

Bone and Joint Infections

Munir Saadeddin FRCSEd

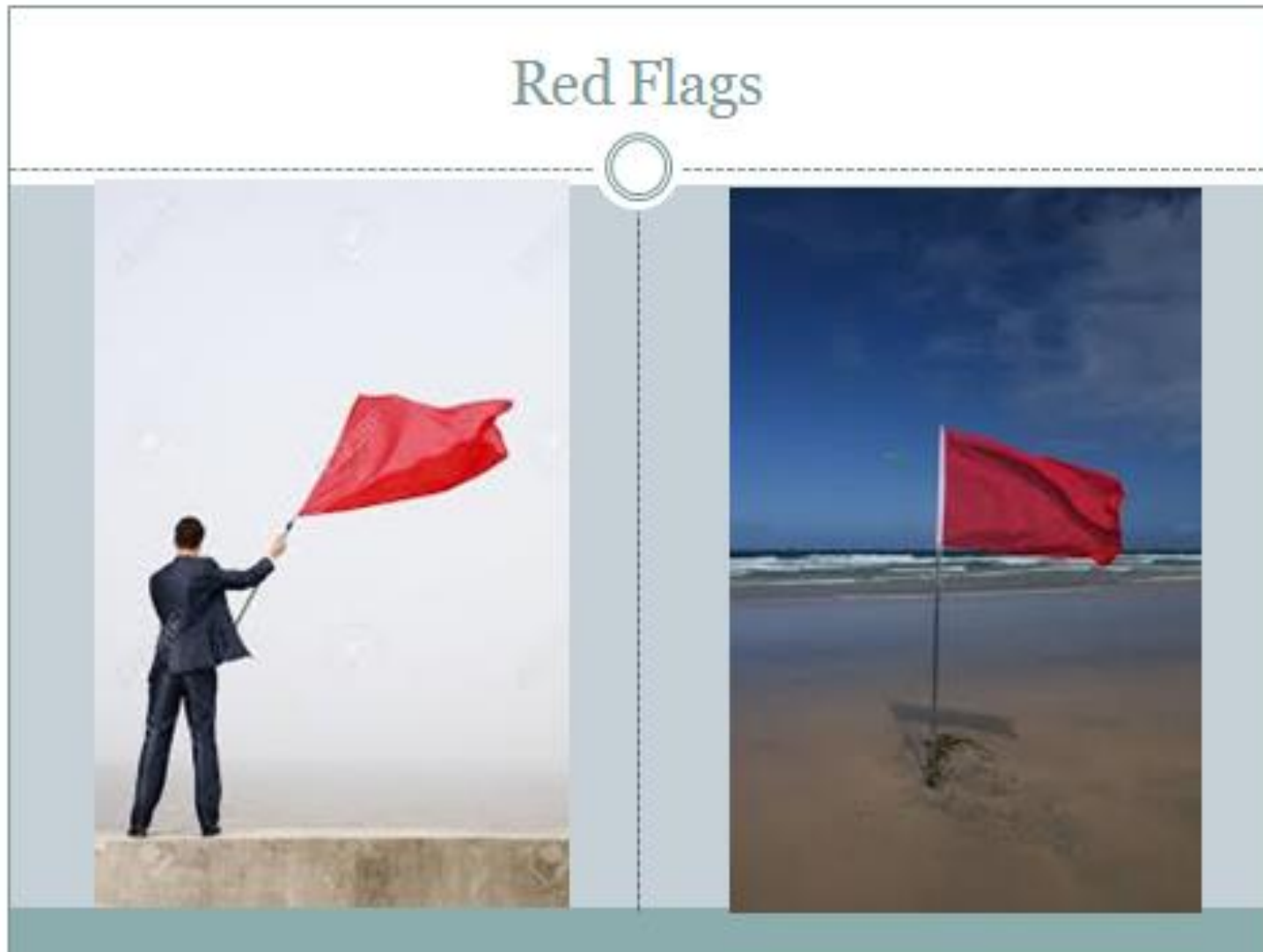
Associate Professor and Consultant

King Saud University and KKUH

Objectives of Lecture

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

Bone and Joint Infections are



