POTT’S DISEASE:
A Radiological Review of
Tuberculous Spondylitis

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1. Explain the evaluation, diagnosis and treatment of spinal tuberculosis.

2. Review features of spinal tuberculosis on radiographs, CT and MRI.

3. Focus on the diagnosis of spinal TB using radiographs, as this is the primary modality available in many resource limited settings where spinal TB is endemic.
Our Patient: Initial Presentation

- A 40 year old healthy Kenyan woman, Ms B.G, presented to her PCP with a **1 yr history of low back pain** (LBP) that began after a fall.
  - Sharp, unremitting pain exacerbated by movement, without radiculopathy
  - Physical exam was unremarkable
  - Minimal relief with NSAIDS and physical therapy

- She became **pregnant** three months later.
  - LBP continued and worsened throughout pregnancy

- Postpartum
  - Developed **bilateral anterior thigh paresthesias** exacerbated by sitting
  - Due to failure to respond to conservative therapy, she was sent for radiological evaluation.

Further exploration of this topic requires a review of the anatomy of the spine and of a differential diagnosis of low back pain.
Spine Anatomy

CERVICAL
- Vertebral body
- Transverse process
- Intervertebral disc
- Spinous process

THORACIC
- Vertebral body
- Transverse process

LUMBAR
- Vertebral body
- Transverse process

Pedicle

Vertebral body

Intervertebral disc

Spinous process

http://www.soifamordanek.com
http://www.columbiaspine.org
http://www.fla-ortho.com
Differential Diagnosis Low Back Pain

• MECHANICAL
  – Degenerative disk disease, compression fracture, musculoskeletal sprain or strain

• NEUROGENIC
  – Disk herniation, sciatica, spinal stenosis, infection, malignancy, connective tissue disorder (ie. ankylosing spondylitis)

Others:
• VISCEROGENIC
  – UTI, pyelonephritis, retroperitoneal tumor or bleed
• VASCULAR
  – Abdominal aortic aneurysm
• PSYCHOGENIC

With this differential in mind for patient BG, further imaging revealed infection of the spine.
Introducing Pott Disease

• Known by many names: spinal tuberculosis, tuberculous spondylitis, *Pott* disease or *Pott’s* disease

• First described in 1782 by Percival Pott, a British orthopedic surgeon.

• **Differential diagnosis** of Pott disease
  – Pyogenic or fungal osteomyelitis
  – Eosinophilic granuloma
  – Multiple myeloma
  – Multiple compression fractures
  – *Note:* Brucellosis of the spine and Pott disease are radiologically indistinct.
Our Patient: Imaging

• Ms. BG’s diagnosis was made based on her imaging

• Imaging
  • **Plain film** of the spine demonstrated compression fracture L1-2 with anterior kyphosis
  
  • **MRI** spine revealed
    • T12 – L3 vertebral osteomyelitis
    • L1-2 compression fractures with forward angulation
    • Cauda equina impingement
    • Left psoas abscess
Our Patient: Radiograph

Lateral radiograph

Anterior collapse of L1, L2 vertebrae with loss of disk space. (*)

Central lucencies within the L1 vertebrae (*).
Noncontrast axial CT

Large left psoas abscess with hypoattenuated core region.
Our Patient: MRI Spine

Sagittal T2W

Destruction of L1-L2 disk space and collapse of adjacent vertebral bodies (*) with retropulsion into the spinal canal(*). In image, edema in T12 to L3 vertebral bodies (*), suggestive of spinal osteomyelitis.
Our Patient: Clinical Outcome

• **Diagnosis:** Pott disease was diagnosed based on
  – Radiologic findings
    1) psoas abscess
    2) continuous anterior vertebral body destruction
    3) cord compression
  – Emigration from an area with endemic tuberculosis
  – Indolent nature of symptoms

• **Treatment:**
  – Patient was placed on bed rest and fitted for a thoracolumbosacral orthosis (TLSO)
  – Underwent debridement and spinal stabilization
    • Mycobacterium tuberculosis was isolated from surgical specimens and sputum
  – Placed on a long course of Rifampin, Isoniazid, Pyrazinamide, & Ethambutol
Pott Disease: Epidemiology

• Pott disease is uncommon in the United States
  – U.S. versus Kenya (homeland of case patient)
    4/100,000/yr : 384/100,000/yr
  – Spinal tuberculosis loosely reported as 100-200 cases yearly

• Skeletal tuberculosis
  – Accounts for 10% of all cases of extrapulmonary TB
  – Targets the hips, knees, spine
  – Spinal tuberculosis is most common, accounts for 50% all skeletal TB cases

• Clinical presentation varies by geographic location
  – High TB prevalence
    • Pott disease is commonly seen in children
    • Targets thoracic vertebrae
  – United States
    • Seen in immigrants from endemic countries, immunocompromised, men > women
    • Targets lumbar vertebrae
Pott Disease: Pathophysiology

