in the right upper and lower extremities, accompanied by gait imbalance over several years—consistent with cervical myelopathy. On clinical examination, motor strength was largely intact, except for mild weakness in the left upper extremity (UE) graded as 4+/5 on the Medical Research Council (MRC) scale. Hyperesthesia was present in the right upper and lower extremities. Magnetic resonance imaging (MRI) of the cervical spine at presentation to us revealed a long-segment ventral IDEM meningioma (Figures 1D–F, 2A, B) and a new right-sided posterior T1–T2 meningioma (Figure 2C). Computed tomography (CT) confirmed calcifica-

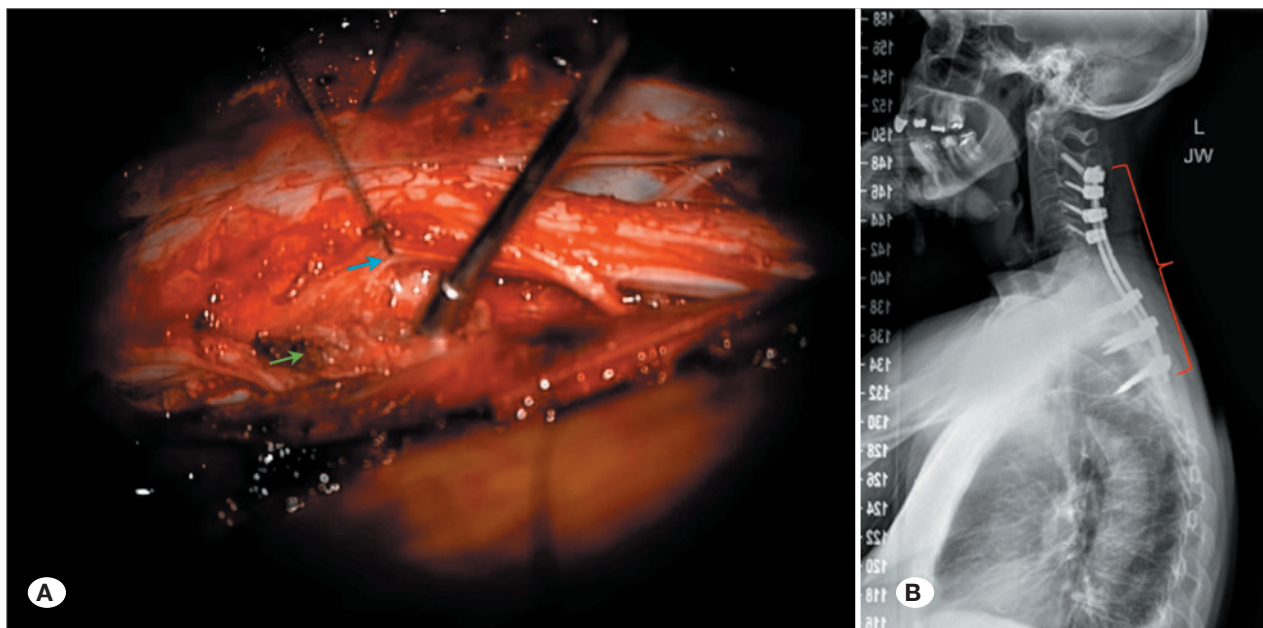
tion of the ventral meningioma (Figures 2D, E). A C4–C7 and T1–T2 laminectomy was performed with complete C5/6 and C6/7 facetectomy and C2–T3 posterolateral arthrodesis and instrumented fusion (Figure 3B). Intraoperative monitoring was performed using motor and sensory evoked potentials that remained stable throughout the procedure. Upon dural opening, the ventral meningioma was not immediately visible as it was anterior to the spinal cord. Division of the dentate ligaments facilitated spinal cord rotation (Figure 3A), and the combination of complete facetectomy and ligament division allowed for excellent tumor exposure without spinal cord re-



**Figure 1:** Sagittal T1W (A), T2W (B), T1W with contrast (C) magnetic resonance imaging (MRIs) after first surgery showing minimal residual tumor ventrally along the spinal canal, marked with red arrows. Sagittal T2W (D) and T1W with contrast MRIs (E and F) showing significant growth of the ventral meningioma in an en plaque fashion, marked with green arrows, causing spinal cord compression and interval development of a new tumor at T1–2 level, marked with yellow arrows.



**Figure 2:** Axial magnetic resonance imaging (MRIs) with contrast (**A & C**) and axial T2W MRI (**B**) showing both the cervical ventral tumor (**A and B**), marked with green arrows, and the dorsolateral right T1-2 tumor, marked with a yellow arrow. Sagittal (**D**) and axial (**E**) Computed tomography images showing the calcified nature of the ventral tumor, marked with green arrows.



