CHRONIC OSTEOMYELITIS

Done by: Mohammad Al-Momani
Chronic osteomyelitis is a severe, persistent, and sometimes incapacitating infection of bone and bone marrow. It is often a recurring condition because it is difficult to treat definitively. A common sequel to acute haematogenous osteomyelitis.

An area of bone has been destroyed by the acute infection leaving sequestra surrounded by dense sclerosed bone called involucrum.

Sequestra provoke a chronic seropurulent Discharge which escapes through a sinus (or several sinuses) at the skin surface.
Vascular thrombosis

Bone necrosis *(Sequestrum formation)*

New bone formation occurs *(Involucrum)*

Multiple openings appear in this involucrum, through which exudates & debris from the sequestrum pass via the sinuses *(Sinus formation)*

Chronic osteomyelitis involving the metaphysis of the tibia
Bacteria can remain dormant for years, giving rise to recurrent acute flares and purulent discharges. The usual suspects are S. aureus, E. coli, S. pyogenes, Proteus and Pseudomonas.
Factors That Turn Acute Bone Infection to Chronic Osteomyelitis:

- Trauma (orthopaedic surgery or open fracture)
- Prosthetic orthopaedic device
- Diabetes
- Peripheral vascular disease
- Chronic joint disease
- Alcoholism
- Intravenous drug abuse
- Chronic steroid use
- Immunosuppression
- Tuberculosis
- HIV and AIDS
- Sickle cell disease
- Presence of catheter-related blood stream infection.
2.4 Chronic osteomyelitis  Chronic osteomyelitis may follow on acute. This young boy in (a) presented with draining sinuses at the site of a previous acute infection. The x-ray shows densely sclerotic bone. (b) In adults, chronic osteomyelitis is usually a sequel to open trauma or operation.
Following acute bone infection, the patient returns with

- **Pain**
- **Pyrexia**
- **Redness**
- **Tenderness**
- **Discharging sinus** (seropurulent discharge)
**Diagnosis**

**Sinogram (Culture of the discharge):**
- can help to localize the focus of active infection, however, that a superficial swab sample may not reflect the really persistent infection; samples should be taken from *deeper tissues*.

**Bone scans:**
- are useful in revealing hidden foci of inflammatory activity.

**x-ray:**
- features of bone rarefaction surrounded by dense sclerosis and cortical thickening; within that area there may be an obvious sequestrum.
CT and MRI: are invaluable in planning operative treatment: together they will show the extent of bone destruction and reactive oedema, hidden abscesses and sequestra.

Technetium-99m diphosphonate bone scanning (MDP) bone scans are usually positive 24 hours after an acute infection, and the scans demonstrate a well-defined focus of tracer activity 1-2 hours after the injection.
Staging Of Osteomyelitis:

- The Cierny-Mader staging system.
- It is determined by the status of the disease process.
- It takes into account the state of the bone, the patient's overall condition and factors affecting the development of osteomyelitis.
The Cierny-Mader Classification

Cierny-Mader Classification for Osteomyelitis

<table>
<thead>
<tr>
<th>Anatomic Type</th>
<th>Medullary osteomyelitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td></td>
</tr>
<tr>
<td>Stage 2</td>
<td>Superficial osteomyelitis</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Localized osteomyelitis</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Diffuse osteomyelitis</td>
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</tbody>
</table>

Physiologic Class

<table>
<thead>
<tr>
<th>A Host</th>
<th>B Host</th>
<th>C Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>Compromised</td>
<td>Treatment worse than disease</td>
</tr>
</tbody>
</table>

SYSTEMIC COMPROMISE (Bc)
- Malnutrition
- Renal liver failure
- DM
- Chronic hypoxia
- Immune deficiency
- Malignancy
- Extremes of age
- Immunosuppression
- Tobacco abuse

LOCAL COMPROMISE (Bl)
- Chronic lymphedema
- Venous stasis
- Major vessel compromise
- Arteritis
- Extensive scarring
- Radiation fibrosis
- Small vessel disease
- Complete loss of local sensation
The Cierny-Mader Classification

1: Medullary Osteomyelitis - Infection confined to medullary cavity.

2: Superficial Osteomyelitis - Contiguous type of infection. Confined to surface of bone.

3: Localized Osteomyelitis - Full-thickness cortical sequestration which can easily be removed surgically.

