MRI of the Spine
The Good, The Bad, and the Ugly
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Outline
- Diagnostic Approach
- Terminology and Concepts
- Common Spine Pathology

Before Imaging
- Adequate clinical history/indication
  - Opportunity to add value to imaging
- Indication for IV contrast
  - Known or suspected malignancy
  - Prior surgery
  - Possible or known infection

Standard Spine Sequences
- T2-weighted: Axial and Sagittal
- T1-weighted: Sagittal +/- axial
- STIR or T2W fat sat: sagittal

Additional Sequences
- Axial Gradient Echo: Standard for Cervical spine
- Trauma
  - Coronal STIR or T2W craniocervical junction ligaments
  - Axial T1 fat saturation for dissection
- CSF flow imaging: craniocervical junction obstruction

Radiologist Approach to Spine MRI
- Alignment
- Bones
- Spinal Cord
- Spinal Canal
- Disc spaces
- Neural foramen, facet joints
- Extrapinal tissues
Alignment

- Identify Spondylolisthesis
- Identify etiology
  - History of Trauma?
  - Degenerative?
  - Congenital?

Bones

- Is there a focal or diffuse bone marrow abnormality?
- T1W and STIR/Fat Sat images critical
- Identify etiology
  - History of Cancer or trauma?
  - Value added opportunity – Contrast

Spinal Cord

- Are the images adequate to exclude cord pathology
  - Most radiologist consider this priority #1
- T2W images critical
- Identify etiology
  - Cord expanded?
  - Value added opportunity – Contrast
Spinal Canal

- Very common cause of patient symptom
- Surgical target
- Cord Compression is an emergency

Disc Spaces

- Disc Height
- Disc Water content
- Very common cause of patient symptom
- Surgical target

Extraspinal

Common Pathology Encountered
- Degenerative
- Tumor
- Infection
- Trauma
Back Pain
- 80% of Americans have back pain at some point = 240 million people!
- 95% of them do not need surgery, however 50% of them believe surgery is the only cure
- MRI is the test of choice for majority of spine indications
- Likely we over utilize MRI

Back pain: Where does it come from?
- Muscle
- Disc
- Facets
- Nerves
- Bone
- Ligaments
- Psychological

Fixable Causes
- Lumbar Stenosis
- Disc protrusion
- Spondylolisthesis
- Scoliosis

Disc Disease – New England Journal of Medicine Study
- Many people with back pain have disc bulges or protrusions
- 64% of patients with no back pain have an abnormal MRI
- Surgical treatment of degenerative changes based solely on MRI is not recommended
- MRI findings must be integrated with history and physical examination

Disc Pathology Nomenclature
- Standardization nomenclature approved in 2001
- Agreed upon definition of:
  - Bulge
  - Protrusion
  - Extrusion

Disc Nomenclature
- Focal versus Broad Disc Protrusion

Disc Nomenclature

Protrusion versus Extrusion

- Bulge: >180 degree of the circumference
- Herniation: < 180 degree
- Protrusion: wide neck
  - Broad: between 90 and 180 degrees
  - Focal: < 90 degrees
- Extrusion: narrow neck
  - Migration: remains in continuity
  - Sequestration: fragment no longer in continuity

Disc Nomenclature Summary

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Disc Protrusion

- Last step is to indicate effect on the adjacent nerve root(s)

Approach to Spinal Canal/Cord Masses

- Many different pathologies can result in a spinal canal mass:
  - Bone tumor, Metastasis, Spinal cord tumors, Disc or joint pathology, Infection
- How can we narrow the diagnosis?
Approach to Spinal Canal/Cord Masses

#1: Intramedullary Space

#2: Intradural Extramedullary

#3: Extradural Mass

Spinal Canal Pathology: Based on location

- **Intramedullary:**
  - Astrocytoma, Ependymoma
  - Nontumor: demyelination, infarct, trauma

- **Intradural Extramedullary:**
  - Meningioma, Nerve sheath tumor, lipoma, (epi)dermoid

- **Extradural:**
  - Discogenic, bone origin, metastatic disease, lymphoma

Infection

- Accurate diagnosis of a spinal infection is important
- Osteomyelitis often requires ~6 weeks of antibiotics
- Spine infections may require surgery
- Spine infection may result in deformity/disability
- MRI detection of spine infection superior to CT
Example: Discitis and Osteomyelitis

Trauma: Compression Fracture
- Identifying bone marrow edema
- CT better for majority of fractures
- MRI better at determining acuity

Trauma:
- Malalignment
- Ligamentous Injury
- Cord Injury

Summary
- General Approach to Spine MRI
- Terminology
- Common pathologies in the spine