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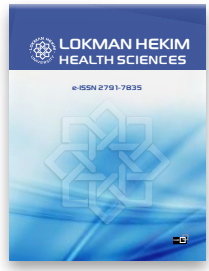

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CASE REPORT

Filum Terminale Schwannoma Presenting as a Purely Cystic Lesion on Non-Contrast Magnetic Resonance Imaging: Case Report*

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Abstract

Spinal schwannomas are benign nerve sheath tumors that typically present as solid or heterogeneous, well-circumscribed masses with contrast enhancement on magnetic resonance imaging (MRI). A 61-year-old male presented with progressive low back and leg pain. Non-contrast MRI revealed an apparently completely cystic intradural mass at the level of the conus medullaris. Contrast-enhanced MRI demonstrated heterogeneous enhancement. The lesion was totally excised via laminectomy under intraoperative neuromonitoring and was found to originate from the filum terminale. Histopathological examination confirmed the diagnosis of schwannoma. This case highlights the importance of contrast-enhanced MRI for accurate differential diagnosis of intradural lesions, the role of intraoperative neuromonitoring in preventing neurological deficits, and the necessity of histopathological examination for definitive diagnosis.

Keywords: Cyst; Magnetic resonance imaging; Resection; Schwannoma

Schwannomas are benign, slow-growing, encapsulated tumors arising from the myelinated nerve sheaths of spinal nerve roots and constitute the most common benign intradural extramedullary tumors of the spine. They are typically solitary and predominantly solid lesions.[1] Although cystic degeneration may occur, purely cystic schwannomas within the spinal canal are uncommon.[2] These tumors are most frequently encountered in the lumbar region; however, schwannomas originating from the filum terminale are very rare.[3] So far, only two cases have been reported in the literature. Accurate pre-operative diagnosis of these lesions can be challenging. Magnetic resonance imaging (MRI) is essential for lesion characterization, localization, and surgical planning. However, definitive diagnosis relies on histopathological examination.[4]

In this report, we present a case of a schwannoma originating from the filum terminale, which appeared entirely cystic on non-contrast MRI but was found to contain a solid component during intraoperative evaluation.

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Case Report

A 61-year-old male presented with a history of long-standing, progressively worsening intermittent low back pain and bilateral leg pain. His walking distance was reduced, with neurogenic claudication occurring at approximately 200 m. He had no history of trauma, infectious disease, or spinal disorders such as rheumatoid arthritis or ankylosing spondylitis, and no comorbidities, including diabetes mellitus or hypertension. Neurological examination was unremarkable. Deep tendon reflexes were normal, with no pathological reflexes observed. Sphincter function was intact.

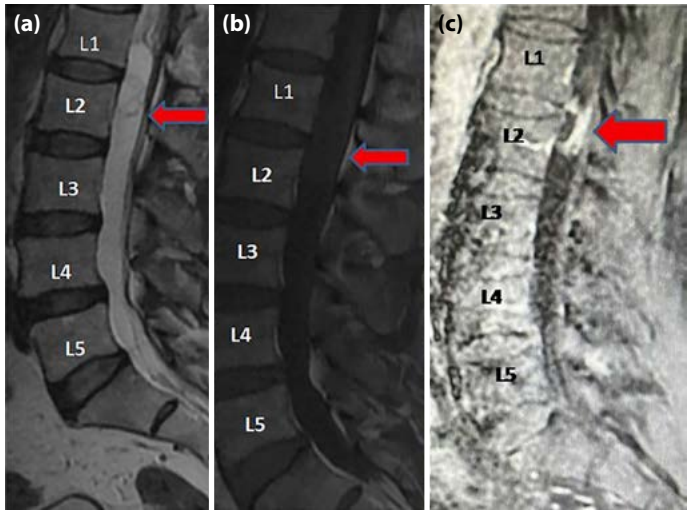

Figure 1. T2 **(a)** -T1 **(b)**, and contrast-enhanced **(c)** magnetic resonance images on the sagittal plane.

Lumbar MRI performed at an external center demonstrated an apparently completely cystic lesion at the level of the conus medullaris. The lesion was hypointense on T1-weighted images and hyperintense on T2-weighted images (Figs. 1, 2). Contrast-enhanced MRI was subsequently performed, revealing heterogeneous contrast enhancement (Fig. 1).

A surgical procedure under general anesthesia was performed to remove the tumor via a posterior midline approach with L1 inferior-L2 superior laminectomies. Intraoperative neuromonitoring was employed during the surgery. Under microscopic visualization, the dura mater was opened at the midline. After opening the dura, the distal, predominantly cystic portion of the lesion was accessed

