

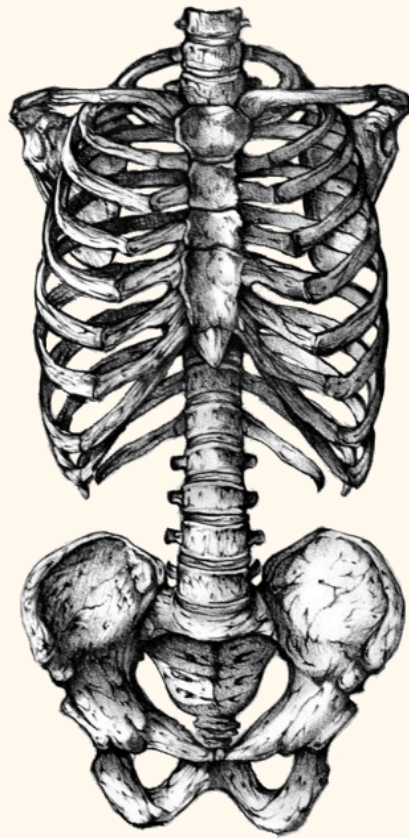
# Lecture 4

## Bone & joint infection

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### Outline

- Osteomyelitis:
  - Acute OM
  - Chronic OM
- Septic arthritis
- Other less common infections:
  - TB
  - Brucelosis



### Objectives

- 1- What is bone and joint infection?
- 2- Why we consider bone and joint infection as a **red flag**.
- 3- How does the **presentation** in children and adults differ.
- 4- What are the most involved **organisms** in children and adults.
- 5- How do we **diagnose** and confirm diagnosis of bone and joint infection.
- 6- Principles of **management** of bone and joint infection.
- 7- **Complications** of bone and joint infection.

# Osteomyelitis

(infection of the bone and bone marrow)

## 1. Acute osteomyelitis

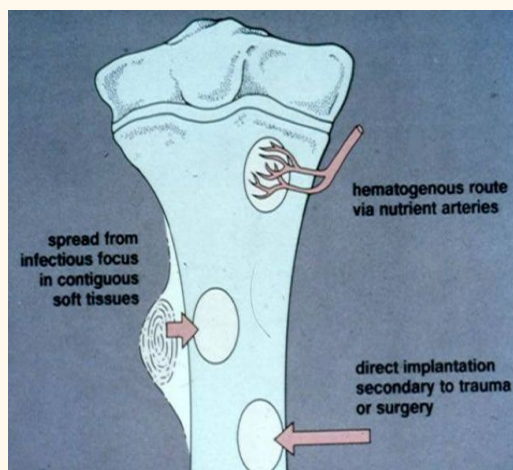
- A serious condition!
- Mainly a disease of **children** (boys > girls)<sup>1</sup>.

### Route of infection:

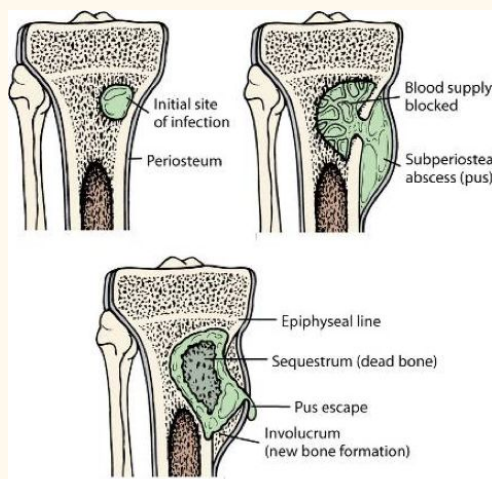
- **Hematogenous** (UTI, RTI, skin infection) most common in children
- direct (from infected nearby tissue)
- through a penetrating **wound** (open fracture).