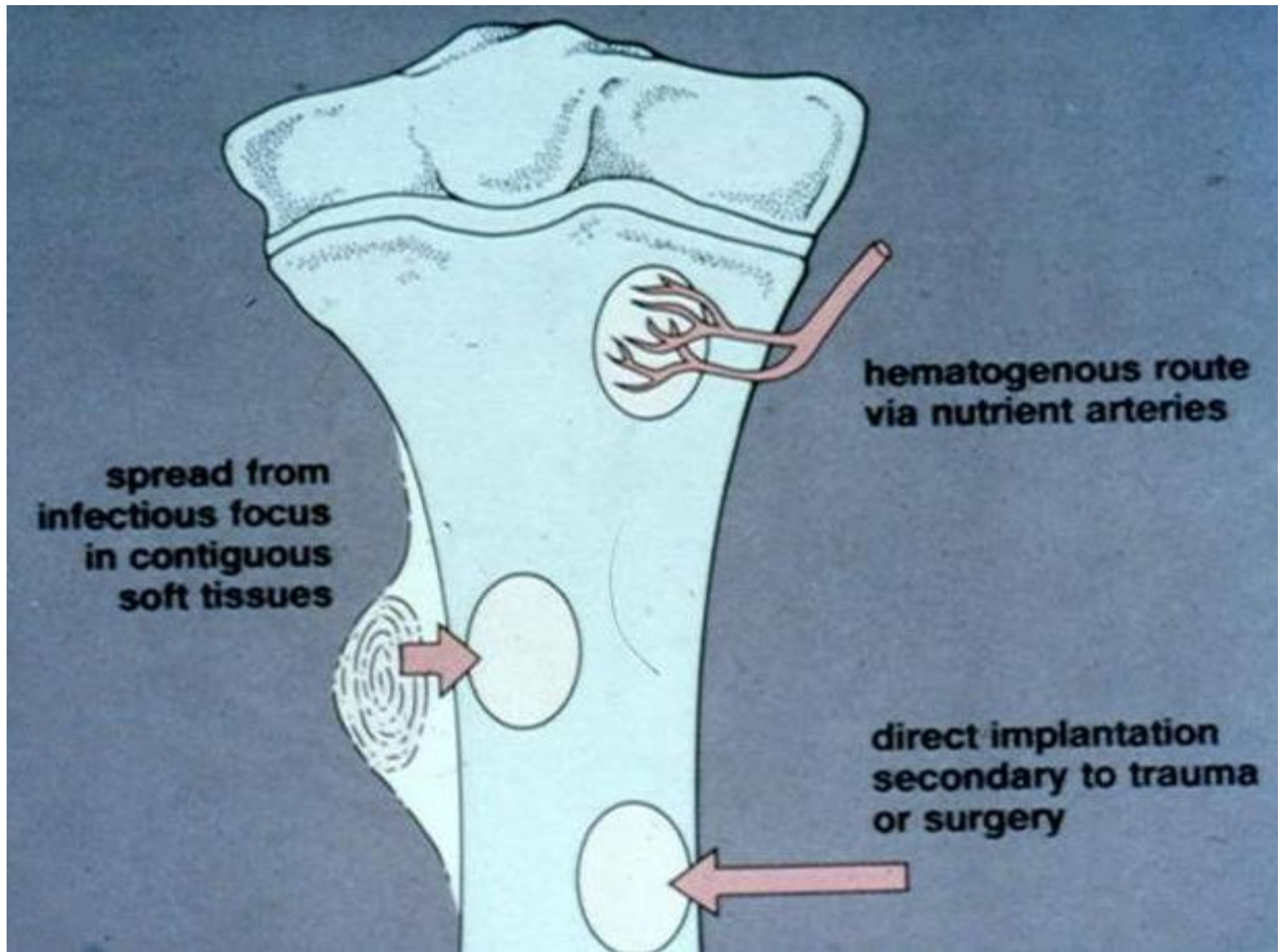
Topics to be discussed

- **Bone infection**= Osteomyelitis
- (infection of bone and bone marrow)
 - Acute, Chronic, Subacute.
- **Less common infection of Bone**=
 - Tuberculosis, Brucellosis, Syphilis and Fungal.