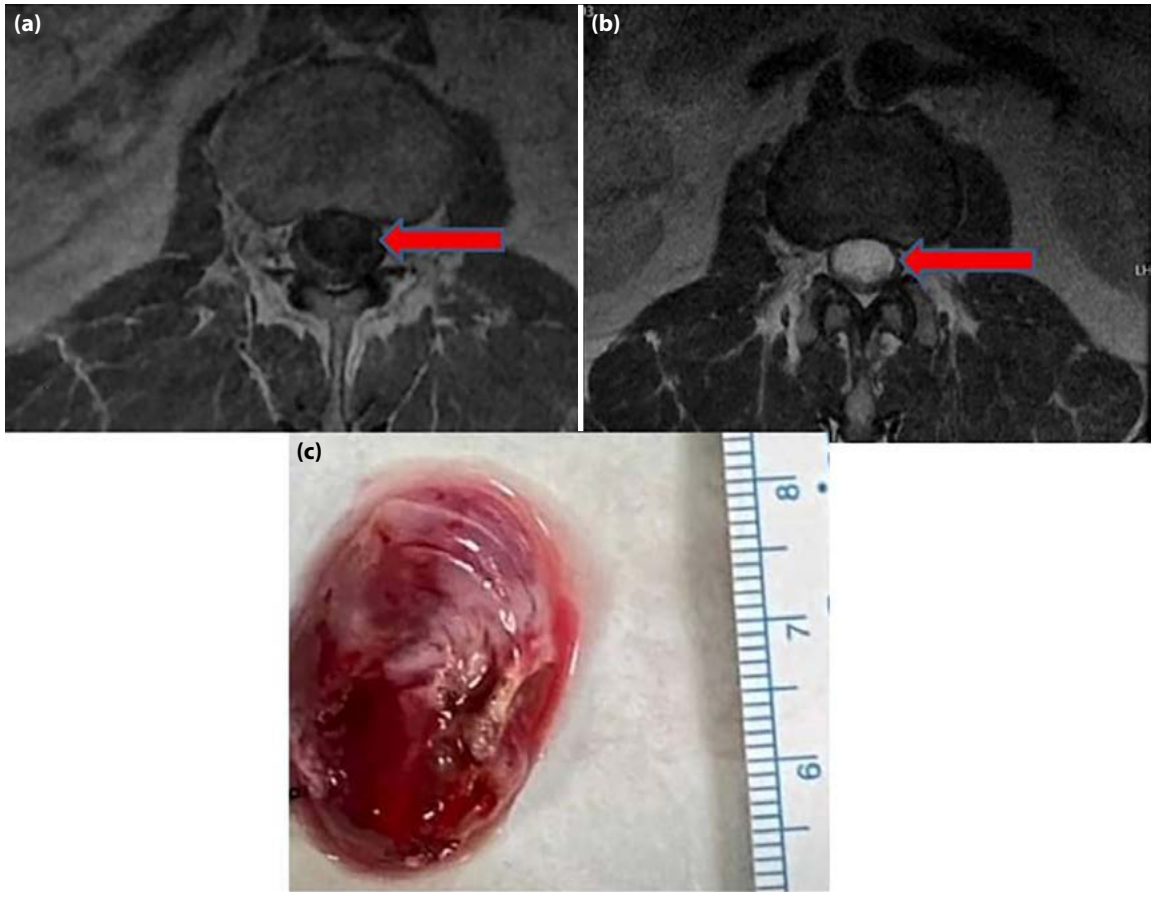

Figure 2. T1 **(a)**, T2 **(b)** magnetic resonance images on the axial plane, and macroscopic appearance of the lesion **(c)**.

via careful dissection between the nerve roots. Further dissection revealed the solid component of the lesion.

The lesion was found to originate from the filum terminale. The filum terminale was repeatedly stimulated using a neuromonitoring probe and subsequently sacrificed, allowing complete excision of the lesion without any intraoperative complications (Fig. 2). Histopathological examination confirmed the diagnosis of cystic schwannoma. Immunohistochemically, the tumor cells were positive for S100, CD56, and vimentin, whereas glial fibrillary acidic protein, epithelial membrane antigen, and chromogranin A were negative. No adjuvant therapy was administered following surgery. The patient has been under clinical follow-up for approximately 2 years, with no evidence of recurrence or neurological deficit.

Discussion

Schwannomas are almost always benign, well-circumscribed tumors that arise from the clonal proliferation of Schwann cells. Although most cases are sporadic, some are associated with neurofibromatosis type 2, schwannomatosis, or Carney complex.[5] In our case, the tumor was sporadic and not associated with any syndromic condition, and no additional lesions were detected elsewhere in the body. More than half of these lesions are located in the intradural extramedullary compartment, approximately 25% are purely extradural, 15% have both intradural and extradural components, and intramedullary involvement is rare.[6] In our case, the lesion was confined to the intradural extramedullary compartment.