**Figure 3:** Intraoperative image (**A**) showing the use of a suture through the dentate ligament, marked with a blue arrow, and rotation of the spinal cord, allowing excellent visualization of the ventral tumor, marked with a green arrow, after a complete facetectomy. Post-operative X-ray (**B**) showing C2 to T2 instrumented fusion, highlighted with a red bracket, and good restoration of lordosis.

traction. Postoperatively, the patient exhibited new-onset left upper extremity weakness (2/5 strength on the MRC scale) and was discharged to a skilled nursing facility. A one-year postoperative MRI showed a well-decompressed spinal cord with no significant residual or recurrent tumor (Figure 4). Her preoperative numbness improved, and motor strength in the left upper extremity improved to 4/5, with a left-hand grip at approximately 50% of normal. Ambulation also improved. Given the pathology-confirmed grade I meningioma, adjuvant therapy was not required, and she remains under radiological surveillance with her oncologist per institutional protocol.

## Case 2

A 59-year-old woman underwent posterior cervical C4-C6 laminoplasty seven years ago for a C5-C6 ventral IDEM grade I meningioma. Her initial post-operative MRI showed gross total resection of the dural-based mass with minimal dural enhancement (Figures 5A, B). Seven years post-surgery, she presented with right arm weakness and numbness, left leg numbness, instability, and recurrent falls. Physical examination revealed bilateral Hoffmann's sign, hyperreflexia at both the knees and ankles, and a motor strength of 4/5 across all muscle groups in the right upper extremity with a positive Romberg's test consistent with a diagnosis of cervical myelopathy. MRI confirmed tumor recurrence (Figure 5C). A redo C3-C7 laminectomy with complete C4/5 and C5/6 facetectomy was performed, achieving gross total resection of the ventral IDEM tumor, followed by C2-T1 instrumented fusion. Intraoperative motor and sensory evoked potentials remained stable throughout the procedure. Her postoperative course was uneventful, and she was discharged home on postoperative day three. Neurologically, she remained at baseline with no further motor deficits and improved gait balance. A six-week postoperative MRI showed no residual tumor but revealed a cerebrospinal fluid (CSF) pseudomeningocele, which was managed conservatively given its asymptomatic nature (Figures 5D, E). Considering her young age, the complexities of additional surgery, and her previous recurrence, adjuvant

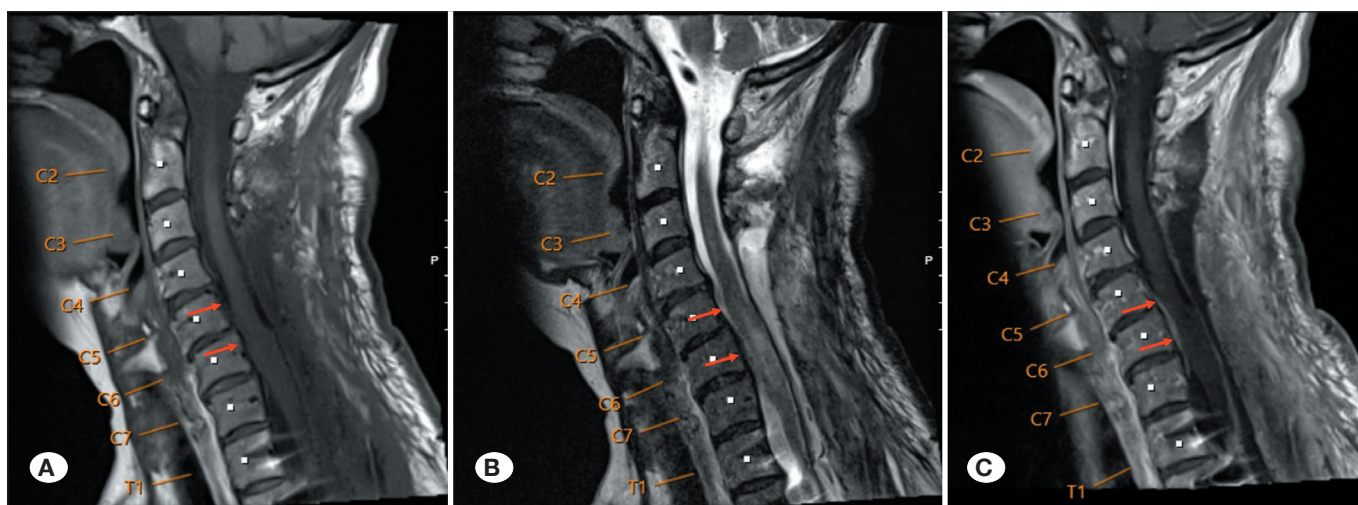
radiation therapy was recommended due to persistent dural enhancement and potential risk of further recurrence, despite pathology confirming grade I meningioma. At one-year post-surgery, she continues to do well, with a stable neurological exam and no significant tumor recurrence.

