Overview

- Our Patient
- Spinal Anatomy
- Differential Diagnosis
- Menu of Tests
- Intradural Spinal Tumors
- Summary
1. Learn the general anatomy of the spine
2. Learn the clinical presentation and differential diagnosis of spinal lesions
3. Understand the radiological tests to use to evaluate spinal lesions
4. Develop an understanding of the different types of intradural spinal lesions and their radiological presentations
Ms. S is a 57 year old woman who presented to her primary care physician complaining of episodic left lower back pain radiating to her left groin. The pain had been increasing in severity for the past few months.

- PMH/PSH: Unremarkable
- Physical Exam was positive for left flank pain
- Urine analysis was unremarkable
- 31 pairs of spinal nerves
  - 8 Cervical
  - 12 Thoracic
  - 5 Lumbar
  - 5 Sacral
  - 1 Coccygeal
- Conus Medullaris at L1, L2

Image adapted from: Andrew L. Chen, MD; http://www.nlm.nih.gov/MEDLINEPLUS/ency/imagepages/1116.htm
Vertebral Body Anatomy

Axial CT Lumbar Vertebra

- Trabecular Bone
- Cortex
- Pedicle
- Transverse Process

Lumbar Vertebra

- Spinous Process

Nervous system cell types:

- Neuronal Cells
- Astrocytes (CNS)
- Oligodendrocytes (CNS)
- Schwann cells (PNS)
- Ependymal cells (CNS)

Image adapted from: M. Headwouth, Mayfield Clinic; http://www.mayfieldclinic.com/Images/PE-AnatSpine_Figure8.jpg
Meninges Anatomy

CSF is located in subarachnoid space

Pia Mater

Arachnoid Mater

Dura Mater

Image adapted from: M. Headwouth, Mayfield Clinic; http://www.mayfieldclinic.com/Images/PE-AnatSpine_Figure8.jpg
• Dermatomes specify the spinal level supplying the sensory nerve for each area of the skin.

• Ms. S seemed to be affected along the L1, L2 dermatome
## Partial Differential Diagnosis of Lumbar Radiculopathy

1. **Renal:**
   - Kidney Stone

2. **Degenerative conditions:**
   - Disc herniation

3. **Inflammatory conditions:**
   - Guillain – Barré
   - Multiple Sclerosis
   - Transverse Myelitis
   - Sarcoidosis

4. **Infectious conditions:**
   - Viral, bacterial, or parasitic
   - Abscess
   - Tuberculosis

5. **Vascular conditions:**
   - Cord Infarction

6. **Neoplasms:**
   - Spinal Tumors
1. Renal:
   - Kidney Stone

2. Degenerative conditions:
   - Disc herniation

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   - Guillain – Barré
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6. Neoplasms:
   - Spinal Tumors

Not likely given presentation
### Our Patient: Differential Diagnosis

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Menu of Radiological Tests

- Plain Film
- CT – myelography → done for patients who are contraindicated for MRI
- MRI → Test of choice when patient has neurologic signs and symptoms
- Nuclear Medicine → done in cases when there is concern of bone metastasis
- Angiography → done in cases when there is concern of vascular supply concern
Ms. S had CT done due to concern of renal stones. On CT no evidence of renal calculi or hydronephrosis was observed.

Calcified density within spinal canal that may be causing compression of spinal cord is seen.
### Our Patient: Differential Diagnosis

#### Post CT

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Hypo/Iso -intense well circumscribed mass that is compressing spinal cord - consistent with radiological presentation of spinal tumor.

No disc herniation was observed on MRI.

Sagittal T1

Spinal Cord

Intervertebral Disc

PACS BIDMC
1. Renal:
   - Kidney Stone

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   - Spinal Tumors
Spinal Tumors

- Tumors of the spinal cord account for 15% of all CNS tumors
- Incidence is 0.5 - 2.5 per 100,000
- Usual presentation is months or years of radiculopathy or myelopathy type symptoms
- Can be primary in origin or metastatic
- Can be distinguished based on presenting symptoms, age of presentation, location in cord, and MRI findings
- Exact tumor pathology requires biopsy
- Treatment for many of the spinal tumors is surgical resection if possible
Types of Spinal Tumors

Spinal Tumors

- Extradural
  50% of all spinal tumors

- Intradural – extramedullary
  40% of all spinal tumors

- Intradural – intramedullary
  10% of all spinal tumors

Spinal Tumors

Extradural
- Metastatic
- Osteoblastoma
- Osteochondroma
- Chondrosarcoma
- Myeloma
- Giant Cell tumor
- Others

