Skip Laminectomy and Removal of Multiple Spinal Tumors (Schwannomas) at Different Spinal Level with Correction of Listhesis, Surgical Technique & Technical Notes

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ABSTRACT

Background: Spinal schwannomas are benign nerve sheath tumors that commonly arise from dorsal sensory roots and may present as solitary or multiple lesions. Multilevel involvement and associated spinal instability, such as listhesis, pose significant surgical challenges. Conventional multilevel laminectomy may achieve tumor excision but is associated with postoperative instability and deformity. Skip laminectomy combined with spinal instrumentation offers a motion-preserving alternative while enabling complete tumor removal and stabilization. **Methods:** We report a single-stage surgical approach combining skip laminectomy for multilevel tumor excision with instrumented stabilization for associated L5–S1 listhesis. A 46-year-old male presented with long-standing urinary incontinence, progressive lower limb weakness, and gait disturbance. MRI revealed multiple intradural extramedullary lesions at D12, L1, L3, and L5 levels consistent with schwannomas, along with L5–S1 listhesis. The patient underwent L5 laminectomy with pedicle screw fixation and rod placement followed by skip laminectomy for multilevel tumor excision in the same operative session. **Results:** Complete excision of all lesions was achieved without intraoperative or postoperative neurological deterioration. The patient had an uneventful recovery with stable neurological status, adequate pain control, and early mobilization. Postoperative MRI confirmed complete tumor removal and satisfactory spinal alignment with instrumentation. Histopathology confirmed schwannoma without malignant transformation. No complications such as cerebrospinal fluid leakage, infection, or implant failure were observed during early follow-up. **Conclusion:** Skip laminectomy combined with single-stage multilevel schwannoma excision and spinal stabilization is a feasible and safe surgical option in selected patients, allowing effective tumor removal and correction of instability with favorable early outcomes.

Keywords: Schwannoma, skip laminectomy, spinal tumor, listhesis, multilevel surgery

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INTRODUCTION

Schwannomas are prevalent tumors of the peripheral nerve sheath that consist mostly of Schwann cells. Associated tumors encompass neurofibromas, perineuriomas, granular cell tumors, and malignant peripheral nerve sheath tumors [1,2]. Thay are harmless nerve sheath tumors (25–30% of spinal tumors) that typically develop from dorsal sensory roots and lead to pain, radiculopathy, or neurological impairments due to compression [3].

Complete surgical removal is the favored approach for symptomatic spinal schwannomas. While laminectomy provides excellent visibility, extensive or multilevel resections can lead to instability,

deformity, muscle damage, chronic pain, and may necessitate spinal stabilization [4,5]. Many spinal schwannomas, typically observed in schwannomatosis, affect various levels and nerve roots. Multilevel laminectomy heightens the risk of instability; therefore, contemporary surgical techniques emphasize minimal bone resection while ensuring complete removal [6]. Minimally invasive techniques like hemilaminectomy, laminotomy, tubular retractor–assisted surgery, and unilateral laminectomy reach similar gross total resection outcomes to traditional laminectomy while minimizing tissue damage, blood loss, and postoperative instability, and enhancing spinal stability preservation [4,6].

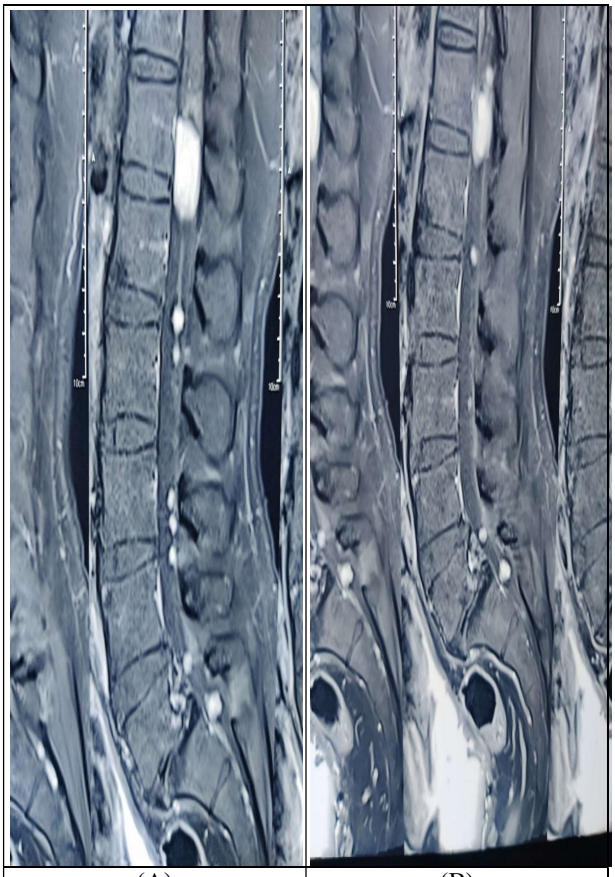
Selective or focused laminectomy can accomplish complete removal of long-segment schwannomas while maintaining spinal stability. When associated with spondylolisthesis, surgery must tackle instability as well; however, reports of single-stage skip laminectomy with fixation are uncommon [7,8].

