Osteo-articular TB in Children

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Questions

• Spinal TB is the most common form of osteoarticular TB
  TRUE or FALSE

• Osteoarticular TB is often associated with a recent history of trauma
  TRUE or FALSE
Epidemiology of Osteo-articular TB

• OA-TB is uncommon: 1-3% of all TB and 10-20% of all extrapulmonary TB cases
• In endemic areas, children are more likely than adults to be affected
• 50% of all OA-TB is SPINAL TB (spondylitis, Pott’s disease) – thoracic spine and lumbosacral spine almost equally affected and cervical spine the least
• Next common are weight bearing joints, usually single joints – hips (50%), knees (20%) and ankle/foot (10%). elbow and shoulder joints are affected in 10-15% of cases
• In 5-10% other bones (e.g. skull, ribs, fingers and toes), sometimes multiple sites are affected (multiple sites almost always in young infants)
TB in Musculoskeletal system

Spinal TB (50%)

Extra-spinal TB

- TB arthritis (synovial disease)
  - Hip 50%, then knee, ankle (weight bearing joints)
- TB Osteomyelitis
- TB Bursitis / tendon sheath (rare)

Uncommon forms:

- Multiple cystic tuberculosis
- Disseminated skeletal tuberculosis
- Multiple diaphysitis
- Tuberculous dactylitis

Pathogenesis

- *M. tuberculosis* most common organism, although *M. bovis BCG, M bovis* and some non-tuberculosis mycobacteria (*NTM*) can also cause osteitis/arthritis.
- In children, main route of OA-TB is through haematogenous spread from a primary infection (lungs, tonsils, alimentary track). CXR-changes seen in +/- 50% only.
- Can sometimes spread lymphatically, directly from pleura into bone or direct infection from outside.
- Often in children (30-50% of cases) there is a history of previous injury.
- Spread mainly to methaphyses or directly into sinovium.
Lumbar spine TB with straight back and gibbus
TB Spine

• Mycobacteria are deposited via the end arterioles in the vertebral body adjacent to the anterior aspect of the vertebral end plate – thus the anterior portion of the vertebral body is most commonly involved

• Intervertebral disc spaces are affected LATE – preservation of the disc spaces in TB is an important diagnostic feature

• Subligamentous spread of infection may lead to multiple contiguous or “skip” vertebral body lesions

• Extension of infection into adjacent soft tissue to form paravertebral or epidural abscesses is common. Epidural abscesses may cause neurological complications (cord compression)
TB spine

- Extension of infection along the ilio-psoas muscle may result in psoas abscesses and discharging sinuses in unusual locations e.g. buttocks, groin or chest.
- In cervical spine TB, paravertebral masses may occur in retropharyngeal locations.
- Collapse of anterior vertebral body/bodies results in gibbus deformity.
TB Spine

- Usually insidious onset with slow progression
- Constitutional symptoms: fever, fatigue, weight loss and night sweats may be present
- Back pain most common complaint; infants may stop walking (due to pain). Hip pain with “flexure contracture” may indicate psoas abscess.
- Stiff/rigid spine due to muscle spasm is common
- Acute onset kyphosis/gibbus common in children
- Neurological signs (weakness/paralysis) may occur early. Paraplegia usually occur late due to missed diagnosis
- Cold abscesses and sinus formation may occur in distant locations because pus can dissect along tissue planes
- Cervical spine – torticollis, retropharynx abscess, lymphadenopathy, hoarseness
Spinal TB - pathology

Paradiscal type (most common)

• Destruction adjacent to the endplates of two (or more) vertebral bodies
• Disc space preserved until late

Differential diagnoses:

• Pyogenic vertebral osteomyelitis,
• Other infections *Salmonella typhi, Brucella*, fungi
• Tumors
  – Benign (hemangioma, bone cysts)
  – Malignant tumors (Ewing’s sarcoma, myeloma)
  – Metastases

Courtesy: Dawid Burger
TB spine diagnosis & imaging

• Plain radiography remains the first special investigation.
• Classical picture – destruction of 1-2 (adjacent) vertebral bodies with sparing of the disc space with gibbus formation and +/- paravertebral abscess
• In low prevalence TB areas difficult to distinguish TB from other causes (e.g. pyogenic and other infections and malignancies)
• Typical TB features (if present): posterior elements of vertebra involved, calcification and late preservation of adjacent intervertebral disc(s)
TB spine diagnosis & imaging

- Magnetic resonance imaging (MRI) – whole spine (to identify skip lesions). Investigation of choice (with gadolinium DTPA enhancement)
- Information on the condition of the spinal cord, soft tissue and bony elements can be obtained
- Pathology visible on MRI before plain X-rays (e.g. intravertebral abscess can be seen before collapse occurs)
- **Bacteriological/histological confirmation** (both diagnosis and DST)
- Biopsies/FNA can be technically difficult. At TBH spinal core-needle biopsies showed 12% rate of MDR-TB over period 2010-2012. History of source case DST important
Spinal TB - Radiology

