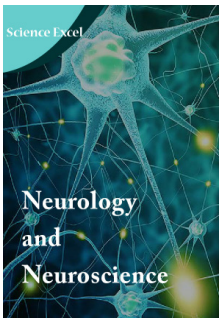
Neurology & Neuroscience

Case Report



Posterior Approach for Upper Cervical Schwannomas (C1–C2): Two Case Reports and Literature Review

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Abstract

Upper cervical schwannomas at the C1–C2 level are rare and present surgical challenges due to the complex anatomy and proximity to critical neurovascular structures. We present two cases of schwannomas located at the C1–C2 junction treated via a posterior approach. In the first case, a 75-year-old female underwent laminectomy, and in the second, a woman in her 30s underwent laminoplasty. Both surgeries achieved gross total resection with favorable neurological outcomes. We discuss the rationale for the surgical approach, the importance of preserving spinal stability, and the role of individualized decision-making in managing these rare tumors.

Introduction

Schwannomas of the upper cervical spine, particularly at the craniocervical junction (C1–C2), are rare and present substantial surgical challenges due to the complex anatomy and proximity to critical neurovascular structures such as the vertebral artery, spinal cord, and upper cervical nerve roots [1,2]. These slow-growing benign tumors originate from Schwann cells and may cause progressive symptoms, including cervical pain, myelopathy, and sensory or motor deficits depending on their size and location [3].

Surgical resection remains the mainstay of treatment, aiming for complete tumor removal and preservation of neurological function. The choice of surgical approach—anterior, posterior, or combined—should be based on anatomical factors, patient age, presence of spinal instability, and tumor morphology [4,5]. The posterior approach is often preferred when the tumor is predominantly dorsal or lateral to the spinal cord, allowing direct access with minimal neural manipulation [6].

Despite its utility, the literature on the surgical management of C1–C2 schwannomas remains limited and largely consists of isolated case series. This article presents two cases treated via posterior approach—one by laminectomy and the other by laminoplasty—highlighting the criteria used in choosing the technique, biomechanical implications, and clinical outcomes.

Objective

To describe the surgical management of two cases of upper cervical schwannomas using a posterior approach and to analyze the rationale for choosing laminectomy versus laminoplasty, discussing implications for spinal alignment and postoperative stability.

Case Reports

Case 1

A 75-year-old hypertensive female presented with progressive weakness in all limbs and reduced gait endurance. MRI revealed a C1–C2 schwannoma with severe spinal cord compression (Figure 1).

Posterior laminectomy was performed with gross total resection. No signs of instability or kyphosis were observed, and fusion was not required. Postoperative recovery was uneventful, with complete neurological resolution (Figures 2, 3 and 4).

Case 2

A healthy 30-year-old woman presented with acute paraparesis and rapidly worsening symptoms. MRI confirmed a left-sided C1–C2 schwannoma. A posterior laminoplasty was chosen due to the patient's age, allowing tumor resection while preserving posterior elements (Figures 5, 6, 7 and 8). The patient made a full recovery and was discharged on postoperative day 3.

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Figure 1. *Sagittal T2-weighted MRI of the cervical spine. An expansive intradural extramedullary lesion at the C1–C2 junction is indicated by the blue arrow, with features consistent with schwannoma. The lesion is well-defined and heterogeneously hyperintense on T2, causing anterior spinal cord compression and significant reduction in perimedullary cerebrospinal fluid space, with no apparent osseous invasion. The cord is compressed but partially preserved in morphology. These findings are consistent with an upper cervical schwannoma, likely arising from the C2 nerve root, with significant compressive effect on the spinal cord.*

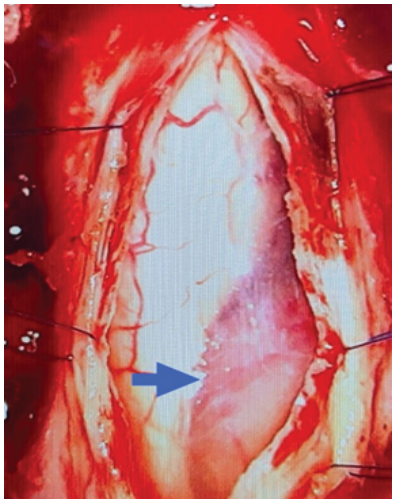

Figure 2. Intraoperative image showing posterior cervical exposure after laminectomy. The blue arrow points to a violaceous, round, well-demarcated lesion visible through the opened dura mater, located lateral to the spinal cord. This formation is consistent with an intradural extramedullary schwannoma at C1–C2, originating likely from a cervical nerve root and causing medial spinal cord displacement.

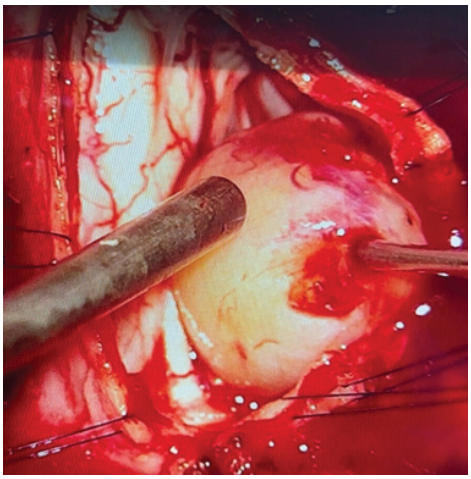

Figure 3. *The tumor is shown being carefully dissected and mobilized using microsurgical instruments. The lesion appears rounded, with a smooth surface and pinkish-yellow coloration, consistent with schwannoma, and shows superficial vascularization.*

Figure 4. *The image shows a sagittal T2-weighted MRI of the cervical spine in the postoperative period following resection of a schwannoma at the C1–C2 junction. The blue arrow indicates the region previously affected by the tumor. There is no evidence of the previously present extramedullary mass, and re-expansion of the anterior and posterior perimedullary cerebrospinal fluid space is observed, indicating relief of spinal cord compression.*

Discussion

Surgical resection of upper cervical schwannomas remains technically challenging due to the intricate anatomy of the craniocervical junction. The posterior approach offers direct access to the lesion with minimal traction on neural structures and is often preferred when the tumor is dorsolateral to the spinal cord [6,7]. In both cases, the posterior route allowed for extensive tumor exposure and gross total resection while preserving segmental stability.

