Tuberculous Spondylitis
(a.k.a. Pott’s Disease)

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Our Patient S.T.

- 82 year old male from China
- PMH:
  - s/p brachytherapy for prostate cancer in 1997
  - h/o pulmonary TB as a teenager, treated with Chinese medicine
- HPI:
  - 3 month history of progressive lower back pain
  - Outside lumbo-sacral spine films reveal:
    - “mild degenerative changes & stable L2 compression fracture”
- A/P: lumbar spondylosis & stable L2 compression fx
  - Daypro 600mg PRN
  - Exercise
  - Bracing
Anatomy of Spine

Cervical vertebrae (7)

Thoracic vertebrae (12)

Lumbar vertebrae (5)

Sacrum

Anatomy of Lumbar Vertebra

Vertebral body

Pedicle

Transverse Process

Lamina

Spinous Process

Anatomy of Paraspinal Muscles

Vertebral Body of L2

Psoas muscle

Transverse process

Spinous process of L1

Erector spinae muscle

DDx for Low Back Pain in S.T.

- Metastatic Prostate Cancer
- Lumbar Spondylosis (degenerative changes)
- Musculoskeletal Tuberculosis
- Other:

**Major Causes of Low Back Pain**

**Radicular** — with evidence of nerve root involvement
- Intraspinal causes
  - Proximal to the disc (causa equina) — neurofibroma, ependymoma, meningoma
  - Disc level — herniated intervertebral disc, spinal stenosis (canal or lateral recess), synovial cyst of facet joint
- Vascular — arteriovenous malformation (AVM) of spinal cord, spinal dural A-V fistula
- Extraspinal causes
  - Pelvic — vascular, gynecological (endometriosis), sacroiliac joint, retroperitoneal neoplasms affecting the lumbosacral plexus, lumbosacral plexitis
  - Peripheral nerve — mononeuropathy, polyneuropathy (diabetic and other), trauma, local neoplasm, herpes zoster (shingles)

**Nonradicular** — no evidence of nerve root involvement
- Traumatic — musculoskeletal strain, vertebral compression fracture, transverse process fracture
- Chronic or subacute — spondylosis and degenerative disc disease, spondylolisthesis, sacroiliac joint disease, muscular (chronic and repeated strains), deconditioning, postural, "fibromyalgia"
- Nonmechanical low back pain
  - Referred pain — abdominal or retroperitoneal (e.g., abdominal aortic aneurysm, pancreatic disease, endometriosis)
  - Infection — bone, disc, epidural, urinary tract (especially in women)
  - Neoplasm of vertebrae or epidural space — metastatic tumor, multiple myeloma, primary bone tumor
  - Rheumatologic disease — ankylosing spondylitis, degenerative disease and other arthropides
  - Miscellaneous metabolic and vascular diseases — osteopenia with compression fracture, Paget's disease, Psychogenic

Lumbo-sacral films for S.T.

Both Images From BIDMC, Boston, MA
Diagnosis of S. T.

• **First Diagnosis:** Lumbar spondylosis with a stable L2 compression fracture

• However, due to history of prostate cancer, bone scan and CT were performed to rule out mets…

• Bone scan revealed increased tracer activity at the L1/L2 disc space involving the inferior L1 end plate and superior L2 end plate

• CT revealed no evidence of recurrent prostate cancer, but some unexpected findings…
CT for S.T.

- **Psoas abscess**
- **Acute destructive changes in L1-L2**
- **Moth eaten appearance of vertebral body**

All Images From BIDMC, Boston, MA
Diagnosis of S. T.

- CT guided aspiration was performed of R psoas abscess
  - Ziehl Neelson acid fast stain was negative
  - Culture revealed *Mycobacterium Tuberculosis*

- **Second Diagnosis**: Pott’s disease
  - secondary to primary pulmonary infection > 50 years ago!

- In the weeks following this diagnosis, S.T. began to experience increased pain and new onset urinary incontinence

- MRI performed to evaluate degree of spinal cord compression and to assess the need for urgent surgical correction...
MRI for S.T.