- Thoracic-Spine
Spinal TB - Radiology

- Lumbar spine: Psoas shadow obliteration
Mother has PTB
Child complains of Hip pain – hip XR normal. Fatigue, does not want to walk, lost weight. ESR=75, CRP=80
Spinal TB Management

• **Anti-TB treatment:** 2HRZE/7-10HR (different opinions) but *need to consider DST* (child/source case)

• **Bracing:** Custom-fit bracing seems to prevent some progressive kyphosis and progressive neurological compromise. Difficult for children to wear these

• **Surgery:** The aims of surgery are 1) to relief neurological symptoms and 2) to prevent the progression or to correct deformity. Brace for 3-4 months after surgery
Spinal TB – causes of neuro deficit

Early onset paraplegia
• Mechanical pressure
• Tuberculous granuloma
• Tuberculous myelitis
• Spinal artery thrombosis
• Tuberculous arachnoiditis

Late onset paraplegia
• Transection of spinal cord by bony bridge / kyphotic deformity
• Fibrosis of dura

Courtesy Dawid Burger
Absolute indications:
• Marked neurological deficit (due to severe kyphosis or retropulced bone or disc – surgically correctable cause)
• Large abscesses causing respiratory distress
• Neurological deficit worsening despite adequate TB treatment
• Progression of kyphosis or instability, despite adequate TB Rx
Relative indications:

- Inability to obtain adequate material for culture/DST and diagnosis
- Persistence of pain or spasticity due to demonstrable mechanical block
- Pain related to instability
- To drain paraspinal or psoas abscesses if not responding to adequate TB treatment

Spinal TB Management – indications for surgery (3)

General indications (from literature)

- Uncertain diagnosis
- Draining of large abscesses
- Failure of conservative treatment (anti-TB Rx)
- Progression of neurological deficit
- Impeding or progressive kyphosis

Case 1

12 year old girl
Gibbus
Back pain

Deformity of 46°
Two levels affected

Courtesy Dr Dawid Burger
Case 1

Complete destruction of T11
Anterior scalloping
Large pre-vertebral abscess

Courtesy Dr Dawid Burger
Case 1

Instrumented fusion from anterior
Fibula strutgraft
Correction of sagital profile

Courtesy Dr Dawid Burger
Case 2

3 year old baby girl
Severe kyphotic deformity
Myelopathic with Frankel C neurology (2/5 power)

Courtesy Dr Dawid Burger
Case 2

Involves T4-T10 level
Sharp gibbus
Cord is tethered with long segment
myelopathic change

What to do ??

Courtesy Dr Dawid Burger
Case 2

Courtesy Dr Dawid Burger
Extraspinal OA-TB

- TB bacilli almost always spread by haematogenous route to the bone or joint
- Involvement of joints: Most commonly metaphyseal osteomyelitis (granulomas) crossing the epiphysseal plate into the joint space or seeding of the sinovium directly via the bloodstream causing tuberculous synovitis, which then spreads transphyseally to the metaphysis.
- Clinical signs: Pain (80%), loss of function (80%), swelling (30%), sinus tract formation (20%), abscess formation (20%). Frequently history of trauma!
Imaging – plain radiography

- Radiographic findings vary with site and age of lesion
- Radiological findings progressive (initially normal):
  - periarticular soft tissue swelling
  - joint effusion (initial widening of joint space)
  - osteopenia
  - subchondral cystic erosion (lytic lesions)
  - eventually joint space narrowing, collapse and sclerosis with deformity
  - finally ankylosis
Phemister’s triad
(characteristic of TB arthritis)

1. juxtarticular osteopaenia
2. peripheral osseous erosions
3. gradual narrowing of joint space
### TABLE 1.
Tuli Classification. The Natural History of Tuberculous Arthritis Progresses Through 5 Stages [71]

