Pott's disease in a child

Carole SCHEIFER,
Université Pierre et Marie Curie, Paris, France, 6th Year

Clinical rotation at the BIDMC
Gillian LIEBERMANN, MD
September 2014
Pott`s disease: Agenda

- Epidemiology
- Anatomy review
- Pathophysiology
- Imaging findings and their modalities: our index case and companions cases
- Differential diagnosis
Tuberculous spondylodiscitis or Pott's disease

The man who gave his name to the disease was **Percival Pott**, a leading surgeon in London in the 18th century and the first person who made the description of the disease.

The Royal College of Surgeons of England

http://www.bbc.co.uk/arts/yourpaintings/paintings/percivall-pott-17131788
Pott's disease: an introduction

- Infection by *mycobacterium tuberculosis*
- Association of an inflammation of the disc called **discitis** and an inflammation of one or more vertebrae, usually adjacent to the disc space, called **spondylitis**, resulting in spondylodiscitis
- Slow growth, and therefore slow progression of the infection
- Frequent delay in diagnosis because of wide range in clinical presentation
Pott`s disease: Epidemiology

Tuberculosis

- TB is according to the WHO the second greatest killer worldwide due to a single infectious agent (WHO), after AIDS
- 95% of TB death occur in low- and middle-income countries
- In 2012, an estimated 530,000 children became ill with TB and 74,000 HIV-negative children died with TB
- About 10,000 cases of TB were reported in the USA in 2012

Pott`s disease

- The spine is the most common site for osseous involvement by Tuberculosis (about 50%)
- The most likely part of the spine to be affected is the thoracic spine
- Pott`s disease represents 1-5% of all TB cases

WHO Statistics 2014
Anatomy of the spine

24 vertebrae divided in 4 parts:
- Cervical spine
  7 first vertebrae
- Thoracic spine
  12 vertebrae articulating with the 12 pairs of ribs
- Lumbar spine
  5 vertebrae
- Sacrum

Anatomy of the spine

Normal curvature: The normal "S"-like curve

Lordosis

Kyphosis

Cervical
Thoracic
Lumbar
Sacrum
Coccyx

Anatomy of the vertebra

Vertebral body

Spinous process

Transverse process

Pedicle

Emplacement for the intervertebral disc: endplate

http://www.spineuniverse.com/sites/default/files/imagecache/gallery-large/wysiwyg_imageupload/3998/2014/02/24/lumbar%20vertebrae.jpg
Pathogenesis of Pott's disease

- The first step is a **reactivation** of quiescent primar tuberculosis in a distant site
- Extension is usually **hematogenous** spread
- The initial site of infection in a vertebra is usually the **anterior corner** because of its rich vascularization in adults
- The spread is done via anterior spinal artery or retrograde infection through Batson's venous plexus: the theories are controversial
Pathogenesis of Pott's disease

- As the disk is avascular there is no direct initial infection spreading to the disc, except in children.
- Further the infection spreads within the vertebral body, then to the opposite endplate and the disc space creating a spondylodiscitis,
- It continues to the vertebral arch and then it extends to the adjacent vertebrae beneath the anterior or posterior longitudinal ligaments.

Spondylodiscitis: a red flag for endocarditis, a case report, C Mauffrey, The Internet Journal of Orthopedic Surgery, Volume 3, Number 2
Clinical presentation of Pott's disease

- Frequent delay in the diagnosis because of non-specific clinical presentation
- Longstanding back pain
- Lower limb weakness and other neurological deficits
- Fever and weight loss
- 50% chance of having associated TB

Museum of the Royal College of Surgeons, Edinburgh
Our Index case...

Our patient is an 8-year-old girl from Haïti with early onset of scoliosis/kyphosis
Usual first imaging....