This technical note outlines the surgical method of skip laminectomy for excising multiple spinal schwannomas situated at various spinal levels, along with concurrent correction of related listhesis. We emphasize the operational planning, microsurgical details, stabilization approach, and technical factors that enable total tumor removal while reducing surgical morbidity and maintaining spinal stability.

CASE PRESENTATION

A 45-year-old male patient, presented with a long-standing history of progressive neurological and urological symptoms. He had a 9-year history of urinary incontinence, initially of urge type, which gradually progressed to continuous dribbling over the last one year. He also complained of chronic low back pain for approximately 7 years, insidious in onset, mild in intensity, and not associated with any specific aggravating or relieving factors.

Over the last one year, the patient developed progressive weakness and wasting of both lower limbs (left more than right), along with difficulty in ambulation. He also noticed left foot drop for the last 6 months. On neurological examination, higher mental functions were intact and cranial nerves were normal. Lower limb examination revealed reduced muscle bulk bilaterally, normal tone, and muscle power of 4/5 in both lower limbs. Deep tendon reflexes were diminished at the ankles bilaterally, while the left knee jerk was exaggerated. Plantar responses were flexor bilaterally, and sensory examination was intact across all modalities. Gait was high-stepping in nature. No obvious spinal deformity or local tenderness was noted on examination.



(A)	(B)

Fig 1: A & B are pre operative MRI

Magnetic resonance imaging (MRI) of the spine revealed multiple intradural extramedullary lesions at D12, L1, L3, and L5 levels, suggestive of spinal nerve sheath tumors (schwannomas), along with associated L5–S1 listhesis (Figure 1).

Fig 1: Preoperative MRI of the whole spine showing multiple well-defined intradural extramedullary lesions at D12, L1, L3, and L5 levels consistent with spinal schwannomas. Associated L5–S1 spondylolisthesis is also noted, contributing to spinal instability. The patient subsequently underwent L5 laminectomy with transpedicular screw fixation and skip laminectomy for multilevel tumor excision in a single sitting. Intraoperatively, multiple well-encapsulated tumors were identified arising from nerve roots and were carefully dissected and completely excised without neurological injury.

SURGICAL TECHNIQUE

The patient was positioned prone under general anesthesia on a Hall frame with appropriate padding and abdominal free-hanging to reduce epidural

venous pressure. A standard posterior midline approach was used. Paraspinal muscles were dissected subperiosteally to expose posterior spinal elements. Level confirmation was performed using fluoroscopy.

Step 1: Stabilization Phase

L5 laminectomy was performed first to decompress the S1 nerve root. Pedicle screw fixation was applied at L5–S1, followed by rod placement, achieving reduction of listhesis and spinal stabilization.

Step 2: Skip Laminectomy and Tumor Excision

Skip laminectomy was performed at D12, L1, L3, and L5 levels. After dural exposure, the dura was opened at each level. Multiple well-encapsulated intradural extramedullary tumors were identified arising from nerve roots. Gross total excision was achieved with meticulous microsurgical dissection while preserving neural structures.

Step 3: Dural and Wound Closure

Watertight dural closure was achieved using continuous suturing and confirmed with Valsalva maneuver. Layered closure of muscle, fascia, subcutaneous tissue, and skin was performed over a drain.