## DISCUSSION

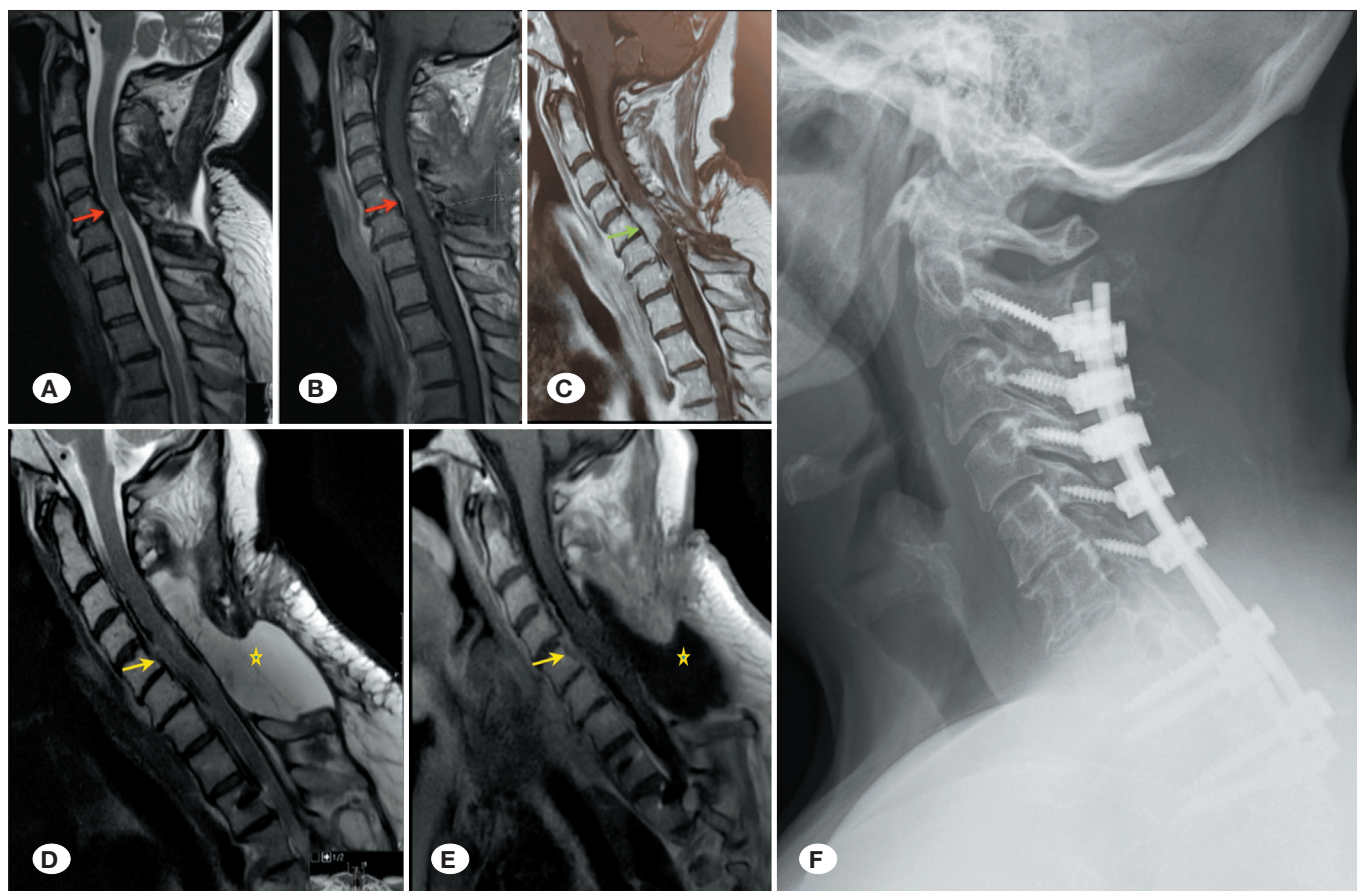
Subtotal resection has been reported as a risk factor for recurrence after surgery for IDEM meningioma, emphasizing the importance of complete resection (5). Due to concerns regarding posterior-based approaches for resecting more ventrally located tumors, some surgeons have described anterior approaches because of their direct and excellent view of the anteriorly based tumor (1,4,6,8,11). However, the depth of the operative field, the need for posterior instrumentation after a multilevel corpectomy, and the increased risk of cerebrospinal fluid leak-related complications negate any purported advantages of an anterior approach (1,4,8,11). One of the arguments against the posterior-based approach for ventral meningiomas is the inability to resect the involved dura. However, given that there is no difference in recurrence rates between patients who underwent Simpson grade I and II resections, this concern appears debatable (5).