<table>
<thead>
<tr>
<th>Stage</th>
<th>Clinical Findings</th>
<th>Radiographic Findings</th>
<th>Treatment</th>
<th>Anticipated Outcome</th>
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<tbody>
<tr>
<td>Stage I</td>
<td>1.) Soft tissue swelling</td>
<td>1.) Soft tissue swelling</td>
<td>1.) Chemotherapy</td>
<td>Normal or minimal residua</td>
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<tr>
<td></td>
<td>2.) 75% motion preserved</td>
<td>2.) Osteopenia</td>
<td>2.) Rest</td>
<td></td>
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<td></td>
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<td></td>
<td>3.) ROM</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>4.) Splinting</td>
<td></td>
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<tr>
<td>Stage II</td>
<td>1.) Soft tissue swelling</td>
<td>1.) Soft tissue swelling</td>
<td>1.) Chemotherapy</td>
<td>50–70% mobility</td>
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<td>(early arthritis)</td>
<td>2.) 25–50% loss of motion</td>
<td>2.) Marginal joint erosions</td>
<td>2.) Rest</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.) Diminution in joint space</td>
<td>3.) ROM</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>4.) Splinting</td>
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<td></td>
<td>5.) Synovectomy</td>
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<tr>
<td>Stage III</td>
<td>1.) 75% loss of motion</td>
<td>1.) Marginal erosions</td>
<td>1.) Chemotherapy</td>
<td>Stable, painless joint</td>
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<tr>
<td>(advanced arthritis)</td>
<td>2.) Cysts</td>
<td>2.) Osteotomy</td>
<td>2.) Osteotomy</td>
<td>after salvage, with</td>
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<tr>
<td></td>
<td></td>
<td>3.) Significant loss of joint space</td>
<td>3.) Arthrodesis</td>
<td>or without motion</td>
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<td></td>
<td></td>
<td>4.) Arthroplasty</td>
<td></td>
</tr>
<tr>
<td>Stage IV</td>
<td>1.) 75% loss of motion</td>
<td>1.) Joint destruction</td>
<td>1.) Chemotherapy</td>
<td>Stable, painless joint</td>
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<tr>
<td>(advanced arthritis)</td>
<td>2.) Subluxation or dislocation</td>
<td>2.) Osteotomy</td>
<td>2.) Osteotomy</td>
<td>after salvage</td>
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<td>3.) Arthrodesis</td>
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<td>4.) Arthroplasty</td>
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<tr>
<td>Stage V</td>
<td>1.) Ankylosis</td>
<td>1.) Ankylosis</td>
<td>1.) Chemotherapy</td>
<td>Stable, painless joint</td>
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<td>2.) Osteotomy</td>
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Tuli SM. General principles of osteoarticular tuberculosis. Clin Orthop Relat Res. 2002 May
11-month-old boy

U/S: There is a large joint effusion with marked synovial thickening suggestive of a chronic synovitis/arthritis. No associated bony abnormality. Clinical correlation is required. Synovial biopsy recommended. Tuberculous arthritis to be considered.

Sinovial biopsy = TB
10-yr-old girl. History injury of L hip and thigh with pain not improving. Lytic lesions L hip as well as osteopenia and narrowed joint space.
Other imaging modalities

- Ultrasound: Effusion and synovitis
- CT: may differentiate between OA-TB and neoplasm
- MRI: findings non-specific?

Final diagnosis

- Joint aspiration or synovial biopsy
- Culture of fluid an/or tissue important, also for DST
Chronic tuberculous rheumatism (Poncet’s disease)

• Rare condition – presents as a polyarthritis associated with TB elsewhere (e.g. PTB), with no evidence of bacteriological involvement of the joints themselves (reactive arthritis)

• Treating the TB resolves the arthritis
Tuberculous osteomyelitis

- Single lesions > multifocal lesions
- Intercurrent PTB in only 50% cases
- Affects any bone including tubular and flat bones
- TB bacillus implants in the medulla of the metaphysis and less often, the diaphysis. A granulomatous lesion is formed, enlarges, caseation and liquefactive necrosis occurs. Transphyseal spread to the joint or erosion through the cortex with formation of paraosseous mass may occur
- Symptoms: Pain, swelling, erythema (redness), refusal to bear weight
Diagnosis

- Plain X-ray: soft tissue swelling, some periosteal reaction (can be extensive in infants with multiple bone lesions or dactylitis), osteolysis with minimal reactive change, periarticular osteopenia, and erosions

- Some unusual forms of osteomyelitis:
  - closed cystic TB: well defined cystic lesions in bone
  - multiple (cystic) bone lesions /disseminated bone TB
  - tuberculous dactylitis
  - closed multiple diaphysitis
TB Osteomyelitis - Radiology

Metaphyseal / diaphyseal

Transphyseal spread to the joint or erosion through the cortex with periostial response

Most common

Solitary lytic lesion

Sclerotic rim

Possible sequestrae
TB Osteomyelitis

Spina ventosa:
• a spindle shaped expansion
• multiple layers of subperiostial new bone
• occurs in the short tubular bones of the hands and feet
5-yr-old girl with parietal abscess
Biopsy confirmed TB
Treatment TB Osteomyelitis

• TB Treatment: 2HRZE/4-10HR
• Surgical intervention may be required to prevent chronicity (remove sequestrum)
• Surgery in osteomyelitis (if indicated!)
  – Sequestrectomy
  – Debridement
  – Bone grafting or transport
In Conclusion

Early clinical and radiological diagnosis is vital to preserve joint function and prevent deformity.

Antituberculous drugs are the mainstay of treatment.

Judicious surgical intervention can help to promote earlier healing and preserve function.

Courtesy Dr Dawid Burger
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