• **Tuberculosis infiltrates the spine via**
  – Hematogenous spread through the dense vasculature of cancellous bone of the anterior vertebral bodies
  – Lymphatic spread from para-aortic lymph nodes possible but rare

• **Up to 75% of infected individuals develop a soft tissue infection**
  – Commonly occurs in the psoas muscle → “cold abscess”
    • Known as cold abscess because forms slowly and does not normally present with heat, inflammation or pain
  – Paraspinal fistula which may form a communication with the chest wall or pelvic floor

• **Left untreated, degeneration and inflammation of the vertebrae causes**
  – Herniation into the cord space → cord compression and cauda equina
  – Kyphosis → gibbous (severe kyphosis)
  – Paraplegia
Pott Disease: Complications

Gibbous

*Later*al radiographs and T2W MRI

Young male with gibbus deformity (A) at thoracolumbar junction seen on radiograph (B) and T2W MRI (C).

Cord Compression

*Radiograph* (1), *sagittal CT reconstruction* (2) and *MRI* (3) of a 70 year old man with Pott disease.

Note continuous vertebral body destruction of thoracolumbar spine, causing severe kyphosis.

Patient developed compression of the conus medullaris, resulting in inability to ambulate.

Oguz et al.- http://www.springerlink.com.ezp-prod1.hul.harvard.edu/content/h482j21x5548q078/fulltext.pdf

Pott Disease: Diagnosis

• Physical Diagnosis:
  – Usually presents with 4 month to 3 year history of low back pain with or without associated neurological deficits.
  – Signs of nearby cold abscess or fistula may be present
  – Only 20% present with concomitant TB lung infection
  – Routine lab tests and the Mantoux skin test are of little diagnostic aid

KEY POINT: Must maintain high clinical suspicion in order to make the diagnosis of tuberculous spondylitis in a timely fashion.
Pott Disease: Pathology

- **Definitive diagnosis:**
  - Made via sputum or biopsy showing **acid fast bacilli** or pathognomonic **caseating granulomas** in tissue sample.
Pott Disease: Imaging

- **Menu of tests**
  - May start with **plain film** to visualize gross deformities i.e. kyphosis, fracture.
  - **CT** is good for visualizing disco-vertebral lesions and paravertebral abscess, particularly for abscess calcification.
  - **MRI** provides the best visualization of the extent of spinal canal and soft tissue involvement. Allows for early detection.

Examples of types of imaging modalities:

- **Lateral Radiograph** - shows signs of early disk destruction (*)
- **Coronal T2W MRI** - disk destruction and bone marrow edema (*)
- **Transaxial CT** - large left paravertebral abscess (*)

Oguz et al. - http://www.springerlink.com.ezp-prod1.hul.harvard.edu/content/h482j21x5548q078/fulltext.pdf
Pott Disease: Additional Imaging

• Lesser used imaging modalities include:
  
  – Bone scintigraphy
  
  – Ultrasound- useful in visualizing paraspinal abscesses

46 year old male with spinal TB on bone scintigraphy

Increased radionuclide uptake in thoracic and lumbar spine (*) secondary to increased bony metabolism from infection.
Radiographs: General Features

• **Features of Pott’s on radiograph include**
  – Signs of infection with lytic lucencies in anterior portion of vertebrae
  – Disk space narrowing
  – Erosions of the endplate
  – Sclerosis resulting from chronic infection
  – Compression fracture
  – Continuous vertebral body collapse
  – Kyphosis; gibbous (severe kyphosis)

• **Atypical features**
  – Soft tissue swelling from paraspinal abscesses, +/- calcification
  – Involvement of only one vertebral body
  – Involvement of several vertebral bodies *without* intervertebral discitis
  – Bowing of rib cage secondary to collapse of multiple vertebral bodies
  – Destruction of lateral or posterior aspects of vertebral bodies
Radiographs: Erosions

- Lucent area in lateral aspect of adjacent vertebral bodies ➔ erosions (*)
- Loss of intervertebral disk space (*)
- Central lucency (*) with surrounding sclerosis suggesting chronic infection (*)

Radiographs: Endplate Destruction

Image 1
Lateral radiograph of spinal TB in a 23 yo man showing endplate erosion, loss of disk space (*), and anterior compression fracture of the lumbar spine.

Image 2
Lateral radiograph of 56 yo man with Pott disease with additional features of sclerosis at vertebral endplates that have undergone severe compression and erosion (*).
Radiographs: Osteosclerosis

**Image 1**
Frontal radiograph 45 yo female. Note compression fracture with loss of intervertebral disk space (*).

**Image 2**
Lateral radiograph of 56 yo male. Similarly, note compression fracture and secondary osteosclerosis (*).
72 yo M with long history of long history of spinal TB.