**Plain film**

The reasoning:

- Fast
- Low cost
- Detects bone abnormality
- Gives a global overview and a first impression
XRay of the spine

Spine deformation with kyphosis

Accentuation of the thoracic kyphosis and incurvation of the lumbar spine

Chest XRay, profile, PACS Children's Hospital
XRay of spine

A normal curvature

Mayo foundation for medical education

Chest XRay, profile, PACS Children's Hospital

http://www.mayoclinic.org/~/media/kcms/gbs/patient%20consumer/images/2013/08/26/10/57/ds00194_im03006_mcdc7_scoliosisatu.jpgashx
XRay of the spine

- height loss in vertebra
- collapse of the anterior bodys resulting in kyphosis
- destructive, sclerotic changes
- disc space narrowing

At this point the most probable cause is either posttraumatic or postinfectious.
- height loss in vertebra
- collapse of the anterior body resulting in! kyphosis
- destructive, sclerotic changes
- disc space narrowing
Possible findings on an Spine XRay

- **Normal**
  - Relative preservation of disc in early stages, disc space narrowing later on
  - Irregularity of the *antero*-superior end with radiolucency
  - Erosions of the endplate
  - Compression fracture
  - Kyphosis because of vertebral body collapse, mostly of the anterior part of the vertebra

- 'Sub-ligamentous' spread: **multiple levels**

- Sclerosis resulting from chronic infection

- When trying to remember all those findings, please remember that it is a real continuum, for example: a slow destruction of the vertebral body is demonstrated by radiolucency and erosions, then results in compression fracture, which is responsible for kyphosis
Earlier findings may include:

- Radiolucency and erosions of the 2 endplates ("mirror"-image)
- Disk space narrowing

XRay of the spine, profile

http://galerieunf3s.univ-nantes.fr/main.php?g2_itemId=2299
What to do next?

CT Scan

- Better evaluation of bone lesions and their extent
- Clues to distinguish between infectious and posttraumatic origin
CT SCAN findings

- nearly complete destruction of L1 and L2
- well circumstribed lytic and sclerotic lesions.
CT SCAN findings

- preservation of posterior elements
- well circumstribed lytic lesion of the left pedicle
- well defined lytic and sclerotic lesions.
- Difficulties to evaluate epidural reaction/abscess
What to do next?

MRI of the spine

- No radiation exposure
- Excellent for soft tissue abnormality
- Better evaluation of the intervertebral disc
- Evaluation of the presence and extent of an epidural component or cord compression
- Early detection
- Highly sensitive
- Recommended by the ACR criteria in case of suspicion of infectious origin
### Clinical Condition: Low Back Pain

**Variant 3:** Patient with one or more of the following: suspicion of cancer, infection, and/or immunosuppression.

<table>
<thead>
<tr>
<th>Radiologic Procedure</th>
<th>Rating</th>
<th>Comments</th>
<th>PRL*</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRI lumbar spine without and with contrast</td>
<td>8</td>
<td>Contrast useful for neoplasia subjects suspected of epidural or intraspinal disease. See statement regarding contrast in text under “Anticipated Exceptions.”</td>
<td>O</td>
</tr>
<tr>
<td>MRI lumbar spine without contrast</td>
<td>7</td>
<td>Noncontrast MRI may be sufficient if there is low risk of epidural and/or intraspinal disease.</td>
<td>O</td>
</tr>
<tr>
<td>CT lumbar spine with contrast</td>
<td>6</td>
<td>MRI preferred. CT useful if MRI is contraindicated or unavailable, and/or for problem solving.</td>
<td>🌟🌟🌟🌟</td>
</tr>
<tr>
<td>CT lumbar spine without contrast</td>
<td>6</td>
<td>MRI preferred. CT useful if MRI is contraindicated or unavailable, and/or for problem solving.</td>
<td>🌟🌟🌟🌟</td>
</tr>
<tr>
<td>X-ray lumbar spine</td>
<td>5</td>
<td></td>
<td>🌟🌟🌟🌟</td>
</tr>
<tr>
<td>Tc-99m bone scan whole body with SPECT spine</td>
<td>5</td>
<td>SPECT/CT may be useful for anatomic localization and problem solving.</td>
<td>🌟🌟🌟🌟</td>
</tr>
<tr>
<td>CT lumbar spine without and with contrast</td>
<td>3</td>
<td></td>
<td>🌟🌟🌟🌟🌟</td>
</tr>
<tr>
<td>X-ray myelography lumbar spine</td>
<td>2</td>
<td></td>
<td>🌟🌟🌟🌟</td>
</tr>
<tr>
<td>Myelography and postmyelography CT lumbar spine</td>
<td>2</td>
<td>In some cases postinjection CT imaging may be done without plain-film myelography.</td>
<td>🌟🌟🌟🌟🌟</td>
</tr>
</tbody>
</table>

**Rating Scale:** 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

*Relative Radiation Level*
MRI findings

- Vertebral body destruction of L1 and 2, predominant on the anterior part with loss of height.
- Abnormal soft tissue within the ventral epidural and paraspinal space.
- Destruction of the disc.
- Bone marrow oedema of a third adjacent vertebra, sign for 'sub-ligamentous' spread: multiple levels.
- Compare with the normal vertebrae.
MRI findings

- Vertebral body destruction of L1 et 2, predominant on the anterior part
- Abnormal soft tissue within the ventral epidural and paraspinal space
- Destruction of the disc
- Anormal T1- Hypointensity of the vertebrae
- Compare with the normal vertebrae
Linear enhancement surrounding unenhanced centrum, well circumscribed in the epidural area, posterior to several vertebrae.

