Vertebral Osteomyelitis of the Lumbar Spine

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1. Vertebral Anatomy and Arterial Supply

Of note, the lumbar arteries send metaphyseal anastomoses to give arterial supply to the vertebral body, the disc, and the adjacent vertebral bodies.

(Left) Colorado Comprehensive Spine Institute.
2. Vertebral Osteomyelitis: Clinical Features

- Vertebral osteomyelitis is an infection of one or more vertebrae
  - **Incidence**: 2.4 cases per 100,000 people
  - **Location**: Typically involves 2 adjacent vertebral bodies and the intervertebral disc between them.
    - Lumbar spine (58%)
    - Thoracic Spine (30%)
    - Cervical Spine (11%)
  - **Presentation**: Back pain (86%), Fever (35-60%), Neurologic impairment (33%)

2. Vertebral Osteomyelitis: Routes of Infection

- **Routes of infection:**
  - Hematogenous seeding (*S. aureus*, *E. coli*) – most common
  - Direct inoculation during spinal procedure (*S. epidermidis*, *P. acnes*)
  - Contiguous spread from adjacent soft tissue infection

2. Vertebral Osteomyelitis: Complications

• Complications:
  - Epidural abscess – *neurosurgical emergency*
  - Psoas abscess
  - Paraspinal abscess
  - Extension of infection to aorta and/or IVC
  - Vertebral body collapse

2. Vertebral Osteomyelitis: Imaging Modalities

- Menu of Imaging Modalities:
  - MRI
  - CT
  - Plain Film
  - Combined Gallium SPECT and Tc-99 Bone Scan
  - In-111 labeled leukocyte scan

2. Vertebral Osteomyelitis: Imaging Modalities

- **MRI:**
  - 96% Sensitivity, 92% Specificity
  - **First line if vertebral osteomyelitis is suspected, or if neurologic deficits are present**
  - IV contrast is necessary to distinguish between epidural abscess and phlegmon

2. Vertebral Osteomyelitis: Imaging Modalities

• MRI, continued:
  • T1: Decreased signal intensity in disc and adjacent vertebral bodies, and loss of endplate definition
  • T2: Increased signal intensity in disc
  • C+: Ring enhancement suggest abscess, Homogenous enhancement suggest phlegmon

2. Vertebral Osteomyelitis: Imaging Modalities

- **Plain Film:**
  - Not ideal for detecting vertebral osteomyelitis
  - 82% Sensitivity, 57% Specificity
  - Radiographic findings appear 6-8 weeks after onset of symptoms
  - Despite this, often the first step taken in working up a patient with recurrent back pain

- **Findings on Plain Film:**
  - Disc space narrowing with end plate erosion
  - Vertebral body destruction
  - Sclerosis and new bone formation as healing progresses

2. Vertebral Osteomyelitis: Imaging Modalities

• **CT:**
  - Useful for visualizing bony destruction if MRI is contraindicated.
  - Limited study data
  - Findings: End plate destruction, hypodense vertebral bodies

• **SPECT and Tc-99 Bone Scintigraphy:**
  - Useful if MRI is contraindicated
  - 90% Sensitivity, ~100% Specificity.
  - Findings: Increased uptake around the affected vertebral bodies

• **In-111 Labeled leukocyte scan:**
  - Low sensitivity, so rarely used.

3. Our Patient: Clinical Presentation

• **HPI**: 57M with history of **L3-L4 osteomyelitis** (diagnosed in 8/2014) complicated by **R psoas abscess** (s/p IR drainage in 3/2015) who presented in April 2015 with a **2 month history of low grade fever, recurrent back pain and progressive lower extremity weakness for 1 week**.

• **PMH**: 8.1cm AAA s/p EVAR and resection of infected aneurysmal hematoma (in 9/2014 in the UK)

• **SH**: Receives medical care in the Middle East, the UK, and the USA.

• **Exam**: Afebrile, BP 112/68, HR 108. Exam otherwise significant for a I/VI systolic murmur at the LSB, minimal tenderness overlying the lumbar spine, 3/5 right lower extremity strength, 2/5 left lower extremity strength, decreased light touch sensation and absent DTRs in lower extremities.

• **Labs**: all cultures negative at the time of presentation
3. Our Patient: Vertebral Body Changes and Epidural Space Involvement on T1 MRI

- Decreased disc and vertebral body signal intensity, loss of endplate definition
- Homogenously enhancing phlegmon with multiple small ring enhancing abscesses in the epidural space
- Magnetic susceptibility artifact
3. Our Patient: Psoas Abscess on T1 MRI

Axial C+ T1-Weighted MRI Lumbar Spine

- Ring enhancing fluid collection suggestive of psoas abscess
- Magnetic susceptibility artifact
3. Our Patient: Vertebral body changes on T2 and STIR MRI

- Increased intervertebral disc signal intensity
- Magnetic susceptibility artifact
3. Our Patient: Vertebral Body and Intervertebral Disc Changes on Plain Film

- Disc space narrowing, end plate erosion, and vertebral body destruction
- Aortoiliac stent graft
3. Our Patient: Psoas Abscess and Vertebral Body Changes on CT

Coronal and Axial C-CT Lumbar Spine

- Fluid collection suggestive of psoas abscess
- Destructive changes of the vertebral body with end-plate destruction
3. Our Patient: Differential Diagnosis

• Focal Vertebral Body Abnormality with Low T1 signal and High T2 signal:
  • Infection (Osteomyelitis or Discitis, including Pott Disease)
  • Acute Fracture
  • Degenerative Joint Disease
  • Flow artifact from aorta or iliac arteries
  • Primary bone tumor
  • Osseous metastasis
  • Multiple Myeloma

3. Our Patient: Differential Diagnosis

• Extradural Lesion with Abnormal Adjacent Bone:
  • Infection (Osteomyelitis with epidural abscess or granuloma)
  • Osseous metastasis with epidural involvement
  • Osteoporosis with fracture and granulation tissue
  • Posttraumatic fracture fragment or hematoma
  • Spinal neoplasm
  • Lymphoma

3. Our Patient: Clinical Course

• **April 2015**: Urgent decompression via L3-L4 corpectomy via anterior approach with L2-L5 anterior fusion
  - Psoas abscess had increased in size since previous drainage, so drained by IR.
  - Epidural culture were positive for *Coxiella burnetti*

• **May 2015**: L3-L4 laminectomy via posterior approach with L1-S1 posterior fusion

• **June 2015**: Readmitted for fever, found to have new L psoas abscess and new sinus tract to R psoas abscess
3. Our Patient: Post-Operative Plain Film

- Posterior L1-S1 Fusion
- Anterior L2-L5 Fusion
- Aortoiliac stent-graft
4. Summary

- Vertebral osteomyelitis most often affects adjacent vertebrae in the lumbar spine, and results either from hematogenous seeding, direct inoculation, or contiguous spread.

- MRI spine with and without contrast is the best imaging modality for detecting vertebral osteomyelitis and its complications, including epidural abscess (which requires urgent neurosurgical decompression).

- Findings on MRI include decreased disc and vertebral body signal intensity as well as loss of endplate definition on T1, and increased disc signal intensity on T2. Ring enhancing fluid collections are suggestive of abscess.
References


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