Surgical Management of a Giant Sciatic Nerve Schwannoma: A Nerve-Sparing Approach

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Abstract

Schwannomas are slow-growing benign tumors arising from Schwann cells, predominantly occurring in the head and neck region. However, extremity schwannomas are rare, occurring in about only 1% of cases. The majority of these tumors are usually smaller, measuring less than 5 cm; however, larger tumors are termed "giant schwannomas." We report a case of giant schwannoma of the lower limb successfully managed with nerve-sparing surgical excision.

A 48-year-old female presented with a 9 × 6 cm well-defined swelling, firm, smooth on the posterolateral aspect of the left thigh, with tingling and numbness in the left lower limb. In contrast, in magnetic resonance imaging (MRI), the tumor was fusiform, a large, well-defined, heterogeneous enhancing lesion measuring approximately 8.7*6.5*4.8 cm (CC*TS*AP) with areas of hemorrhage in the posterior aspect of the left lower thigh arising from the sciatic nerve, causing displacement of adjacent muscles without infiltrating or invading the surrounding muscle/bone. Excision biopsy was done and confirmed as a schwannoma. The postoperative course was uneventful without neurological deficit.

Schwannomas are the most common peripheral nerve sheath tumors, which are slow-growing and predominantly located in the head and neck region. Lower extremity localization is rare; however, if present, the maximum diameter is 5 cm as reported in most cases. Clinical presentation may range from asymptomatic to compressive symptoms, sometimes unspecific and unclear symptoms. Radiological evaluation using ultrasound and MRI plays a crucial role in diagnosing these tumors, accurately determining the origin of the lesion, and assessing the surrounding tissue involvement. The recommended treatment is surgical excision/enucleation without causing damage to the involved nerve.

Keywords

- Schwann cells
- giant schwannoma
- Antoni A
- Antoni B
- sciatic nerve
- ultrasound
- MRI
- enucleation

Introduction

Schwannomas are benign tumors originating from Schwann cells of the peripheral nerve sheath, encapsulated by epineurium. These tumors are predominantly localized to the head and neck region, most commonly presenting at the cerebellopontine angle as an acoustic neuroma of cranial nerve (CN) VIII. Other CNs may also be involved. However, lower limb schwannoma is extremely rare, comprising approximately 1% of cases. Differentials include ganglion cyst, Morton's neuroma, lipoma, or vascular malformation, making diagnosis difficult at the initial stage. Due to the slow

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growth of the tumor, most of the cases are asymptomatic, but large tumors might cause compressive symptoms. Ultrasound and magnetic resonance imaging (MRI) are useful in diagnosing these tumors. Complete enucleation of the tumor with careful intraoperative dissection to prevent damage to the involved nerve results in good outcomes.[1,2]

We report a rare case of a large sciatic nerve schwannoma in a 48-year-old female, successfully managed with nerve-sparing surgical excision.

Case Presentation

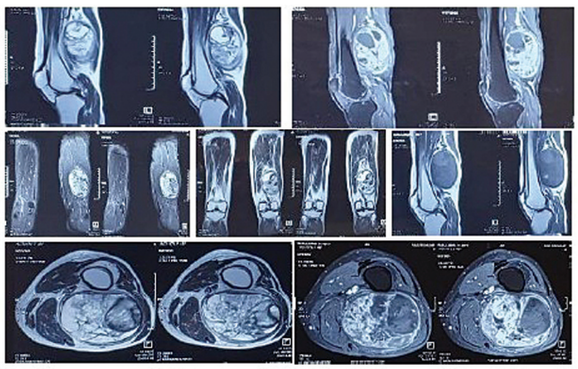
A 48-year-old female presented to our outpatient department with a complaint of a solitary swelling on the posterior aspect of her left thigh for the past 15 years. The swelling had gradually increased in size and was associated with a dragging sensation, tingling, and numbness in the left lower limb. The patient had no difficulty walking. Medical, surgical, and family histories were unremarkable.

On examination, a firm, smooth, well-defined swelling measuring approximately 9×6 cm was palpable in the posterior thigh extending from the mid-thigh to the knee region. The mass was mobile perpendicular to the nerve axis, nontender, and without signs of inflammation. Knee and ankle joint movements were normal, with preserved power and intact neurovascular status.

MRI of the left thigh revealed a well-defined fusiform, eccentric, T1 isointense, and T2/short tau inversion recovery (STIR) heterogeneously hyperintense lesion measuring $8.7 \times 6.5 \times 4.8$ cm, with areas of hemorrhage. It originated from the sciatic nerve, displaced adjacent muscles, but did not infiltrate or invade bone or surrounding soft tissue. Postcontrast imaging showed heterogeneous enhancement, suggestive of a schwannoma (►**Fig. 1**).