4: Diffuse Osteomyelitis - Loss of bone stability, even after surgical debridement.
Treatment depends on the frequency of relapsing flare-ups. If seldom, it can be **conservative**. If an abscess presents it should be **incised**. **Sequestrectomy** should be performed only if a sequestrum is radiologically visible and surgically accessible.
Antibiotics

Chronic infection is seldom eradicated by antibiotics alone. But the drug must be capable of penetrating sclerotic bone and should be non-toxic with long-term use. 

(a) to suppress the infection and prevent its spread to healthy bone
(b) to control acute flares

Antibiotics are administered for 4–6 weeks (starting from the beginning of treatment or the last debridement) before considering operative treatment.

Local treatment

A sinus may be painless and need dressing simply to protect the clothing. An acute abscess may need urgent incision and drainage.
External fixation:

may need to be applied so that internal fixation devices can be removed.

All infected and dead tissue must then be excised. After 3 or 4 days the wound is inspected and if there are renewed signs of tissue death the debridement is repeated – several times if necessary. Antibiotic cover is continued for at least 4 weeks after the last debridement.
1. pathologic fracture
2. secondary amyloidosis
3. endocarditis
4. sepsis
5. development of squamous cell carcinoma in the draining sinus tracts
6. sarcoma in the infected bone.
SEPTIC ARTHRITIS
Septic arthritis is inflammation of a synovial membrane with purulent effusion into the joint cavity, due to infection.

The joint is invaded through a penetrating wound, by eruption of an adjacent bone abscess or by blood spread from a distant site. As infection spreads through the joint, articular cartilage is eroded;

**Synovial membrane**

- Membrane surrounding joint
- Produce synovial fluid
- Contain rich capillary network
- for phagocytic and hyaluronate-producing function
• Bacterial, but sometimes viral, mycobacterial, and fungal.
• Usually caused by *Staphylococcus aureus*. Other organisms are: *E.coli*, *Proteus*, *Streptococcus*

Predisposing Factor:

- Rheumatoid arthritis
- Chronic disorder
- Intravenous drug abuse
- Immunosuppressive drug therapy
- Age >80 or very young children
- AIDS
Bacteria can gain entrance to a joint via many routes:

1. The hematogenous route.
2. Dissemination from osteomyelitis.
3. Spread from an adjacent soft tissue infection.
4. Diagnostic or therapeutic measures.
5. Penetrating damage by puncture or cutting.
**Hematogenous Spread**
Most common form of spread
Usually affect people with underlying medical problem

**Direct Inoculation**
May result from penetrating trauma
Introduction of organisms during diagnostic and surgical procedures. For eg arthroscopy and intra-articular injection

**Direct spread from adjacent focal of infection**
More common in children.
*Osteomyelitis* usually begin in the metaphyseal region, from which it breaks through the periosteum into the joint.
Synovial membrane is highly vascularised.

Bacteria can easily enter synovial joint via blood stream.

There will be inflammatory reaction with seropurulent exudate and increase in synovial fluid.

As pus appear in the joint, the articular cartilage is eroded and destroyed. Partly by the bacterial enzyme, and partly by the enzyme released from synovium, inflammatory cell and pus.

Infant
- Destroy the epiphysis, which is still largely cartilaginous.

Children
- Vascular occlusion lead to necrosis of epiphyseal bone

Adult
- Effect confined on articular cartilage
- Extensive erosion can occur due to synovial proliferation and ingrowth
a) In the early stage, there is an acute synovitis with a purulent joint effusion
b) Soon the articular cartilage is attacked by bacterial and cellular enzyme.
c) If infection is not arrested, the cartilage may be completely destroyed
d) Healing then leads to ankylosis
IF LEFT UNTREATED, IT WILL SPREAD TO THE UNDERLYING BONE AND OUT OF JOINT TO FORM ABSCESS AND SINUS.