- **Joint infection**

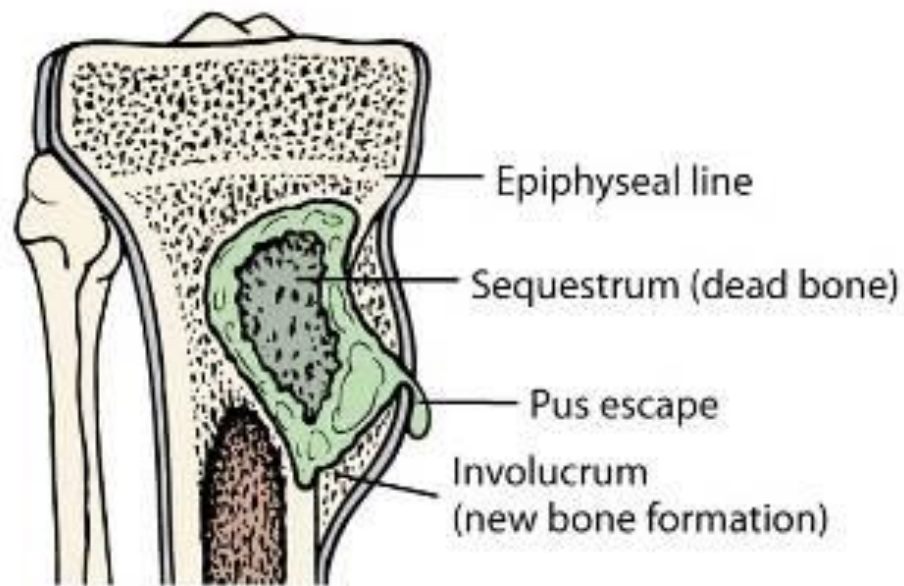
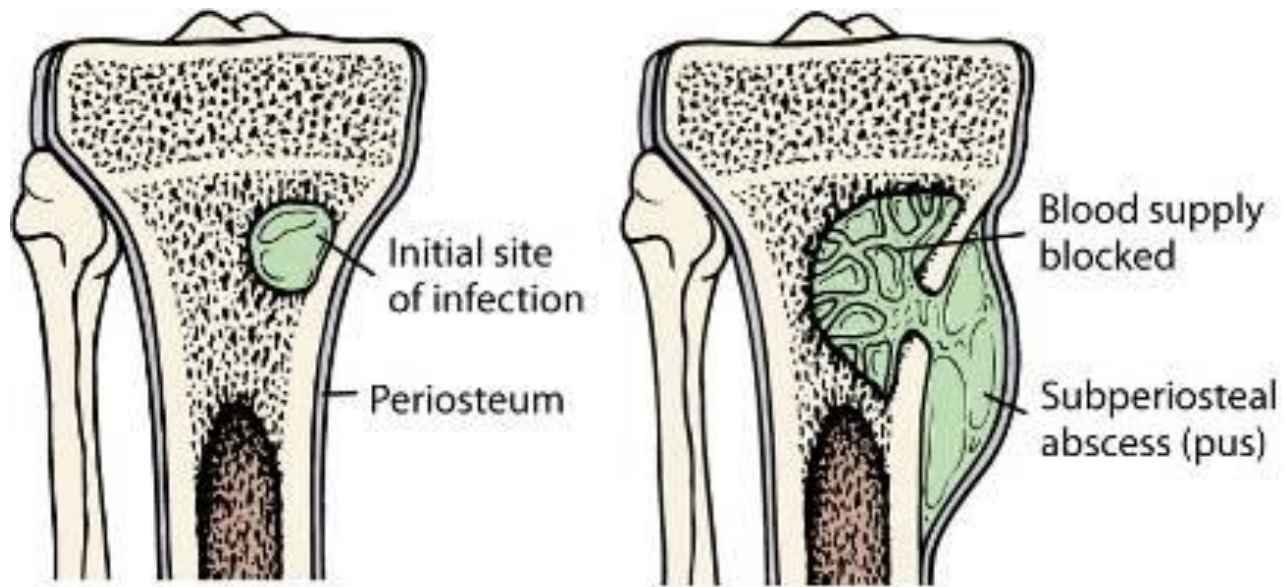
Acute Osteomyelitis

- A serious condition.
- Most likely **hematogenous spread** via blood stream from infected focus somewhere in the body.
- Less occurrence from **direct spread** from infected nearby tissues.
- It may follow **open fracture**.



Spread of infection

- Infection starts at bone marrow.
- Infection spreads to cortex and lifts up periosteum, swelling becomes tense= increase of pain.
- Local blood vessels get obstructed.
- Periosteum bursts into soft tissues and pus becomes under skin; eventually spontaneous discharge.
- If pus bursts into epiphysis; epiphyseal arrest will occur.