### Spread of infection:

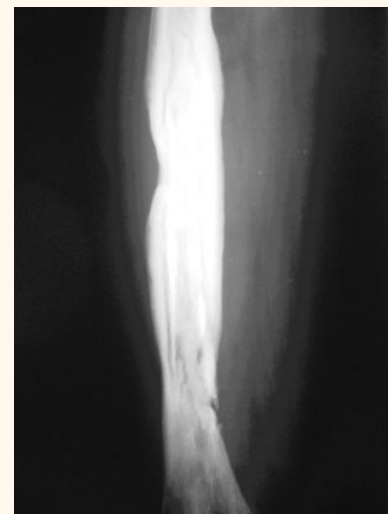
- The infection usually starts in the vascular **metaphysis** (area rich of blood supply=favours bacterial colonization)
- may spread towards the surface, to form a **subperiosteal abscess** (very painful process)
- Local blood vessels get **obstructed** = bone death (**sequestrum**)
- New bone starts forming (**involucrum**) as the body attempt to seal the pus.
- If not treated, periosteum **bursts** into soft tissues and pus becomes under skin; eventually spontaneous discharge.



Route of infection



Spread of infection



Plain x-ray showing large sequestrum inside involucrum

<sup>1</sup> More subjected to trauma

### Diagnosis:

- A. **Clinical** picture (pain, fever, refusal to bear wt.)
- B. **Laboratory** investigations (CBC, ESR, CRP)
- C. **Radiological** investigations (x-ray, U/S, bone scan, MRI)

### HOW TO CONFIRM THE DIAGNOSIS?

- The most certain way to confirm the clinical diagnosis is to **aspirate pus or fluid** from the site of infection. (under local or general anesthesia, via open incision or by needle)
- obtained material are sent urgently for **Direct Smear** and **C&S** including anaerobic, TB and Fungal, and histopathology examinations.
- **Definite** diagnosis depends on seeing organisms at direct smear, or culturing organisms.

### Blood investigations:

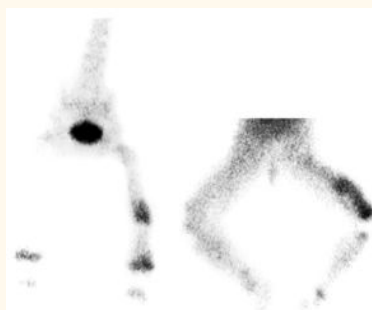
- CBC ( ↑ PMNL)
- ↑ ESR
- ↑ **CRP** (the most sensitive monitor)
- +ve blood culture (present in **50%** of cases; if blood is drawn whilst there is spike of fever)

### Radiological investigations:

- **MRI** (best tool):
  - the **best** method of demonstrating bone marrow inflammation.
  - It is extremely **sensitive**, even in the early phase of bone infection
  - young children require **GA**.
  - decreased T1-weighted bone marrow signal intensity
  - increased post gadolinium fat-suppressed T1-weighted signal intensity
  - increased T2-weighted signal relative to normal fat
- Isotope **bone scan**: Technetium 99 (48 hr) or **Gallium** (72 hr) are **diagnostic** ( ↑ uptake)
- X-ray: will show soft tissue **swelling** (bone changes take 14 days to show, osteopenia is not diagnostic)
- U/S: diagnose soft tissue **swelling** and abscess (cannot distinguish between a haematoma and pus)



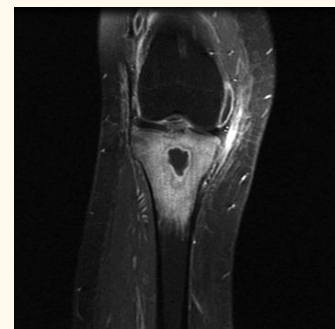
Early plain x-ray: soft tissue swelling, NO bony changes.



Bone scan showing increased uptake in the lower left femur



Bone scan showing increased uptake of most of right femur



MRI showing changes in the bone and bone marrow

### Principles of Management:

- Supportive treatment (admission, adequate **hydration & analgesia**).
- **Splintage** of the affected part.
- Appropriate **antimicrobial** therapy.
- Surgical **drainage**.