Healing with:
1. Complete resolution
2. Partial loss of articular cartilage and fibrosis of joint
3. Loss of articular cartilage and bony ankylosis
4. Bony destruction and permanent deformity
### Clinical Features

#### In children
- ✔️ acute pain in single large joint (esp hip)
- ✔️ **Pseudoparesis**
- ✔️ Child is ill, rapid pulse and swinging fever
- ✔️ Overlying skin looks red & superficial joint swelling may be obvious
- ✔️ Local warmth and marked tenderness
- ✔️ All movements are restricted by pain or spasm.
- ✔️ Look for source of infection from septic toe or discharge ear

#### In adults
- ✔️ Often in the superficial joint (knee, wrist or ankle)
- ✔️ Joints painful, swollen & inflamed.
- ✔️ Warmth and marked local tenderness & movement restricted.
- ✔️ Look for gonococcal infection or drug abuse.
- ✔️ Patient with rheumatoid arthritis and especially those on corticosteroid may develop “silent” joint infection.
## INVESTIGATIONS

### Blood investigations
- Full blood count
- ESR
- CRP
- Blood culture

### Imaging

### Synovial fluid analysis

<table>
<thead>
<tr>
<th>Investigations</th>
<th>Explanation</th>
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<tbody>
<tr>
<td>Full blood count</td>
<td>Elevated white blood cell count</td>
</tr>
<tr>
<td>ESR</td>
<td>elevated</td>
</tr>
<tr>
<td>CRP</td>
<td>elevated</td>
</tr>
<tr>
<td>Blood culture</td>
<td>May be positive</td>
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</table>
Synovial fluid analysis

✓ Aseptic technique is used during aspiration of synovial fluid.
✓ Avoid taken from infected site of skin.
✓ The fluid is then analyzed by gross and microscopic examination and culture.

✓ Gross examinations include appearance, volume, viscosity, mucin clotting (amount of proteoglycans).

✓ Microscopic examinations include leucocyte count, staining of smears, serum glucose ratio, protein.

✓ Finally, culture and sensitivity test for definitive diagnosis and treatment.
**TABLE 4. Kocher Criteria for Septic Arthritis of the Hip (8)**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Value</th>
</tr>
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<tbody>
<tr>
<td>Temperature</td>
<td>&gt;101.3°F (38.5°C)</td>
</tr>
<tr>
<td>White blood cell count</td>
<td>&gt;12,000/µL (12×10⁹/L)</td>
</tr>
<tr>
<td>Erythrocyte sedimentation rate</td>
<td>&gt;40 mm/h</td>
</tr>
<tr>
<td>Inability to ambulate</td>
<td>MRCPCH / Pediatrics / Neonatology</td>
</tr>
<tr>
<td>*C-reactive protein</td>
<td>&gt;2.5 mg/L (23.81 nmol/L)</td>
</tr>
</tbody>
</table>

Kocke et al in 1999: the presence or absence of the above 4 clinical predictors could be used to accurately predict the likelihood of a septic hip in a child with limp.
X-ray

Early Stage — Normal except widening of joint space, **ultrasound** helpful

Look for **soft tissue swelling**, loss of tissue planes, widening of joint space and slight subluxation due to fluid in joint. Gas may be seen with *E. coli* infection

Late stage — Narrowing and irregularity of joint space

Plain film findings of superimposed osteomyelitis may develop (periosteal reaction, bone destruction, sequestrum formation).

- **MRI and radionuclide imaging**
- are helpful in diagnosing arthritis in obscure sites such as the sacroiliac and sterno-clavicular joint.
Joint space loss

subchondral erosions and sclerosis of the femoral head

osteonecrosis and complete collapse of the femoral head
General supportive care
- Analgesics
- IV fluids

Splintage
- The joint must be rested either on a splint or in a widely split plaster
- In neonates and infants, with hip infection the joint is held abducted and 30 degree flexed, on traction to prevent dislocation.

Antibiotics
Treatment is started once the blood and samples are obtained without waiting for the detail results. Choice of antibiotic depends on the most likely pathogen.
**SURGICAL MANAGEMENT**

Arthrocentesis—a needle is placed into the joint to extract and remove the joint fluid.

- **Arthroscopic debridement and copious irrigation with normal saline**—more frequently in knee joint septic arthritis

- **Amputation** esp. in ischemia & risk of sepsis
1. Acute osteomyelitis
2. Trauma
3. Hemophilic bleed
4. Rheumatic fever
5. Juvenile rheumatoid arthritis
6. Sickle-cell disease
7. Gaucher’s disease
8. Gout and pseudo-gout
Bone destruction and dislocation of the joint (esp. Hip)

Cartilage destruction
- may lead to either fibrosis or bony ankylosis
- in adult partial destruction of the joint will result in secondary osteoarthritis

Growth disturbance
- presenting as either localised deformity or shortening of the bone