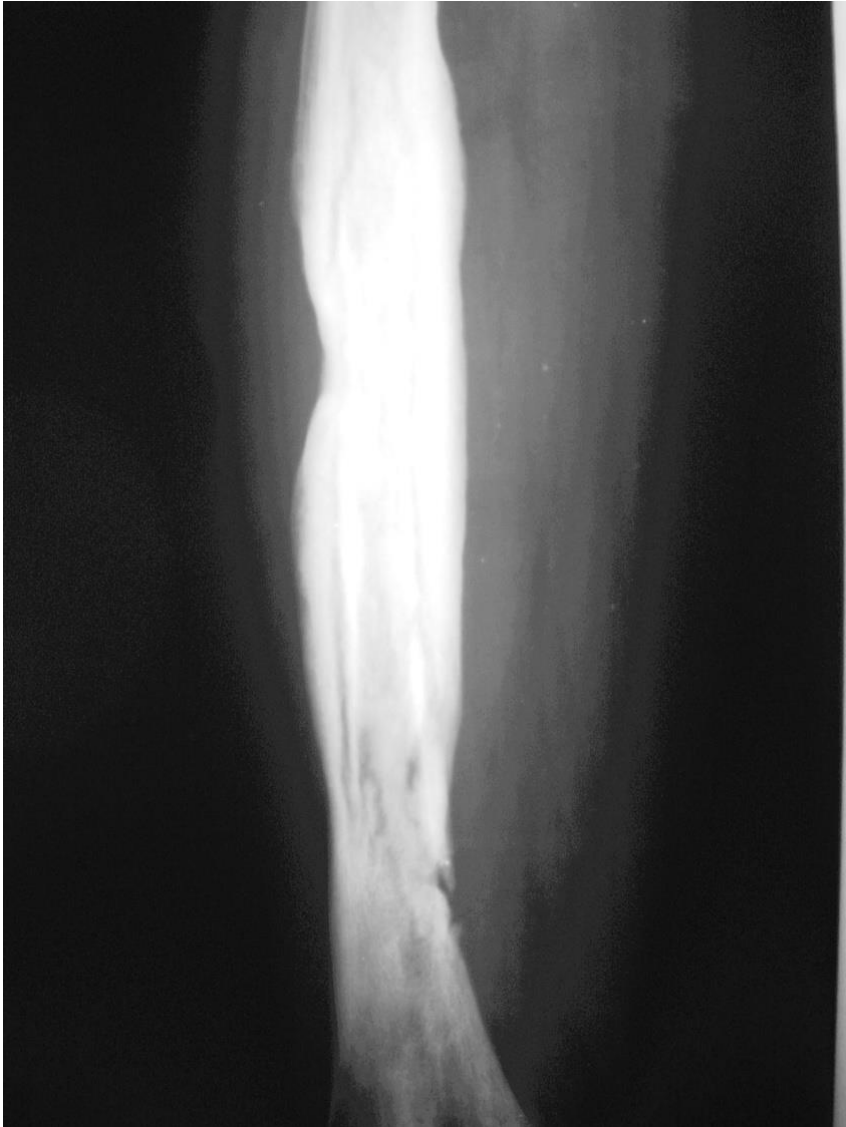
Sequestrum and Involucrum

- **Sequestrum** = Dead bone = separated piece from its surroundings.

This happens when blood supply is cut off from area of bone due to infection.

- **Involucrum** = New bone formed at site of infection and trapping a cavity of bone.

Sequestrum and Involucrum



- Plain x-ray showing:
Large sequestrum inside involucrum.

Diagnosis

- Clinical picture.
- Blood investigations.
- Radiological investigations.
- **Definite diagnosis**: identifying= obtaining organisms from site of infection.

Clinical Picture

- Usually ill child.
- **Generally**=Pain, fever, malaise, restlessness, loss of function(child is not moving involved limb and unable to bear weight on it if it was at lower limb usually).
- **Locally**= swelling at a limb usually near a joint like knee or hip or shoulder with increased local temperature.

