Bone and Joint Infections

Types of bone/joint infections
- Arthritis (infective/septic)
- Osteomyelitis
- Prosthetic bone and joint infections

Septic Arthritis
- Common destructive athroplasty
- Mono-articular
  - Poly-articular 10%
- Acute usually pyogenic
- Chronic usually nonpyogenic

Pathogenesis
- Usually follows haematogenous spread
- Can result from joint injection (bypassing natural defences)
- Post-infectious (following STDs or enteritis; commoner in presence of HLA-B27)

Bacterial arthritis: predisposing factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>In adults (%)</th>
<th>In children (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-existing arthritis</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>Trauma</td>
<td>32</td>
<td>28</td>
</tr>
<tr>
<td>Other diseases</td>
<td>23</td>
<td>3</td>
</tr>
<tr>
<td>Other infection</td>
<td>9</td>
<td>26</td>
</tr>
<tr>
<td>None</td>
<td>8</td>
<td>43</td>
</tr>
</tbody>
</table>

Some patients have multiple risk factors
Clinical features
- Mostly acute onset
- Monoarticular (90%)
- Fever
  - mild (60 - 80% of cases)
  - >39°C (1/3rd of cases)
- Limitation of joint movement
- Swelling (synovial effusion)

Frequency of joint involvement
- Most commonly: knee
- Also: hip, ankle, elbow
- Infrequent: wrist, shoulder, fingers

<table>
<thead>
<tr>
<th>Joint</th>
<th>Bacterial</th>
<th>Medical</th>
<th>Viral</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Children</td>
<td>Adults</td>
<td>Mycobacterial</td>
</tr>
<tr>
<td>Knee</td>
<td>41</td>
<td>54</td>
<td>24</td>
</tr>
<tr>
<td>Hip</td>
<td>23</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td>Ankle</td>
<td>14</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Elbow</td>
<td>12</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Wrist</td>
<td>4</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Shoulder</td>
<td>4</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Fingers</td>
<td>1.4</td>
<td>4</td>
<td>12</td>
</tr>
</tbody>
</table>

Several pathogens involve multiple joints

Laboratory findings
- Elevated ESR (or CRP)
- Neutrophilia (esp. in children)
- Joint (synovial) fluid examination
  - turbid or purulent
  - leucocytes >50,000/mm³, pred. neutrophils
  - Gram stain positive in one-third
- Blood culture positive in one- to two-thirds
- Culture other sites (e.g. urethra, biopsy)

Radiology
- Soft tissue swelling
- Joint capsule distension
- Destructive changes IF late (>2 weeks)
  - erosion of articular surface
  - displacement of ossific nucleus
- In mycobacterial infection
  - joint space narrowing
  - erosions
  - cyst formation

Septic arthritis x-ray
Joint space loss and loss of the subchondral line in the tectum of the acetabulum. Which side?

Septic arthritis MRI
Hyperintense joint effusion and increased signal intensity in the bone marrow. Abnormal high signal in the muscles around the hip.
**Acute bacterial arthritis**

<table>
<thead>
<tr>
<th>Bacterial Agent</th>
<th>Children</th>
<th>Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S. aureus</strong></td>
<td>11</td>
<td>33</td>
</tr>
<tr>
<td><strong>H. influenzae type b</strong></td>
<td>31*</td>
<td>1</td>
</tr>
<tr>
<td><strong>Streptococcus sp.</strong></td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td><strong>Gram negative rods</strong></td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td><strong>Anaerobes</strong></td>
<td>&lt;1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Neisseria sp.</strong></td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td><strong>Unknown</strong></td>
<td>35</td>
<td>34</td>
</tr>
</tbody>
</table>

* before introduction of Hib vaccine  
** includes S. pneumoniae, Group A streps  
*** excluded from most series

**Chronic arthritis**

- *Mycobacterium tuberculosis*
- Other mycobacteria
- *Brucella* spp.
- Fungi

**Skeletal tuberculosis**

- Haematogenous spread early in course of primary infection
- Extension from adjacent caseating lymph nodes
- Slowly progressive
- 60% have extra-osseous tuberculosis
- prolonged chemotherapy necessary

**Tuberculosis of the hip**

- Pott’s disease (a Barts man) – did the hunchback of Notre Dame have TB?