In the present case, although the lesion appeared purely cystic on non-contrast MRI, contrast-enhanced imaging demonstrated enhancement in the region corresponding to the solid component, which was also confirmed intraoperatively. These findings highlight the importance of contrast-enhanced MRI in accurately characterizing the lesion and in guiding intraoperative surgical decision-making. A review of the literature revealed only two previously reported cases of schwannoma arising from the filum terminale.[3,7] In the case reported by Passman et al.,[3] the lesion appeared completely cystic on the non-contrast series; however, heterogeneous contrast enhancement was observed following contrast administration. This finding is highly similar to our case. Similarly, in the case reported by Mattar et al.,[7] the lesion demonstrated an almost entirely cystic appearance on the non-contrast series, whereas nodular, homogeneous contrast enhancement was observed after contrast administration. Both previously reported cases presented with low back pain and radicular pain. Similarly, our patient presented with low back and leg pain accompanied by gait disturbance. Apart from the lesion, no other pathology, such as disc herniation or spinal stenosis, that could account for the clinical symptoms was identified. In the post-operative period, the patient's leg pain improved markedly, and a progressive increase in walking distance was observed, from an initial distance of 200 m. Comparable clinical improvement was also reported in the cases described in the literature. In our case, to achieve complete resection of the filum terminale lesion, the filum was sacrificed after repeated confirmation with a neuromonitoring probe.

MRI remains the most reliable modality for the evaluation of spinal cystic lesions.[4] Tumors of nerve sheath origin can often be suggested by their characteristic MRI signal patterns; however, cystic schwannomas may pose a diagnostic challenge, particularly when they present as predominantly or completely cystic lesions. Schwannomas typically appear iso- to mildly hypointense relative to the spinal cord on T1-weighted images and markedly hyperintense on T2-weighted sequences. Areas of increased T2 signal intensity usually reflect cystic degeneration, whereas regions of relatively lower signal intensity may be associated with hemorrhage, increased cellularity, or fibrous tissue.[8]

The enhancement pattern of schwannomas after contrast administration is variable and may range from homogeneous to predominantly peripheral enhancement. In cases of intradural extramedullary cystic masses demonstrating rim or focal enhancement, schwannoma should therefore be considered prominently in the differential diagnosis. One of the distinguishing radiological features of cystic schwannomas is the presence of a well-defined, contrast-enhancing wall or focal enhancing component. This finding is generally absent in most other cystic spinal lesions.[8,9]

Nevertheless, differentiation from other cystic lesions such as arachnoid, epidermoid, dermoid, neuroenteric cysts, teratomas, and hydatid cysts may remain difficult based solely on imaging findings, particularly in the absence of contrast-enhanced studies.[5,9] In the present case, non-contrast MRI suggested a purely cystic lesion, which could have led to misinterpretation of the lesion's nature. However, contrast-enhanced MRI revealed focal enhancement corresponding to a solid component, which was subsequently confirmed intraoperatively. This underscores the critical role of contrast-enhanced MRI

Table 1. Radiological differential diagnosis of lesions demonstrating a cystic appearance on non-contrast magnetic resonance imaging in this region

Lesion	T1 signal	T2 signal	DWI	Contrast enhancement
Arachnoid cyst	CSF-like	CSF-like	No restriction	None
Epidermoid cyst	CSF-like	Hyperintense	Restricted diffusion	Minimal/none
Neuroenteric cyst	Variable	Hyperintense	Usually none	Rare
Tarlov cyst	CSF-like	CSF-like	None	None
Dermoid cyst	Often hyperintense (fat)	Variable	None	Variable
Cystic schwannoma	Hypointense	Hyperintense	Usually none	Peripheral (rim), nodular, homogeneous, heterogeneous

CSF: Cerebrospinal fluid; DWI: diffusion-weighted imaging.

not only in improving diagnostic accuracy but also in pre-operative planning and intraoperative decision-making for spinal cystic lesions. Radiological differential diagnosis of lesions demonstrating a cystic appearance on non-contrast MRI in this region is shown in Table 1.

Although radiological findings may be highly suggestive, definitive diagnosis of schwannomas relies on histopathological examination. Histologically, schwannomas are composed of spindle-shaped cells with pale eosinophilic cytoplasm, arranged in densely cellular Antoni A areas and loosely organized Antoni B areas. The cystic changes observed in schwannomas are thought to result from degenerative processes within Antoni B regions or from ischemic necrosis secondary to tumor growth.[10] In our case, histopathological evaluation confirmed the diagnosis of schwannoma.

Complete surgical excision remains the cornerstone of treatment for spinal schwannomas, as total resection significantly reduces the risk of recurrence and is associated with favorable long-term outcomes. In the present case, total resection was achieved, aided by the use of intraoperative neuromonitoring and microsurgical techniques, allowing safe removal of the lesion.[4] The patient experienced significant post-operative clinical improvement, consistent with outcomes reported in the literature. These findings further support complete surgical resection as an effective and safe treatment strategy, even in rare and atypical presentations such as heterogeneous schwannomas originating from the filum terminale.

Conclusion

Contrast-enhanced MRI is essential for the accurate evaluation of lesions that appear purely cystic on non-contrast imaging, guiding both diagnosis and treatment planning. In schwannomas originating from the filum terminale, complete surgical excision can be safely achieved with the use of intraoperative neuromonitoring. When necessary, sacrifice of the filum terminale may be required to ensure gross total resection and optimal clinical outcomes.

Ethics Committee Approval: This is a single case report, and therefore ethics committee approval was not required in accordance with institutional policies.

Informed Consent: Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Conflict of Interest: The authors declare no competing interests that could have influenced the objectivity or outcome of this research.

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