Fig 2

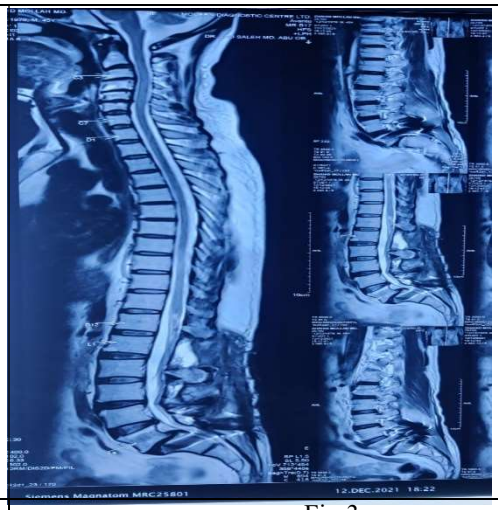


Fig 3

RESULTS

The postoperative course was uneventful. No new neurological deficits were observed. Motor and sensory functions remained stable compared to preoperative status. Pain control was adequate.

The surgical drain was removed on postoperative day 1. The patient was mobilized gradually with spinal support and discharged on postoperative day 4 in stable condition.At early follow-up (5 days), wound healing was satisfactory with no cerebrospinal fluid leakage or infection. Neurological status remained stable.

Fig 2: Per operative picture of skip laminectomies with transpedicular fixation at L5-S1 vertebra. Fig 3: Postoperative MRI showing complete excision of intradural extramedullary lesions with adequate decompression and spinal alignment following instrumentation. Histopathological examination confirming schwannoma with no evidence of malignant transformation.

Postoperative histopathological examination of the excised specimen (measuring approximately 2.0 × 1.5 × 1.0 cm, irregular grey-white tissue fragments) revealed features consistent with schwannoma. Microscopic examination showed typical Schwann cell tumor morphology with no evidence of granuloma or malignant transformation. No immediate complications such as wound infection, implant failure, or neurological deterioration were observed.