Paraspinal abscess within the Psoas Muscle

Pott’s Disease of L1 & L2 vertebral bodies and disc space, resulting in severe central canal stenosis & cord compression

All Images From BIDMC, Boston, MA
Epidemiology of TB in the U.S.

• Peak from mid-1980s to early 1990’s
• Downward trend with lowest rate in 1998
• Worldwide infection in 1.9 billion people
  – Almost 1/3 of the world’s population
  – >75% of cases in south & east Asia & sub-Saharan Africa
• Risk factors for TB:
  – Immunosuppression: 10.7 million also infected with HIV
  – Poor health care delivery and/or Poverty
  – Age: >65 yo are 6% of the population, but 26% of TB
Pathogenesis of *M. Tuberculosis*

- Transmission; airborne particles of 1-5 micrometers
- Infection; inhalation of these particles of bacteria
  - Bacteria are deposited in terminal alveoli
  - Macrophages consume & bring bacilli to lymph nodes

Pathogenesis of *M. Tuberculosis*

- **Primary TB; initial infection**
  - Self-limited, mild pneumonic illness usually undiagnosed
  - Bacillemia and seeding may occur eventually leading to reactivation in other lung areas and extrapulmonary sites

- **Latent TB; organisms dormant**
  - Pulmonary or extrapulmonary
  - May be weeks or years

- **Secondary TB; reinfection or reactivation of latent TB**
  - Multiple caseating granulomas primarily in the upper lobes
  - Extrapulmonary disease
Transmission

Clinical Symptoms

- Fever
- Night sweats
- Anorexia
- Weight loss
- Weakness
Primary Pulmonary Tuberculosis

The “Ghon Complex”

Granuloma

Hilar lymphadenopathy

Granuloma

Granuloma in a hilar lymph node


Secondary Tuberculosis

Focal calcifications

Extensive granulomatous disease

Granulomas with caseous necrosis

Miliary Tuberculosis

• Multitude of 2-4 mm tan granulomas scattered throughout the lung parenchyma
• Occurs when the immune response is poor or overwhelmed by extensive infection

Extra-pulmonary Tuberculosis

• Most common sites:
  – Lymph nodes
  – Pleura
  – Bones or Joints

• Other sites:
  – Genitourinary system
  – Central nervous system
  – Abdomen
  – Pericardium
  – Rarely, virtually any other organ can be involved
Spinal Tuberculosis

- First described by Sir Percivall Pott in 1779
  - Destruction of 2 or more contiguous vertebrae and apposed end plates, disk infection and commonly a paraspinal mass
- Most frequent site of osseous involvement by TB
  - Approximately 50% of skeletal TB
- Most commonly in upper lumbar and lower thoracic
- Usually >1 vertebral body is involved
- 10% with neurological complications:
  - Paraplegia, paraparesis, spinal cord compression
- Relative success in control of TB in the U.S. has led to a low clinical index of suspicion which delays Dx
Epidemiology and Pathogenesis of Spinal TB

- **Primary TB**: bacillemia seeds entire body, but vertebral bodies particularly vulnerable due to high blood flow
- **Small foci of infection**: confined by local immunity & the extrapulmonary infection is clinically inapparent
- **Balance**: immune system continually attacking small, reactivating foci by Th1 cellular immune response
- **Local immune defense fails**: due to poor nutrition, age, HIV or renal failure
  - At this time, reactivation can occur
Clinical Spinal TB

- Local pain, more severe over weeks to months
- Muscle spasm, rigidity
- Occasional fever, weight loss
- Cord compression resulting in paraplegia
Diagnosis and DDx

• **Dx:**
  – Personal or family history should be elicited
  – CXR and history may not be positive
  – PPD not always helpful

• **DDx:**
  – Pyogenic infection, esp. *S. Aureus*
  – Fungal infection
  – Granulomatous disease
  – Neoplasm
Radiologic Manifestations

• **Begins**: superior or inferior anterior vertebral body, adjacent to end plate (discovertebral junction)
• **Spreads**: to intervertebral disc, narrowing disc space due to herniation of disc into collapsed vertebral body
• **Progresses**: to vertebral collapse, anterior wedging & gibbus formation with kyphosis & scoliosis
• **Rarely**: extends to pedicles, laminae or transverse/spinous processes
• **No reactive sclerosis or periosteal reaction in remainder of the vertebra**
Radiographic Diagnosis