The management of recurrent IDEM meningiomas is uniquely challenging. Risk factors for recurrent spinal meningiomas include subtotal resection, higher pathological grade, calcification, and ventral location (8). Re-resection of recurrent spinal meningiomas is complicated by adhesions from previous surgery, spinal cord tethering, lack of an arachnoidal plane between the tumor and spinal cord, and in extreme cases, pia infiltration (8).

The surgical approach to ventral IDEM meningiomas, especially recurrent ones, has not been well established. A direct posterior resection poses many challenges, such as spinal cord retraction and significant scarring, due to the ventral location of these tumors. While an anterior approach may be



**Figure 4:** Post-operative sagittal T1W (A), T2W (B), T1W (C) with contrast magnetic resonance imaging (MRIs) one year after surgery showing a well-decompressed spinal cord with no evidence of any significant residual or recurrent tumor. Original position of tumor is marked by red arrows.



**Figure 5:** Sagittal T2W (A), and T1W with contrast (B) magnetic resonance imagings (MRIs) two years after first surgery showing a gross total resection of the dural-based mass with minimal dural enhancement, marked with red arrows. Sagittal T1W MRI (C) at presentation to us 7 years after initial surgery showing an avidly enhancing, ventral, en-plaque type of meningioma in the spinal canal, extending from C3-C6, causing severe spinal cord compression, marked with green arrow. Post-operatives sagittal T2W (D) and T1W with contrast (E) MRI 6 weeks after surgery showing a well- decompressed spinal cord with no evidence of any significant residual/recurrent tumor but with minimal ventral dural enhancement, marked with yellow arrows. There is evidence of CSF pseudomeningocele (yellow star) in the images D and E. Post-operative lateral X-ray (F) showing C2 to T2 instrumented fusion with well aligned spine.

enticing to avoid the scarred field, the multilevel nature of the recurrent tumor would mandate multilevel corpectomy, along with posterior instrumentation and fusion for spine stabilization. The extensive nature of the surgery associated with an anterior approach increases the risk of worsening morbidity, especially swallowing-related complications, which can be accentuated in elderly patients (1,4,8,11).

The posterolateral approach with complete facetectomy and division of the dentate ligaments allows for rotation of the spinal cord, overcoming the challenges posed by the simple posterior and ventral approaches. This approach offers the best visualization of the tumor while limiting the complications of an extensive anterior surgical resection. Additionally, due to the angle of the approach, the spinal cord rotation required to expose the tumor margins is minimized, mitigating the risks of spinal cord injury (11). Eroglu et al. reported their experience with posterior-based approaches for ventral cervical meningi-

omas in six cases where they were able to resect the tumor without concomitant fusion (3). However, none of the tumors were recurrent, and they were large with significant posterior and lateral displacement of the spinal cord, where a posterior approach would be the procedure of choice and would not even mandate a fusion, which is clearly different from the cases described here. Also, Cristaldi et al. reported a posterolateral transpedicular approach for ventrally seated cervicothoracic spinal cord lesions (2). However, the posterolateral approach for thoracic and cervicothoracic lesions is well-described and would again be preferred for intradural lesions in that region, given the complexity of any anterior approach in that area. The presented cases demonstrate the role of a posterolateral-based approach for multilevel recurrent IDDM tumors entirely within the cervical spine. They also highlight the importance of long-term follow-up, both radiological and clinical, given that the recurrence occurred after gross total resection 7 years and nearly 20 years after the initial surgery.

## CONCLUSION

In conclusion, the management of recurrent ventral intradural meningiomas especially if multilevel can pose a significant challenge. The posterolateral approach with complete facetectomy along with division of the dentate ligaments as demonstrated in our cases is an excellent technique to resect these multilevel recurrent tumors with minimal morbidity. While the choice of surgical approach should be individualized based on the tumor and patient characteristics and surgeon expertise, the cases described here support the role of posterior-based approaches with some modifications as described for recurrent ventral spinal meningiomas.

### Declarations

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**Availability of data and materials:** The datasets generated and/or analyzed during the current study are available from the corresponding author by reasonable request.

**Disclosure:** The authors declare no competing interests.

### AUTHORSHIP CONTRIBUTION

Study conception and design: MKK

Data collection: VS

Analysis and interpretation of results: AK

Draft manuscript preparation: VS

Critical revision of the article: MP

Other (study supervision, fundings, materials, etc...): MKK

All authors (VS, AK, MP, MKK) reviewed the results and approved the final version of the manuscript.

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