Typically the image of a collection.

Probable epidural abscess extented on several vertebral levels.
MRI findings

Linear enhancement surrounding unenhanced centrum: epidural abscess, with no sign of chord compression.

Spinal chord

MRI T1, axial, C+, PACS Children's Hospital
MRI T1, axial C-, PACS Children's Hospital
Abscess in the psoas muscle
Abscess in the right psoas muscle
...in general...

- Slow progression of lesions
- T1-hypointense lesion in the vertebral body resulting in Body collapse mostly of the anterior part with kyphotic deformity.
- Long preservation of disc space
- Contiguous spread of the adjacent discs
- Large epidural and paraspinal abscesses containing calcifications
Companion patient number two...more subtle findings...

- T1 hypointensity of the superior endplate of L5
- Disc space narrowing L4-L5.
- Enhancing after contrast of the superior endplate of L5
- Enhancing posterior to the vertebrae L4, L5 and S1 consistent with epiduritis,

Spine MRI T1 C- and C+, sagittal, COFER Diapothèque
http://galerieunif3s.univ-nantes.fr/main.php?g2_itemId=2668
Pott's disease: Differential diagnosis

- pyogenic spondylitis (or other infectious diseases like brucellosis,...)

- Mechanical: vertebral fracture (traumatic or osteoporotic)

- Benign of malign tumor
Pott's disease: Differential diagnosis

Is it possible to differentiate on imaging between...

<table>
<thead>
<tr>
<th>Pott's disease</th>
<th>Pyogenic spondylitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>No distinction on 18-FDG PET scan (Kim and al.)</td>
<td>thick and irregular enhancement of abscess wall</td>
</tr>
<tr>
<td>thin and smooth abscess wall</td>
<td>Only one vertebra</td>
</tr>
<tr>
<td>subligamentous spread to three or more vertebral levels</td>
<td>According to Jung and al.</td>
</tr>
</tbody>
</table>

Stays controversial
Our patient's outcome...

- Treatment by anti-tuberculosis medication for several months
- Drainage for the right psoas abscess
Let's summarize

- Now you know what radiological signs you should be looking for when suspecting Pott's disease
- You are informed of how important it is to know the geographic origins of your patient
- You are aware of the natural progression of Pott's disease
- You can recall the most important differential diagnosis to keep in mind
Take home messages

- Nonspecific signs
- Slow growth
- Importance of MRI for early detection and evaluation of the spine
- Higher incidence in endemic areas and in immunocompromised people
- Don't forget to screen for other locations: 50% chance of having associated pulmonary, renal,....TB
- It is rare, but it is a serious condition so make sure to always consider Pott`s disease in you differential diagnosis when confronted to a vertebral lesion of the spine
References

- WHO statistics on TB 2012
- ACR Appropriateness criteria
- Teaching Atlas of Musculoskeletal Imaging, edited by Peter L. Munk, Anthony G. Ryan
- radiopaedia.org: pott's disease
- COFER (Collège Français des Enseignants en Rhumatologie)
Credits for the picture in order of appearance

- http://www.bbc.co.uk/arts/yourpaintings/paintings/percivall-pott-17131788
- http://www.digilibraries.com/html_ebooks/109838/28428/www.digilibraries.com@28428-h@images@fig211.jpg
- http://galerieunf3s.univ-nantes.fr/main.php?g2_itemId=2299
- http://galerieunf3s.univ-nantes.fr/main.php?g2_itemId=2668
A great thank you for helping me in my presentation to..

Dr **LU Ning**, Resident in Radiology at the BIDMC

Dr **Gillian Lieberman**

Dr Colin ELLIS, Resident in Radiology at Mount Auburn Hospital

Dr Matthew MILLER, resident at the BIDMC

Dr Martin GUILLEMIN, for his relecture