### Antimicrobial therapy:

- **Empirical** IV antibiotic treatment to be started immediately after sending samples for culture.
- The choice of empirical treatment depends on the **suspected organism** which varies according to age and presence of other circumstances:
  - sicklers: **salmonella**
  - immunocompromised, diabetic, on steroids, drug abuser: MRSA
- To make it simple: always suspect **staph aureus** (give **oxacillins or 3rd generation cephalosporin**) **except sicklers!** (prone to salmonella so give fluoroquinolones or 3rd generation cephalosporin)
- Definitive antibiotic treatment depends on the result of culture of isolated organisms (Always consult ID).

### Surgical drainage:

- Indicated when sure or highly suspecting the **presence of pus** (pus must be drained).
- Under **GA**, soft tissue abscesses are drained and bone site of infection is **drilled** or a window is opened in the cortex to **drain** pus and **urette** infected material from inside medulla (in case of presence of **sequestrum** it has to be **removed**)
- Drain is to be **left** at site of drainage till discharge is minimal.

### Post-op management:

- Definite antibiotic should be continued (**IV for 6 wks**).
- Frequent **Monitoring** of general condition and blood investigations should be done.
- Repeat follow up plain X-rays or CT or MRI may be required.
- Patient should be pain free and generally well before discharge.
- Long term follow up should be done to exclude late complications.

### Complications:

- A. Growth disturbance in skeletally immature.
- B. Pathological fracture.
- C. Chronic osteomyelitis.
- D. Septicemia and distant abscesses.
- E. Septic arthritis.



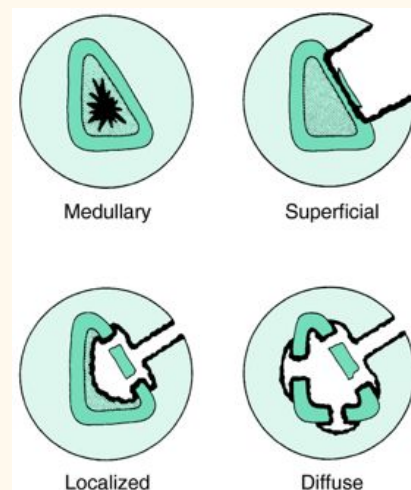
## 2. Chronic osteomyelitis

### Predisposing factors:

- Inappropriately treated **acute OM**
- **Trauma** (open fracture or a prolonged bone operation especially if this involves the use of a foreign implant).
- Immunosuppressed
- Diabetics
- IV drug abusers

### Staging:

LESION	TYPE
Stage 1	Medullary
Stage 2	Superficial
Stage 3	Localized
Stage 4	Diffuse
HOST CATEGORY	
Type A	Normal
Type B	Compromised by local or systemic conditions
Type C	Severely compromised by local and systemic conditions



### Diagnosis:

- Best test to identify the organisms is **operative sampling** of **deep** specimens from multiple foci.
- Imaging:
  - X-ray: can diagnose it easily, will show bone changes (sequestrum & involucrum)
  - Isotope bone scan: to confirm the Dx when there is no discharging sinus (it will show the activity of the disease and how extensive it is).
  - CT<sup>2</sup> & MRI: will show the extent of bone destruction.

### Management:

- **Abx.** (for 6 wks):
  - based on the results of **deep cultures** (empirical treatment is not indicated).
  - to suppress the infection and prevent its spread to healthy bone, and to control acute flares.

<sup>2</sup> The doctor mentioned that CT is the best tool to diagnose sequestrum inside the bone.

- Hardware has to be **removed**
  - stability should be maintained by Ex-Fix
  - Glycocalyx (exopolysaccharide coating envelops bacteria) enhances bacterial adherence to biologic **implants**.
- Surgical **debridement**
  - complete removal of compromised bone and soft tissue.
  - bone grafting and soft tissue coverage is often required.
  - amputations are still required in certain cases.