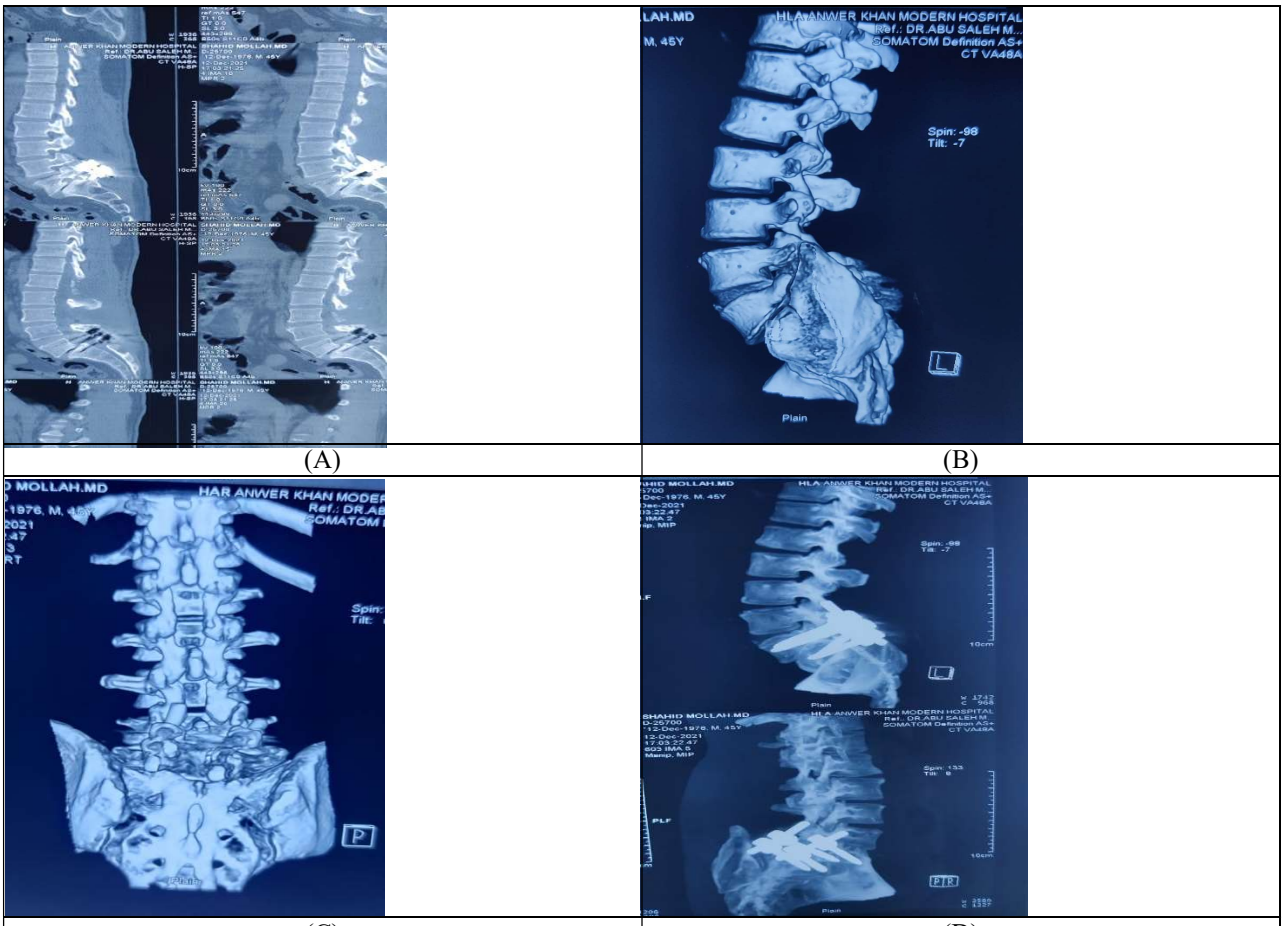


Fig 4: A, B, C & D

Fig 4: A, B, C & D are post operative CT scan of Lumbosacral spine with 3D reconstruction shows skip laminectomy at multiple level with transpedicular fixation at L5-S1 level.

Fig 5: Completely removed Schwannomas from all levels.

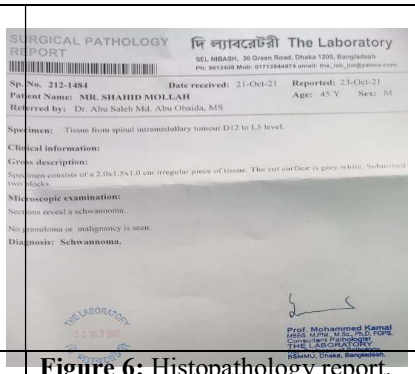


Figure 6: Histopathology report.

DISCUSSION

In our study, the patient had a total removal of an intradural extramedullary schwannoma with the use of instrumentation. After surgery, the patient experienced a smooth recovery with consistent neurological status, no new deficits, proper wound healing, and no signs of cerebrospinal fluid leakage, infection, or complications related to the implant. Initial follow-up MRI verified total tumor excision with adequate decompression, and histopathological analysis confirmed schwannoma without any malignant transformation.

These results align with existing literature that advocates for microsurgical complete removal as the definitive approach for spinal schwannomas. Dobran

et al. found that both laminectomy and hemilaminectomy result in high rates of total tumor excision; nonetheless, hemilaminectomy involves less tissue damage and superior maintenance of spinal stability [9]. In their surgical series, Fernandes et al. also showed that safely achieving complete excision of spinal nerve sheath tumors can result in low morbidity and outstanding neurological outcomes when careful microsurgical techniques are applied [10].

Additionally, Liao et al., in a substantial group of patients, showed that hemilaminectomy provides benefits like decreased blood loss, shorter hospitalization, and fewer complications compared to more extensive laminectomy, while maintaining the level of resection [11]. In general, our case is consistent with these studies, supporting the idea that minimally invasive posterior techniques enable efficient and safe removal of spinal schwannomas with positive functional results.

CONCLUSION

Skip laminectomy combined with simultaneous multilevel schwannoma excision and instrumented stabilization is a safe and effective technique in selected patients. It allows complete tumor removal and correction of spinal instability in a single operative session with favorable early outcomes.

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