Acute Hematogenous OM

Clinical Features

- caused by blood-borne organisms
- More common in children
 - Boys > girls
 - most common in long bone metaphysis or epiphysis
 - Lower extremity >> upper extremity
- Pain
- Loss of function of the involved extremity
- Soft tissue abscess



Blood investigations

- CBC and differentials: usually raised white cell count; predominantly poly morphs.
- Elevated ESR, and CRP(C-reactive protein)
CRP is the most sensitive monitor.
- Positive **blood culture** in up to 50% of cases; if blood is drawn whilst there is spike of fever.

Radiological investigations

- Early **plain x-rays** may not reveal any findings except soft tissue swelling at site of infection.
- Bony changes take up to 14 days to show suspected bone involvement, but osteopenia may appear earlier(not diagnostic).
- **Ultrasound**: may diagnose soft tissue swelling or abscess early, but it is operator dependent.

Radiological investigations

- **Isotope bone scan=Nuclear** medicine isotope bone scan: **Tcm99** bone scan(Technetium 99) or **Gallium** bone scan are diagnostic , as increased local tracer uptake; but take time to appear.
- MRI: best tool for radiological diagnosis as it is sensitive and specific, but difficult in young children as they require general anesthesia.

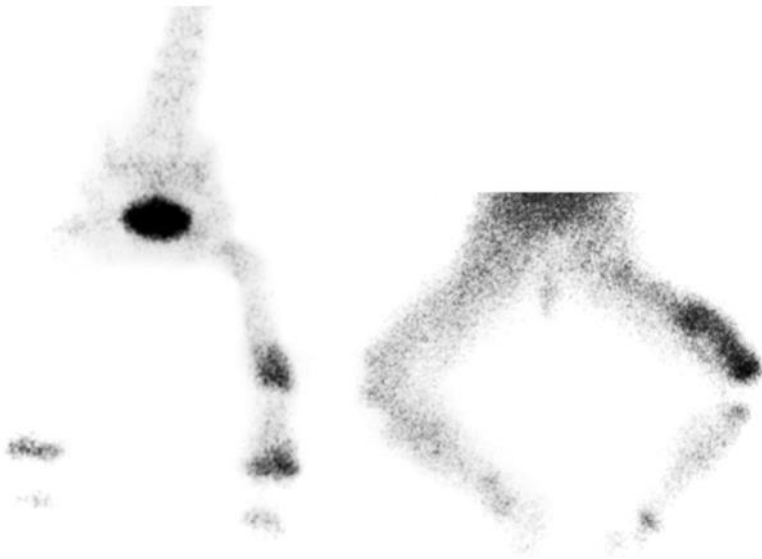
Plain x-rays



- In early days : NO bony changes ,but soft tissue swelling may be evident.