## Septic arthritis (infection of the joint)

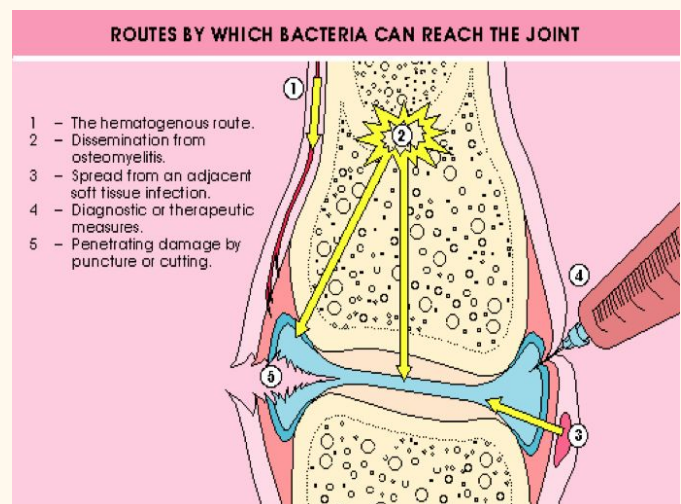
- May affect any age and any joint (the **knee** and **hip** are most affected)
- Route of infection: hematogenous or from the bone
- In neonates: transphyseal vessels
- In joints where the metaphysis is intracapsular (Hip, shoulder, proximal radius and distal fibula)

### Diagnosis:

- Laboratory investigations (CBC, ESR, CRP, blood culture)
- Radiological investigations (x-ray, U/S)
- **Joint aspiration**: WBC **>50,000** (>90%PMNL), damaged WBC and No crystals .

### Management:

- Admission for Emergency **drainage**
  - Either arthroscopic or open (arthrotomy and washout under local anesthesia)
  - A drain should be left at joint till discharge is clear and minimal.
- broad spectrum IV **antibiotics** (for **4 wks**)
- **Splintage**.



Pathology	DDx	Complications
<b>Acute OM</b>	Acute septic arthritis. Cellulitis <sup>3</sup> . Ewing's Sarcoma <sup>4</sup> , lymphoma. Sickle cell bone crisis. Acute rheumatoid arthritis.	Septicemia and distant abscesses. Septic arthritis. Growth disturbance in skeletally immature. Pathological fracture. Chronic osteomyelitis.
<b>Septic arthritis</b>	Acute osteomyelitis. <b>Transient synovitis</b> <sup>5</sup> . Reactive arthritis. Vasculitis <sup>6</sup> . Traumatic haemarthrosis. Haemophilic arthritis	Septicemia. Abscess. Osteomyelitis. Joint destruction. Joint subluxation and dislocation. Ankylosed joint. Avascular necrosis of the femoral head. Growth disturbance

#### Causative organisms:

Pathology	Children	Adults
	<b>S. aureus</b> (found in over 70% of cases)	
<b>Acute OM</b>	Gram +ve: <ul style="list-style-type: none"> <li>● GAS (chronic skin infections)</li> <li>● GBS (new-born babies)</li> <li>● S. pneumoniae</li> <li>● <b>H. influenzae</b><sup>7</sup> (if not vaccinated)</li> </ul> Gram -ve: (occasionally) <ul style="list-style-type: none"> <li>● E. coli</li> <li>● P. aeruginosa</li> <li>● P. mirabilis</li> </ul>	P. aeruginosa (IV drugs)
<b>chronic OM</b>	<ul style="list-style-type: none"> <li>● <b>Staphylococcus aureus</b></li> <li>● <b>Enterobacteriaceae</b> (E. coli, P. mirabilis)</li> <li>● <b>P. aeruginosa</b></li> <li>● Streptococcus pyogenes</li> <li>● S. epidermidis (in the presence of foreign implants)</li> </ul>	
<b>Septic arthritis</b>	Similar to acute OM	

\* patients with **sickle-cell** disease are prone to infection by **Salmonella typhi**.

