Intradural Extramedullary Spinal Tumor Magnetic Resonance Imaging

- Primary Carcinoid Tumor of the Central Nervous System: A Rare Case Report with a Diagnostic Challenge
- A case of sustained neurological improvement in a metastatic intramedullary spinal cord tumor from lung cancer treated with immune checkpoint inhibitor therapy
- Exoscopic-Endoscopic Resection of Intramedullary Spinal Cord Metastasis From Renal Cell Carcinoma With Ventral Exophytic Extension
- Intradural extra-medullary spinal cord tumor after dorso-lumbar spine fixation following 12th dorsal vertebra burst fracture: A case report with literature review
- Full-Endoscopic Resection of a Lumbar Intradural Tumor (Schwannoma): Video Case Report and Description of the Surgical Technique
- Extramedullary Intradural Primary Spinal Angiosarcoma: A Case Study
- A Case Study of Intradural Extramedullary Spinal Schwannoma and Multiple Thoracic Vertebral Haemangiomas Following COVID-19 Infection and Vaccination: Insights from MRI Imaging
- Epidemiology and surgical outcomes of pediatric intradural spinal tumors: results from a retrospective series of patients operated in the first two decades of life

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Intradural extramedullary spinal tumors are lesions located **within the dura mater but outside the spinal cord**. They account for **60-70% of all intradural spinal tumors** and include common entities such as **meningiomas, schwannomas, and neurofibromas**. MRI is the modality of choice for their evaluation.

Standard MRI Protocol

- **T1-weighted images (T1WI):** Typically hypointense or isointense to the spinal cord.
- **T2-weighted images (T2WI):** Most IDEM tumors appear hyperintense; however, meningiomas may show variable intensity.
- **Post-contrast T1-weighted imaging with gadolinium:** Usually shows strong and homogeneous enhancement.
- **STIR (Short Tau Inversion Recovery):** Helps suppress fat signal and enhances lesion visualization.
- **Diffusion-weighted imaging (DWI):** Can help differentiate tumors from abscesses or cystic lesions.

Common IDEM Tumor Types and MRI Features

Tumor Type	T1WI	T2WI	Contrast Enhancement	Additional Features
Meningioma	Iso- or hypointense	Iso- or hyperintense	Strong, homogeneous	Dural tail sign, calcifications, more common in thoracic region

Tumor Type	T1WI	T2WI	Contrast Enhancement	Additional Features
Schwannoma	Iso- or hypointense	Hyperintense	Strong, homogeneous (or heterogeneous if cystic/necrotic)	Dumbbell shape if extending through foramen
Neurofibroma	Isointense	Hyperintense	Mild to moderate enhancement	Fusiform shape, possible multiple lesions (NF1)
Myxopapillary Ependymoma	Isointense	Hyperintense	Intense, homogeneous	Usually in **filum terminale**, sometimes with hemorrhage
Paraganglioma	Isointense	Hyperintense	Intense, homogeneous	Common in the cauda equina; possible **"salt-and-pepper"** appearance due to vascular flow voids

Key Differentiating Features

- **Meningiomas** tend to be **dorsally located**, more common in females, and may show a **dural tail sign**.
- **Schwannomas and neurofibromas** are often **laterally located**, **eccentric**, and can extend into the intervertebral foramen (**dumbbell shape**).
- **Myxopapillary ependymomas** occur almost exclusively in the **filum terminale**.
- **Paragangliomas** may have flow voids and hemorrhagic components.

Advanced Imaging Considerations

- **MR Myelography:** Can be useful for identifying CSF flow obstruction caused by large tumors.
- **MR Spectroscopy:** Sometimes used for metabolic characterization, especially in atypical cases.
- **DWI/ADC Mapping:** May help differentiate tumors from infectious or inflammatory lesions.