**Tuberculous osteomyelitis**

**Viral arthritis**

- Frequent in
  - rubella (>50% of adult women)
  - rubella vaccine
  - mumps
  - hepatitis B (20%)
- Rarer causes include
  - adenovirus
  - herpes viruses
  - echovirus
Management

- Differential diagnosis
  - acute rheumatoid arthritis
  - gout
  - chondrocalcinosis
- Antibiotics
  - depends on age, sexual history and Gram stain
  - consider
    - flucloxacillin
    - cefotaxime

Osteomyelitis - Pathogenesis

- Haematogenous
- Contiguous spread from an infected focus
- Acute hematogenous osteomyelitis - primarily in children
- Direct trauma and contiguous focus osteomyelitis – more common in young adults
- Spinal osteomyelitis – more common in adults over 45 years

Predisposing host factors

- Impairment of immune surveillance, e.g.:
  - malnutrition
  - extremes of age
- Impairment of local vascular supply, e.g.:
  - diabetes mellitus
  - venous stasis
  - radiation fibrosis

Acute osteomyelitis

- Predominantly S. aureus (all types and ages)
- Younger than 4 months also Group A and B Strep, E. coli
- Children (4 months-4 yrs): also Group A Strep and Haemophilus influenzae, and Enterobacter species

Direct osteomyelitis

- Also Pseudomonas species
- Sickle cell disease also Salmonellae species

Clinical features

- Hematogenous long bone – abrupt onset of high fever (only 50% in children; less in adults)
- decreased limb movement, adjacent joint effusion (infants)
- Hematogenous vertebral and chronic – insidious onset, vague complaints over 1 to 3 months
- local non-specific pain
- elevated neutrophil count (<50% of cases)
- elevated ESR

Osteomyelitis

Brodie’s abscess (studied at Barts worked at George’s)
Osteomyelitis

- Haematogenous and contiguous spread osteomyelitis can progress to chronic osteomyelitis
- Result - local bone loss and persistent drainage through sinus.
- Squamous cell carcinoma and amyloidosis are rare complications

Chronic osteomyelitis

- Bone loss and drainage through sinus

Investigations

- Bone biopsy
- Blood cultures
- Sinus tract culture NOT reliable
- Neutrophil count, ESR of limited value in monitoring response to treatment
- Radiography (changes lag infective course by 2 weeks)
- Isotope scan

Management

- Surgical debridement (may not be necessary in children)
- Antibiotics for 4-6 weeks (at least 2wks IV)
  - multiple courses may be necessary
  - consider
    - flucloxacillin
    - clindamycin
    - piperacillin
    - ciprofloxacin
Chronic osteomyelitis

Prosthetic bone and joint infection - Pathogenesis

• Occurs in osseous tissue adjacent to prosthesis
  – bone cement interface
  – bone contiguous with prosthesis (cementless devices)
• Results from
  – local inoculation at surgery or post-op spread from wound sepsis
  – haematogenous spread

Risk factors

• prior surgery at site of prosthesis
• rheumatoid arthritis
• corticosteroid therapy
• diabetes mellitus
• obesity
• malnutrition
• old age

Pathogens

<table>
<thead>
<tr>
<th>Pathogens</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staphylococci</td>
<td>53</td>
</tr>
<tr>
<td>Coagulase negative</td>
<td>28</td>
</tr>
<tr>
<td><em>S. aureus</em></td>
<td>25</td>
</tr>
<tr>
<td>Streptococci</td>
<td>20</td>
</tr>
<tr>
<td>Beta haemolytic viridans</td>
<td>12</td>
</tr>
<tr>
<td>Gram negative rods</td>
<td>20</td>
</tr>
<tr>
<td>Anaerobes</td>
<td>7</td>
</tr>
</tbody>
</table>

Usually single pathogen, multiple well described

Clinical features

• Wide spectrum of severity
• Mostly indolent course with progressive joint pain and occasionally sinus development
• Some are acute with high fever, joint pain, swelling, erythema.

Investigations

• X rays (changes in 50%)
  – luencies at bone-cement interface
  – changes in component position
  – cement fractures
  – periostial reactions
  – gas in joint
• Radio-isotope scans
• Elevated ESR, neutrophil count
• Culture of biopsy/joint fluid
Prosthesis infection

Management

• Retain / replace prosthesis
  – simple debridement (retaining prosthesis) plus antibiotics - only successful in 20% of cases
  – removal of prosthesis, antibiotics for 6wks, re-implantation of prosthesis - 90%+ success
  – removal of prosthesis, immediate re-implantation, antibiotics - 70%+ success
• Resection arthroplasty
• Suppressive long-term antibiotics

Prevention

• Before elective surgery, eliminate infected foci (e.g. bad teeth)
• Use peri-operative antibiotics
• Use laminar flow theatre ventilation
• Surgical team wear exhaust ventilated body suits
• Prophylaxis for subsequent interventions