<sup>3</sup> spreading infection of the skin

<sup>4</sup> rapidly growing malignant bone tumor in child

<sup>5</sup> <10 years

<sup>6</sup> eg: Henoch-Schonlein purpura

<sup>7</sup> Children between 1 and 4 years of age.

pathology	Acute OM	Chronic OM	Septic arthritis
<b>Presentation</b>	General symptoms: <b>Pain, fever, Refusal to bear weight</b> , malaise, restlessness.  Local symptoms: <b>pseudoparalysis</b> , tenderness, redness, swelling, warmth. There may be a recent history of infection.	-Discharging <b>sinus</b> . -Skin and soft tissues involvement. -Periods of quiescence followed by acute exacerbations. -pain, pyrexia, redness, and tenderness.	similar to OM but here the joint is <b>fixed</b> in the position of ease and ALL movements are <b>completely abolished</b> .
Dx.	↑ PMNL, ESR, CRP, +ve culture	<b>operative sampling of deep specimens</b>	Joint aspiration (WBC >50,000)
Rx.	<ul style="list-style-type: none"> <li>• Supportive</li> <li>• Abx. (6 wks)</li> <li>• Splintage</li> <li>• Drainage</li> </ul>	<ul style="list-style-type: none"> <li>• Abx. (6 wks)</li> <li>• Surgical debridement</li> </ul>	<ul style="list-style-type: none"> <li>• Drainage</li> <li>• Abx</li> <li>• Splintage</li> </ul>

## skeletal TB

- Tuberculosis is **chronic** bone infection.
- May affect any age.
- Usually 2ry to TB at lung, bowel, kidney, or lymph nodes.
- Causative organism is Mycobacterium Tuberculosis (**AFB**)
- Symptoms: fever, night sweats, weight loss, malaise (may not be present these days)
- When to suspect? **h/o TB**, presence of **osteopenia** and **loss of joint space**.



Osteopenia and Narrowing of the joint space

### Epidemiology:

- Developing countries: endemic
- Developed countries: immunocompromised (AIDS and drug addicts)
- In KSA: still present **sporadically**

### Diagnosis:

- culture (takes up to **6 weeks**)
- direct smear (when bacillus is seen it is **diagnostic** of TB).
- histopathology: TB granuloma (Langhans giant cells and caseation in a bed of lymphocytes and monocytes)



**Treatment:**

- Medical: antituberculous drugs for **18 mon** (Isoniazide, Rifampicin, Ethambutol, Pyrazinimide)
- Surgical: to evacuate **abscess** or **decompress** spinal cord or to **stabilize** joint or spine.

**Pott's disease:**

Affect any part of spine (most commonly dorsal spine).

**Complications:**

- **kyphosis**
- Para vertebral **abscess**
  - cervical (retropharyngeal abscess=difficulty in swallowing).
  - Lumbar (**psoas abscess**).
- **Paraplegia**
  - Neurological deficits occur due to the **compression** secondary to the deformity or compression from the abscess.
  - Reversible if treated early, Mostly treated non-surgically

**Diagnosis:**

- Imaging
    - **x-ray** spine
      - end plates => **Erosion and destruction**
      - disc space => **Narrowing**
      - Vertebrae => **Anterior wedging**
      - **Kyphus deformity**
      - Soft tissue **mass shadow**
    - CT & MRI can help in the diagnosis
  - **Special tests:**
    - Mantoux tuberculin skin test (TST)
    - Needle **biopsy** of the spine (CT guided) bone biopsy
    - Synovial aspiration
- Send for aerobic/non-aerobic bacteria, fungal, AFB, enriched culture.



TB lesion of dorsal spine



Kyphosis



Psoas abscess

## Brucellosis

- Etiology: consumption of infected milk products.
- Presentations: back pain and stiffness, muscle spasm, fever.
- Less destructive than TB (commonly affects the **sacroiliac joint**)
- Dx: brucella titer **>1/640**, CRP, ESR
- Rx: Abx. (e.g. Septrin, Oxytetracycline)

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