Melanotic schwannoma frequently shows T1 hyperintensity at MRI related to the presence of paramagnetic free radicals in melanin. Neurofibroma, known for its T2 hyperintensity, frequently involves the cervical spine, where it may make surgical resection challenging. Less commonly, malignant peripheral nerve sheath tumor commonly mimics the imaging appearance of a schwannoma but has decidedly more aggressive biologic behavior. In the cauda equina, myxopapillary ependymoma and paraganglioma are believed to arise from the filum terminale and have characteristic imaging manifestations based on their underlying pathologic features. Recent identification of a common genetic marker has led to reclassification of what had previously been regarded as separate tumors and are now known as solitary fibrous tumor/hemangiopericytoma. In the proper clinical setting, the presence of nodular intradural enhancement strongly suggests the presence of leptomeningeal metastatic disease, even when results of cerebrospinal fluid analysis are negative [1)].

Case report from the HGUA

50-year-old woman presents with a 6-8 month history of progressive gait disorder, initially sensorimotor, associated with sphincter involvement. On examination, there is evidence of pyramidal signs in all four limbs and severe spastic sensorimotor impairment of the lower limbs.

An MRI of the entire spinal cord was performed, with acquisitions before and after intravenous contrast administration:

Presence of a large Intradural extramedullary spinal tumor with well-defined contours, located at the dorsal level, extending from the mid-body of the Th6 vertebra to the lower endplate of D7. The lesion has an ovoid shape and approximate dimensions of 1.6 x 1.4 x 3.7 cm. It occupies 85-90% of the spinal canal's width, causing severe displacement and compression of the spinal cord, which is displaced in a posterolateral rightward direction, with signal changes in the evaluable segments suggestive of myelopathy.

In terms of signal characteristics, the lesion is isointense to the spinal cord on T1-weighted sequences

and slightly hyperintense on T2.

It shows moderate and homogeneous enhancement after intravenous contrast administration. No calcifications are observed. The lesion does not appear to extend into the neural foramina. It has a broad dural attachment to the left lateral aspect of the spinal canal,

with an uncertain dural tail sign on sagittal post-contrast acquisition. No similar lesions are observed in the rest of the spinal canal.

There are disc-osteophyte protrusions from C4-C5 to C6-C7, causing mild narrowing of the spinal canal. No destructive vertebral body lesions are observed. No significant foraminal stenosis is present.

Final impression: Large intradural extramedullary dorsal tumor, most suggestive of a spinal meningioma as the primary diagnosis, with a differential diagnosis including a nerve sheath tumor. The lesion causes severe spinal canal stenosis of approximately 85-90%.

The **etiology of the gait disorder** in this **50-year-old woman** is most likely **spinal cord compression** due to a **large intradural extramedullary tumor** at the dorsal level (D6-D7). The key features supporting this include:

Possible Causes Based on MRI Findings: 1. **Severe Spinal Cord Compression (85-90% canal stenosis)**

1. The tumor is displacing and compressing the spinal cord, leading to **myelopathy**.

2. This explains the **progressive gait disorder** with **pyramidal signs** (spasticity, hyperreflexia).

2. **Myelopathy Due to Chronic Compression**

1. The **posterolateral displacement of the spinal cord** with **signal changes** suggests **spinal cord damage** (myelopathy).
2. Chronic compression can result in progressive **spastic paraparesis**, proprioceptive deficits, and sphincter dysfunction.

3. **Primary Diagnosis: Meningioma (Most Likely)**

1. Meningiomas are **common intradural extramedullary tumors** that cause **gradual spinal cord compression**.
2. The **broad-based dural attachment** and **homogeneous contrast enhancement** support this diagnosis.

4. **Differential Diagnosis: Nerve Sheath Tumor (Less Likely)**

1. Includes **schwannoma or neurofibroma**.
2. Typically shows **eccentric growth** and may extend into the foramina (not observed in this case).

Mechanism of Gait Disorder in Spinal Cord Compression: - **Upper motor neuron dysfunction (myelopathy) → Spastic gait** - **Sensory impairment (proprioception loss) → Ataxic gait** - **Weakness in lower limbs → Paraparesis** - **Bladder dysfunction → Additional evidence of cord involvement**

Conclusion: The **gait disorder is due to thoracic spinal cord compression secondary to a likely meningioma, leading to progressive myelopathy.**

1)
Koeller KK, Shih RY. Intradural Extramedullary Spinal Neoplasms: Radiologic-Pathologic Correlation. Radiographics. 2019 Mar-Apr;39(2):468-490. doi: 10.1148/rg.2019180200. PubMed PMID: 30844353.