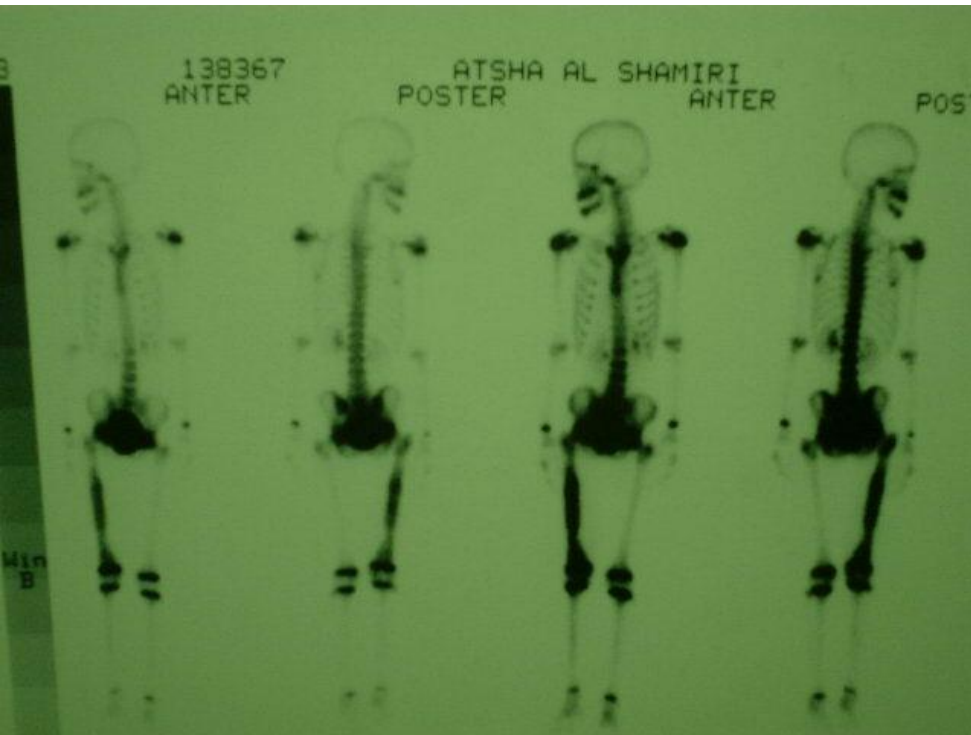
Isotope bone scan

- In this scan there is:
Increased uptake in the
lower left femur



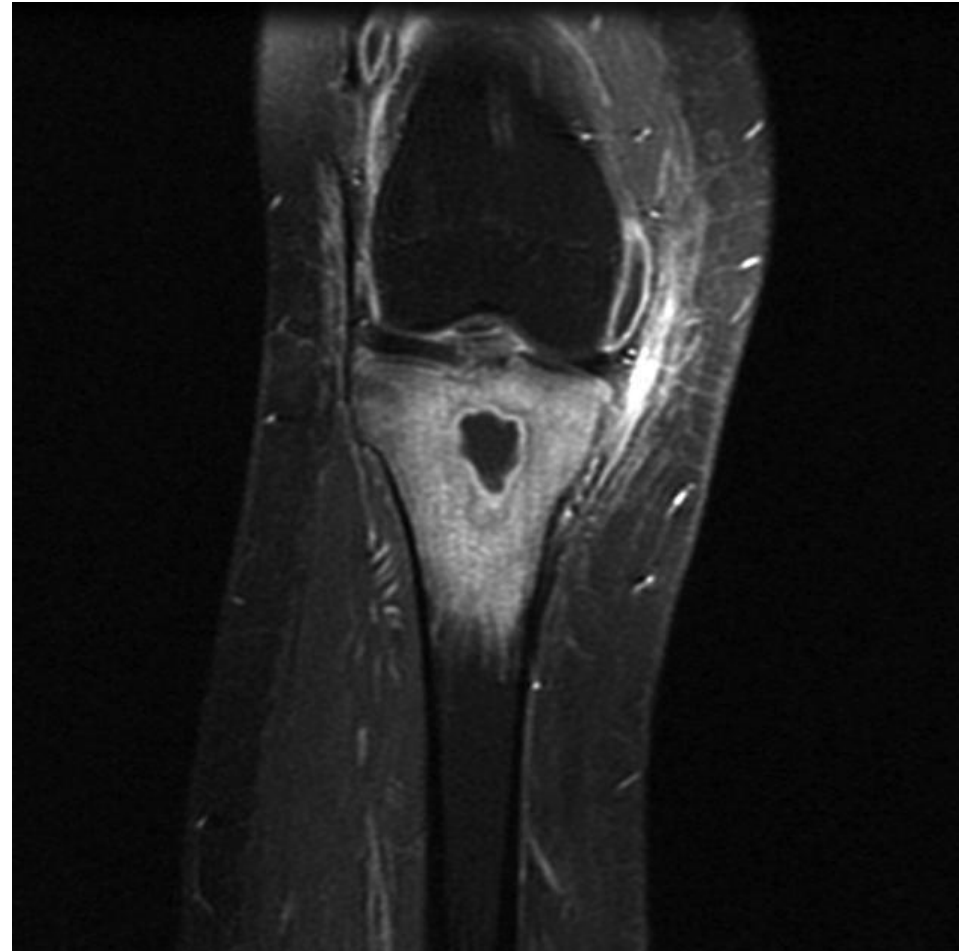
Isotope bone Scan

- Increased uptake of most of right femur



MRI

- ☞ shows changes in bone and bone marrow before plain films
- ☞ decreased T_1 -weighted bone marrow signal intensity
- ☞ **increased post gadolinium fat-suppressed T_1 -weighted signal intensity**
- ☞ increased T_2 -weighted signal relative to normal fat



Differential Diagnosis

- Acute septic arthritis.
- Cellulitis.
- Ewing's Sarcoma, lymphoma.
- Sickle cell bone crisis.
- Acute rheumatoid arthritis.