• **Menu of Tests:**
  
  • **Plain film:** initial evaluation, negative in early disease
    – No pathognomonic distinction from pyogenic spinal infection
    – Loss of vertebral height/ collapse of vertebral body
    – Contiguous vertebral involvement
    – Lytic destruction of anterior vertebral body with wedging
    – Reactive sclerosis on a progressive lytic process
    – Paravertebral masses – possibly an enlarged psoas shadow
    – Disc space narrowing due to destroyed intervertebral discs
    – Vertebral end plates are osteoporotic
  
  • **Bone Scan:** limited value, sensitive, not specific
    – Technetium-99 uptake is increased in osseous TB & may mimic metastases
Radiographic Diagnosis

- **Menu of Tests:**
- **Plain film:**

  - Asymmetry of Psoas
  - Destruction of L1 & L2

Both Images From BIDMC, Boston, MA
Radiographic Diagnosis

• **Menu of Tests:**
  • **CT:** especially for guiding percutaneous biopsy and post-drainage follow up
    – Better bony detail of irregular lytic lesions, sclerosis, disk collapse & disruption of bone circumference
    – Better soft tissue assessment in epidural and paraspinal areas
    – Early lesions more likely to be detected
    – End plate destruction
    – Fragmentation of vertebrae
    – **Paravertebral calcifications**
      • likely in TB, but not in pyogenic infections
Radiographic Diagnosis

• **Menu of Tests:**

• **CT:** Patient is a 17 year old Ethiopian girl with 4 month history of fever, malaise, weight loss and head, neck and back pain

Retropharyngeal abscess surrounding left arch of atlas & extending into spinal canal


Pott’s Disease of the cervical spine

Pott’s Disease of the thoracic spine
Radiographic Diagnosis

• **Menu of Tests:**

• **MRI:** optimal modality for evaluation
  - High sensitivity for early disease
  - Visualize entire spine and canal
  - Define epidural, paravertebral, intraosseous abscesses, cord compromise
  - Demonstrate soft tissue extension & encroachment on important structures
  - Effective for demonstrating neural compression
  - In developed countries, MRI has virtually replaced CT
Radiographic Diagnosis

• **Menu of Tests:**

• **MRI:** Patient is a 62 year old man with progressive weakness of his legs & 3 months of back pain, night sweats, & weight loss.

Non-radiographic Diagnosis

• **PPD:**
  – Determine diameter of induration in 48-72 hours
  – >5mm: HIV+, immunosuppressed, recent contact, CXR+
  – >10mm: high prevalence or high risk patients
  – >15mm: low risk patients
  – False Negative: anergy, HIV+, malignancy, error
  – False Positive: prior BCG vaccine, atypical cross reaction

• **Microbiology**
  – Recommended in non-endemic countries
  – AFB positivity is suggestive
  – Culture is diagnostic
  – Synovial or bone bx is more accurate than FNA
  – Start anti-TB drugs at time of bx to avoid dissemination
Treatment

- Anti-TB chemotherapy with pulmonary TB regimens of 3-4 drugs
- Treat for 12-18 months for because drug penetration into osseous and fibrous tissues is poor
- Surgery, when available, for drainage of abcesses, debridement of infected material, and decompression and stabilization of vital structures (e.g. spinal cord)
- Monitor response to therapy by clinical symptoms

- Anti-TB chemotherapy agents:

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Conclusions

• To diagnose spinal TB, one must consider the possibility
• Rarity leads to clinician inexperience
• Early manifestations are subtle
• Remember Sir Pott’s description:
  – Destruction of 2 or more contiguous vertebrae and apposed end plates, disk infection and commonly a paraspinal mass
• Negative PPD and Negative CXR do not exclude TB
• Conclusive diagnosis requires biopsy and culture
• Radiologist must be aware of high risk groups, because early diagnosis can lead to effective treatment with Abx
References

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