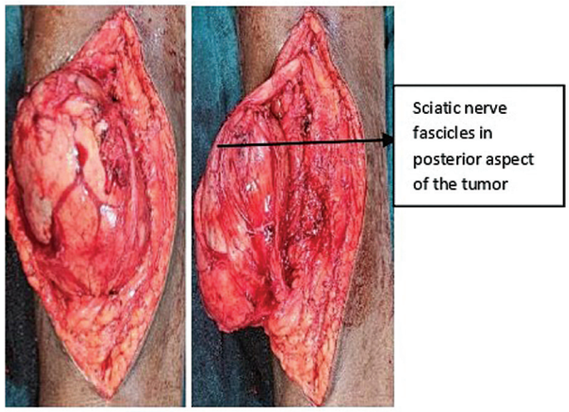
Surgical Procedure

After informed consent, the patient underwent surgery under general anesthesia in the prone position. A longitudinal incision was made from the mid-thigh to the knee.



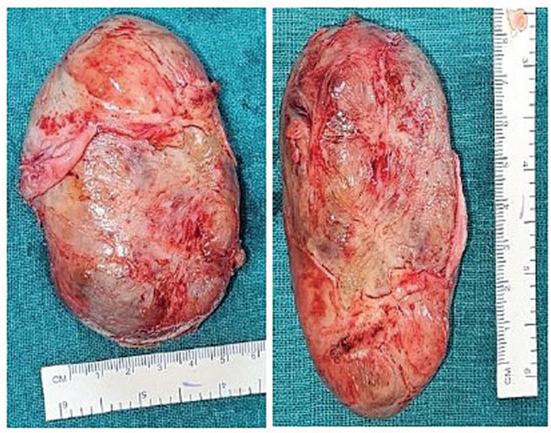
1 Image 1 A) T2Sagittal, B) STIR Sagittal, C) STIR Coronal, D) T2Coronal, E) T1Sagittal, F) T2 Axial, G) STIR Axial

Fig. 1 (**A**) T2 sagittal, (**B**) short tau inversion recovery (STIR) sagittal, (**C**) STIR coronal, (**D**) T2 coronal, (**E**) T1 sagittal, (**F**) T2 axial, and (**G**) STIR axial.



2A and 2B Intraoperative images

Fig. 2 (**A** and **B**) Intraoperative images.



3A and 3B Tumor dimensions

Fig. 3 (**A** and **B**) Horizontal and vertical dimensions of the tumor.

The mass appeared encapsulated, glistening white, and measured approximately $8.5 \times 6 \times 4.5$ cm. It was carefully dissected and completely enucleated without compromising the integrity of the sciatic nerve (►**Figs. 2** and **3**).

Histopathology

The excised mass was encapsulated and composed of spindle cells with alternating hypercellular (Antoni A) and hypocellular (Antoni B) areas. Prominent microcystic changes, hemorrhagic necrosis, hyalinization, hemosiderin-laden macrophages, and scattered lymphocytic infiltrates were observed. Immunohistochemistry was positive for S-100 protein, confirming the diagnosis of schwannoma with ancient degenerative changes.

Postoperative Course

The postoperative period was uneventful. The patient reported mild tingling and numbness in the heel region, which was self-limiting and improved gradually during follow-up.

Discussion

Schwannomas, also known as neurilemmomas, are the most common peripheral nerve sheath tumors. These tumors originate from Schwann cells, which are glial cells responsible for myelinating neurons. Peripheral nerve sheath tumors are common and are broadly classified as benign (neurofibromas, schwannomas, perineuriomas, and hybrid tumors), malignant (classical malignant peripheral nerve sheath tumors, epithelioid cell malignant peripheral nerve sheath tumors, and perineural malignant peripheral nerve sheath tumors), and tumors of uncertain malignant potential (atypical neurofibromatosis [NF] neoplasm with uncertain biologic potential in NF1 patients).[2–5]

Schwannomas represent 8% of all primary brain tumors, with cerebellopontine being the most common (80–90%). Among the CN schwannomas, sensory nerves are more affected compared with motor nerves, with the vestibulocochlear nerve (CN VIII) and the facial nerve (CN VII) being the most commonly affected, respectively. Schwannomas involving the extremities are rare. In this study, a large schwannoma arising from the sciatic nerve is presented. The sciatic nerve is the longest nerve formed by the nerve roots L4-S3, travels from the lower spinal cord through the pelvis, and down the leg. At the posterior aspect of the knee, the sciatic nerve divides into the tibial and common fibular nerves. Motor innervation of the sciatic nerve includes muscles of the posterior thigh (hamstrings), leg, and foot, whereas sensory innervation carries sensations from the skin of the lateral leg, heel, and dorsal and plantar aspects of the foot.[3,4,6]