Note collapse of multiple thoracic vertebrae (*) with resulting bowing in of ribs (*).
Paraspinal abscess seen with circular calcified mass (*).
CT: Features

Features on CT

- Soft tissue findings
  - Abscess with calcification is diagnostic of spinal TB; CT is excellent modality to visualize soft tissue calcifications

- Pattern and severity of bony destruction
  - Pattern of vertebral body destruction - fragmentary, osteolytic, localized and sclerotic, and subperiosteal

- Used to guide needle in percutaneous needle biopsy of paraspinal abscess
Noncontrast axial CT

Large psoas abscess (*) with central calcification (*); these features are highly diagnostic of spinal TB.
Noncontrast axial CT

Extensive vertebral body destruction causing bony fragments (*). Destruction of cancellous bone indicated by hypoattenuation of central vertebral body (*).
MRI: Features

- Highly sensitive and specific for spinal TB
- Provides early detection
- Best to distinguish exact extent of spinal cord and soft tissue involvement

- **Features**
  - Edema of vertebrae and disk space
  - Signs of spinal compromise i.e. cord compression
  - *Note*: Poorly visualizes calcification in abscesses
MRI: Spinal Cord Involvement

Sagittal T2W (Images 1-3) and axial T1W (Image 4)

High intensity activity in T12 to L3 vertebrae indicative of infection (*). Complete destruction of vertebral bodies with osseous retropulsion into the spinal canal, causing cauda equina (*). On axial view, note destruction of vertebral body with loss of circular shape (*).
Pott Disease: Treatment

- Various imaging modalities are useful in determining extent of disease.
- Treatment options then depend on the degree of spinal destruction.

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<tr>
<th>TYPE</th>
<th>LESION</th>
<th>TREATMENT</th>
<th>SAMPLE</th>
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<tbody>
<tr>
<td>Type I</td>
<td>A</td>
<td>The lesion located in vertebra, one level disc degeneration, no collapse, no abscess, no neurologic deficits.</td>
<td>Fine needle biopsy and drug therapy</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>Abscess formation, one level disc degeneration, no collapse, no neurologic deficit</td>
<td>Abscess drainage &amp; debridement</td>
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<tr>
<td>Type II</td>
<td></td>
<td>Vertebral collapse (pathological fracture) Abscess formation Kyphosis (correctable with anterior surgery) Stable deformity, with or without neurological deficit. Sagittal index &lt; 20°</td>
<td>1. Anterior debridement &amp; fusion 2. In existence of neurologic deficit decompression should be added 3. Strut cortical graft is used for fusion</td>
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<tr>
<td>Type III</td>
<td></td>
<td>Severe vertebral collapse Abscess formation, Severe kyphosis Instable deformity, with or without neurological deficit. Sagittal index ≥ 20°</td>
<td>1. Anterior debridement &amp; fusion 2. Decompression 3. Correction of deformity &amp; internal fixation (anterior, posterior or both)</td>
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GATA Classification

Most practicing clinicians simply define Pott’s as **EARLY** or **LATE** disease.

Oguz et al.- http://www.springerlink.com.ezp-prod1.hul.harvard.edu/content/h482j21x5548q078/fulltext.pdf
Conservative Treatment

• Early Disease:
  
  – Treat with a four drug regimen for six to twelve months
  
  – Common antibiotics are Rifampin, Isoniazid, Pyrazinamide, Ethambutol
  
  – Most individuals experience full resolution of symptoms with appropriate anti-tuberculosis treatment
Surgical Interventions

- **Late Disease:**
  - Loosely defined by neurologic deficits, spinal kyphosis >40%, or failure of medical therapy
  - Surgical debridement, abscess drainage, and/or vertebral fusion in addition to antibiotics

Young man with gibbous deformity (*) status post instrumentation surgery.
Note stabilization of spine and resolution of gibbous (*).

Our index patient, Ms. BG after spinal debridement and vertebral fusion.
Summary

• **Imaging modalities** are plain film, CT and MRI; **MRI is gold standard** for imaging spinal TB.

• Spinal tuberculosis is not common in U.S., therefore must **maintain high clinical suspicion** so as not to overlook diagnosis, especially among immigrant populations.

• Diagnosis and treatment of spinal TB in endemic areas is difficult given resource limitations; rely on **radiographs and clinical signs** to facilitate early diagnosis.

• **Conservative versus surgical treatment** of Pott disease depends on degree of spinal destruction, making early diagnosis essential for a positive outcome.
References

Chang et al. Tuberculous spondylitis and pyogenic spondylitis: comparative magnetic resonance imaging features. Spine. 2006 Apr 1;31(7):782-8
Acknowledgements

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