Intradural – extramedullary
- Nerve sheath tumors
  - Schwannoma
  - Neurofibroma
- Meningioma
- Metastasis
- Others

Intradural – intramedullary
- Ependymoma
- Astrocytoma
- Hemangioblastoma
- Paraglioma
- Metastasis
- Others
Most Common Intradural Spinal Tumors

These are the 4 most common Intradural Tumors

Spinal Tumors

Extradural
- Metastatic
- Osteoblastoma
- Osteochondroma
- Chondrosarcoma
- Myeloma
- Giant Cell tumor
- Others

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- Others

Intradural – intramedullary
- Ependymoma
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- Paraglioma
- Metastasis
- Others
Let's start with a discussion of extramedullary intradural tumors.
1. Neurofibromas
   - Most common NST that is usually but not always associated with Neurofibromatosis 1
   - Arises from dorsal sensory nerve roots of thoracic spine usually

2. Schwannomas
   - Usually sporadic, but seen in Neurofibromatosis 2 patients
   - Arises from ventral motor nerve roots of thoracic spine usually

Imaging Findings for NSTs
   - Cannot distinguish neurofibroma from schwannoma on MRI
   - $T_1$: isointense
   - $T_2$: hyperintense
   - Gadolinium: iso/hyper – intense
   - Have target lesions = decreased signal centrally and increased signal peripherally
Companion Patient 1: Schwannoma on Sagittal T1 MRI With Contrast

Sagittal T1 post Gadolinium

Hyperintense target lesion

Hyperintense lesion

49 year old male with 4 month history of pain radiating down left leg
Companion Patient 1: Schwannoma on Axial T2 MRI

Axial T2

Dark line represents dura

Hyperintense lesion outside of spinal cord but within dura compressing spinal cord
Meningioma

- 2nd most common extramedullary intradural tumor
- They are benign slow growing tumors that arise of arachnoid cells
- Females more commonly affected than males; average age of presentation 40-60
- Present usually in thoracic vertebra

Imaging Findings
- T1: Hypo/iso – intense
- T2: Hyper/iso – intense
- Gadolinium: homogenous enhancement
- CT/plain film: Calcifications may be seen
Our patient Ms. S: Meningioma on Sagittal T1 MRI With and Without Contrast

Sagittal T1

Hyperintense homogenously enhanced mass

Hypo/Iso - intense well circumscribed mass compressing spinal cord

Sagittal T1 post Gadolinium

Images from PACS BIDMC
Hyperintense mass outside of the spinal cord but within the dura causing compression of the spinal cord.
Let's continue with a discussion of intramedullary intradural tumors.
Ependymoma

- Most common intramedullary intradural tumor, usually seen in cervical spine or conus
- Composed of ependymal cells of spinal cord
- Present with more neurologic deficits than radiculopathy
- Peak incidence between ages of 30-50

Imaging Findings
- T1: hypointense
- T2: iso/hyper – intense
- Gadolinium: hyperintense
- Spinal cord will appear enlarged
- Scalloping and erosions of vertebral bodies is sometimes seen
Axial T1 post Gadolinium

30 year old female s/p subtotal resection of ependymoma having imaging done to check for tumor growth

Hyperintense heterogeneously enhanced mass – represents tumor growth within spinal cord
Companion Patient #2: Ependymoma on Sagittal T2 MRI

Sagittal T2

Vertebral Scalloping

Principally high intensity intradural mass, which expands the spinal canal
Astrocytomas

- 2nd most common Intramedullary intradural tumor, usually seen in thoracic spine
- Composed of Astrocytes
- Peak incidence between ages of 20-40

Imaging Findings
- T1: hypo/iso - intense
- T2: hyperintense
- Gadolinium: hyperintense
- Spinal cord will appear enlarged

- Cannot tell the difference between Astrocytoma and Ependymoma based only on imaging → need biopsy
Companion Patient #3: Astrocytoma on Sagittal T2 MRI

40 year old male with 6 month history of pain radiating down right leg.

Isointense heterogeneously enhanced mass – represents tumor growth within spine.
<table>
<thead>
<tr>
<th>Lesion</th>
<th>Location</th>
<th>Incidence</th>
<th>Age</th>
<th>Plain Film/ CT</th>
<th>MRI T1</th>
<th>MRI T2</th>
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<td>Intramedullary</td>
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Spinal Tumors in overall are rare, but important not to miss

There is a large differential in patients presenting with radiculopathy or myelopathy

Imaging can be used along with clinical information to narrow the differential and even come up with a diagnosis

Imaging allows characterization of spinal tumors, especially those that are intradural
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References