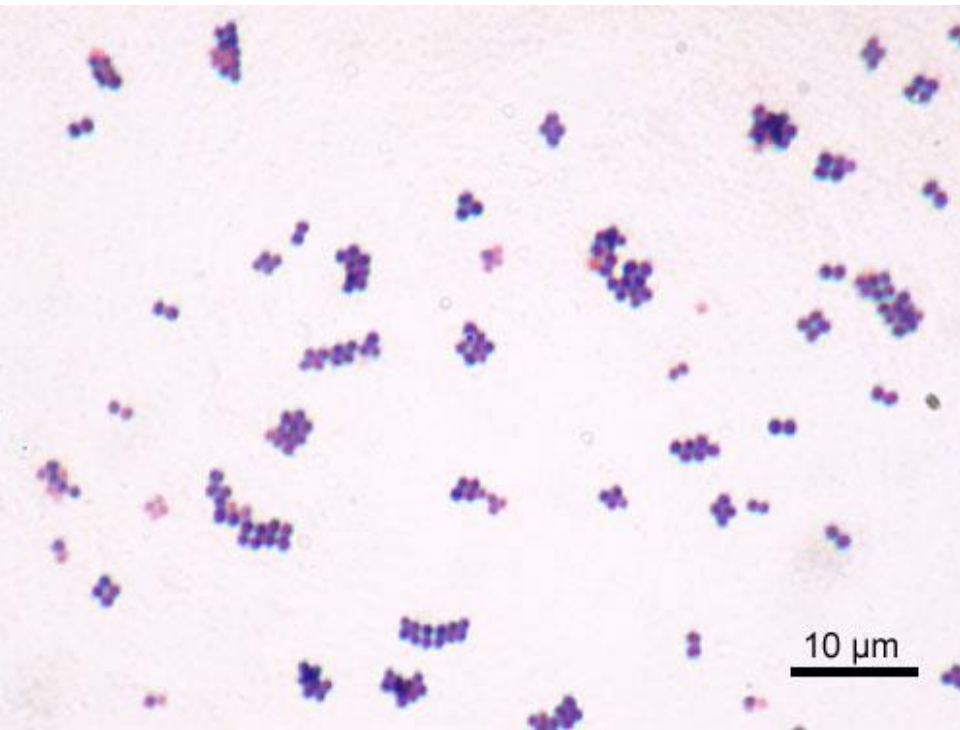
How to confirm diagnosis?

- Ultrasound guided aspiration from site of swelling or abscess.
- X-ray guided aspiration of suspected bone involvement(according to MRI).
- Via open incision –drainage procedure(drilling of bone) when there is high suspicion.
- Aspirated or obtained material at open incision are sent urgently for Direct Smear and C&S including anaerobic, TB and Fungal.
- Histo-pathology examinations are recommended as well.

Management of Acute Osteomyelitis

- When there is suspicion that the diagnosis is : acute osteomyelitis(**Red Flag**); patient should be admitted immediately.
- Patient should receive adequate hydration and pain relief at the same time as investigations.
- Pain relief include: analgesics and splintage.
- Broad spectrum IV antibiotics is started **after** obtaining material for culture or sending blood culture when there is fever.

Definite Diagnosis



- Definite diagnosis depends on seeing organisms at direct smear, or culturing organisms.
- Histo-pathology confirmation is important but usually result is late.