The decision between laminectomy and laminoplasty should consider patient age, cervical alignment, and the risk of postoperative deformity. Laminectomy, as performed in the older patient, has shown favorable outcomes when cervical lordosis is preserved and there are no signs of instability or facet joint degeneration [8]. Laminoplasty, on the other hand, is preferable in younger patients with a longer functional lifespan, as it preserves posterior structures and reduces the risk of decompression-induced kyphosis [9,10].

Biomechanically, preserving the facet joints is crucial for maintaining postoperative spinal stability [11]. In both cases, the tumors expanded the interlaminar space, facilitating surgical access without requiring facetectomy or fusion. This supports previous data suggesting that fusion can be avoided in patients with good preoperative alignment without increasing the risk of instability [12].

Recent studies reinforce that fusion should not be routinely indicated after laminectomy or laminoplasty for cervical schwannomas, except in cases with clear instability, pre-existing

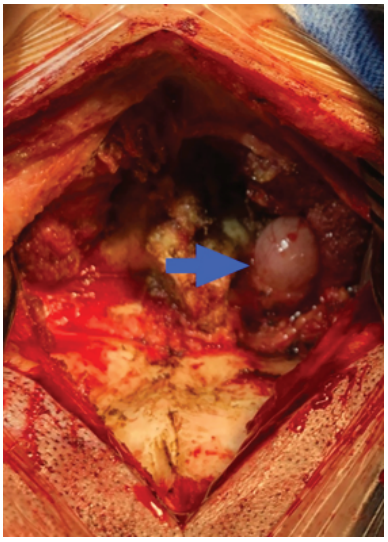

Figure 5. *Intraoperative image of posterior approach to the craniocervical junction (C1–C2), showing an encapsulated, translucent pink lesion with a smooth surface, emerging laterally from the exposed vertebral canal after removal of C1 and C2 laminae. The tumor is partially dissected, consistent with a cervical schwannoma.*

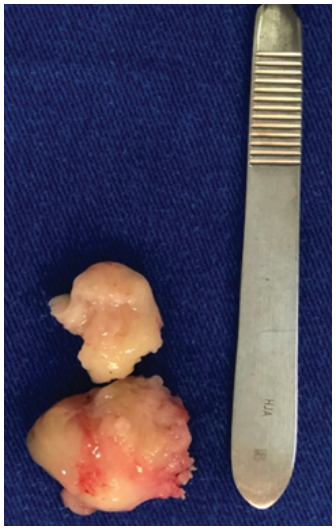

Figure 6. *The completely resected tumor specimen is shown beside a metallic scalpel handle for scale reference. The lesion appears nodular, with regular margins and a pink-yellow color, confirming macroscopic total resection.*

Figure 7. *The image shows a sagittal T2-weighted MRI of the cervical spine, demonstrating postoperative follow-up of a case of upper cervical schwannoma (C1–C2 level). The blue arrow points to the area previously occupied by the tumor. There is no evidence of the expansive lesion, with adequate re-expansion of the anterior and posterior perimedullary cerebrospinal fluid space, indicating effective spinal cord decompression.*

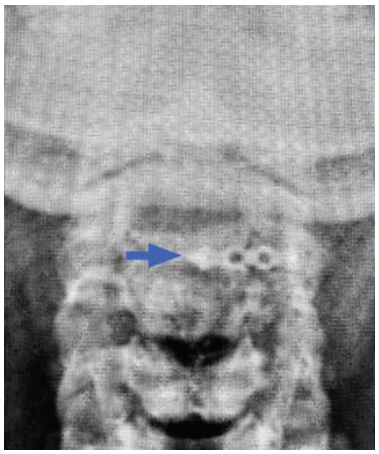

Figure 8. *Anterior-posterior radiographic (X-ray) image of the craniovertebral junction showing the presence of a symmetric metallic element (blue arrow), consistent with miniplates used in laminoplasty. The integrity and symmetry of the structures indicate proper implant positioning, with no evidence of misalignment or instability in this projection.*

deformity, or the need for extensive joint resection [13,14]. Long-term clinical and radiological follow-up remains essential to detect delayed kyphosis or spinal misalignment.

These two cases highlight the importance of personalized surgical planning based on anatomical factors, patient age, and alignment, reinforcing that decompression without fusion can be a safe and effective approach for selected patients with upper cervical schwannomas.

Conclusion

Posterior laminectomy and laminoplasty are effective options for resecting upper cervical schwannomas, with favorable neurological and surgical safety outcomes. The choice between laminectomy and laminoplasty should be tailored to patient age, spinal alignment, and the risk of postoperative instability. Laminoplasty may offer long-term benefits in preserving spinal integrity in younger patients, while laminectomy may suffice in older individuals with preserved lordosis and no radiographic signs of instability. Notably, neither case required fusion, as total resection was achieved without compromising facet joints, which were preserved due to the naturally expanded surgical corridor.

Continuous follow-up is essential to monitor for potential delayed kyphosis or spinal misalignment. Our findings support considering decompression without fusion in selected patients, reinforcing the need for a case-by-case approach in upper cervical tumor surgery.

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