Schwannomas are typically isolated, solitary, slow-growing, and well-encapsulated lesions, whereas multiple schwannomas (schwannomatosis) occur in neurofibromatosis. Bilateral acoustic neuroma associated with neurocutaneous tumor occurs in NF2.[3,4,7]

Schwannomas are sporadic but may also occur in association with NF2, schwannomatosis, or Carney's complex. The incidence of peripheral schwannomas annually is relatively low, 0.6 per 100,000 people, with the flexor surface of limbs being the most commonly affected. Males and females are equally affected. The incidence of schwannomas is highest in the 30- and 40-year age groups. Trauma, Carney's complex, and NF1 or NF2 may contribute to the etiology of these tumors.[4,8,9]

The clinical presentation is varied. Schwannomas are typically asymptomatic due to slow-growing nature. However, large size of the tumor may result in compressive symptoms like venous insufficiency leading to edema, discomfort, and pain in the affected area. Nerve involvement or damage leading to pain, paresthesia, hypoesthesia, sensory loss, tingling and burning sensation, motor deficit, surrounding muscle involvement, and bone involvement may also occur, leading to pain and difficulty in walking. Positive Tinel's sign confirms the nerve compression. The reported size of schwannomas is usually less than 5 cm in most of the studies; however, giant schwannomas that exceed more than 5 cm in size have been reported. Neurological symptoms are more prominent when the size exceeds 25 mm in diameter due to compression on the nerve.[10–14]

Radiological studies like ultrasound and MRI are useful in diagnosing these tumors. On ultrasound, schwannomas appear as solid, delineated, hypoechoic, homogenous lesions. X-rays yield negative results in most cases, but bone involvement might be ruled out. Schwannomas are usually T1 isointense and T2/STIR heterogeneously hyperintense lesions on MRI. The imaging features like split fat sign and bright rim sign with absence of lobular shape and extensive edema favor the diagnosis of schwannoma, particularly when two or more of these features are present. Malignant peripheral nerve sheath tumors can be differentiated from large heterogeneous schwannomas by analyzing imaging features at or near the margin of the mass lesion on MRI. MRI with gadolinium contrast plays a crucial role in providing significant information about the origin and involvement of surrounding tissues by these lesions, thus aiding in accurate diagnosis.[4,9,15–18]

Schwannomas are well-defined encapsulated tumors with smooth nodular outlines, and the capsule comprises three layers, which are epineurium, perineurium, and pericapsular tissues, from outer to innermost layers, respectively. Axons are typically absent within the tumor; thus, surgical removal is easier without disrupting the nerve fibers. In a few cases, the nerve of origin might be visible. These tumors are tan or yellow with areas of hemorrhage and cystic changes on the cut surface. The characteristic microscopic findings of these tumors include Antoni A pattern with spindle cells in palisades, and Antoni B pattern, which comprises irregular cells and myxoid. Immunohistochemistry is positive for S-100. These tumors with extensive degenerative changes are also known as "ancient schwannomas."[11]

The preferred modality of treatment of schwannomas involving the extremities is complete surgical excision/enucleation, which provides symptomatic relief and good outcomes. Intracapsular enucleation results in significantly lower risk of neurological injury compared with extracapsular enucleation. Microsurgical dissection can reduce the risk of nerve injury. Intraoperative electrophysiological monitoring is particularly useful for larger schwannomas, those involving major nerve trunks, or those located in deeper anatomical sites, as it helps minimize the risk of nerve damage. After surgical excision, recurrence of schwannomas is extremely rare.[5,8,15,17–20]

Postoperative outcomes and overall prognosis of the tumor are good; however, residual weakness and neurological symptoms may occur in a few cases, which may resolve over time, with low recurrence or malignant transformation.

Conclusion

Giant schwannomas of the sciatic nerve are exceptionally rare peripheral nerve sheath tumors that may present with long-standing, nonspecific symptoms due to their slow-growing nature. Early imaging, particularly MRI, plays a crucial role in preoperative diagnosis and surgical planning. Complete enucleation of the tumor, while preserving nerve integrity, remains the gold standard for treatment and can be successfully achieved with meticulous surgical technique. In this case, despite the tumor's large size, enucleation was performed without causing permanent neurological deficit,

highlighting the feasibility and effectiveness of a nerve-sparing approach in managing giant sciatic schwannomas. Regular postoperative follow-up is essential to monitor for the resolution of transient symptoms and to detect any signs of recurrence.

Conflict of Interest

None declared.

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