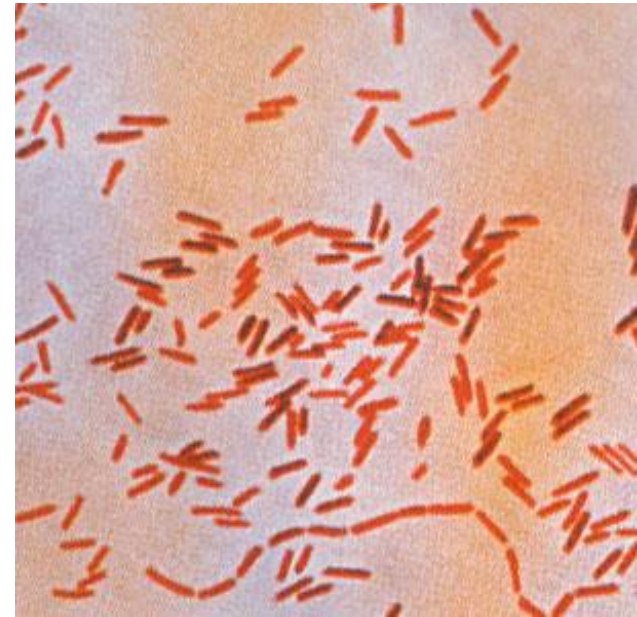
Empirical Antibiotic Treatment

- When patient is acutely ill; empirical IV antibiotic treatment to be started immediately after sending samples for culture.
- This empirical treatment **depends on suspected organisms according to :**
 - Age:** Newborn, young or adult.
 - Presence of **other circumstances:** sickle cell disease or Hemodialysis or drug addicts.

Empirical Treatment

Sickle cell anemia

- *Salmonella* is a characteristic organism
- The primary treatment → fluoroquinolones (only in adults)
- alternative treatment → 3rd - generation cephalosporin



To simplify empirical treatment

- **To make it simple**: always suspect staph aureus: (oxacillins) except sicklers.
- 3rd generation IV antibiotics for special cases

Definitive Antibiotic Treatment

- Depends on result of culture of isolated organisms.
- Always consult ID(Infection Department)

When do we consider surgery?

- When we are sure(as a result of our investigations) there is pus or highly suspect that there is pus inside the bone or in the soft tissues near bone.
- We have to let pus out(drain the pus out) to stop bone and tissue destruction and improve the general condition by getting rid of source of infection in the body.

How do we do Surgery for Bone Infection

- Patient should be prepared well for surgery.
- Surgery is done under GA usually.
- X-ray guidance (image intensifier) is used usually to help exact location of site of drainage.
- Soft tissue abscesses are drained and bone site of infection is drilled or a window is opened in the cortex to drain pus and curette 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 Operative management

- Definite antibiotic should be continued via IV route for 6 weeks usually.
- Monitoring of general condition and blood investigations should be done frequently as in patient, especially CBC, ESR and CRP.
- 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

- Septicemia and distant abscesses.
- Septic arthritis.
- Growth disturbance in skeletally immature.
- Pathological fracture.
- Chronic osteomyelitis.

Complications

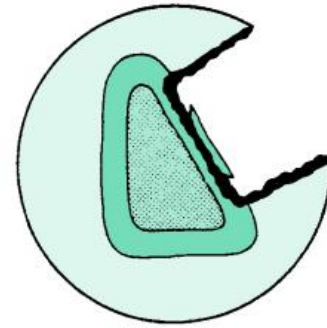


Chronic OM

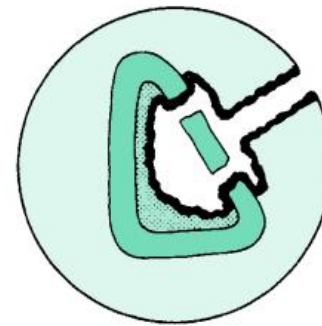
- Common in
 - Inappropriately treated acute OM
 - Trauma
 - Immunosuppressed
 - Diabetics
 - IV drug abusers
- Anatomical classification →



Medullary



Superficial



Localized



Diffuse

Chronic OM

- Features
 - Skin and soft tissues involvement.
 - Sinus tract → may occasionally develop squamous cell carcinoma.
 - Periods of quiescence → followed by acute exacerbations.
- Diagnosis
 - Nuclear medicine → activity of the disease
 - **Best test to identify the organisms → Operative sampling of deep specimens from multiple foci**

Treatment

- **Empirical therapy is not indicated**
- **IV antibiotics → must be based on deep cultures**
- **Most common organisms**
 - S. aureus
 - Enterobacteriaceae
 - P. aeruginosa

Chronic osteomyelitis



**Hardware has to be removed,
but stability should be
maintained (consider Ex-Fix)**

Glycocalyx

exopolysaccharide coating
envelops bacteria
enhances bacterial adherence to
biologic implants

Chronic OM - Treatment

- surgical débridement :
 - **complete removal of compromised bone and soft tissue.**
 - **Hardware**
 - **most important factor**
 - **almost impossible to eliminate infection without removing implant.**
 - **organisms grow in a glycocalyx (biofilm) → shields them from antibodies and antibiotics.**
 - bone grafting and soft tissue coverage is often required.
 - amputations are still required in certain cases.





Septic Arthritis

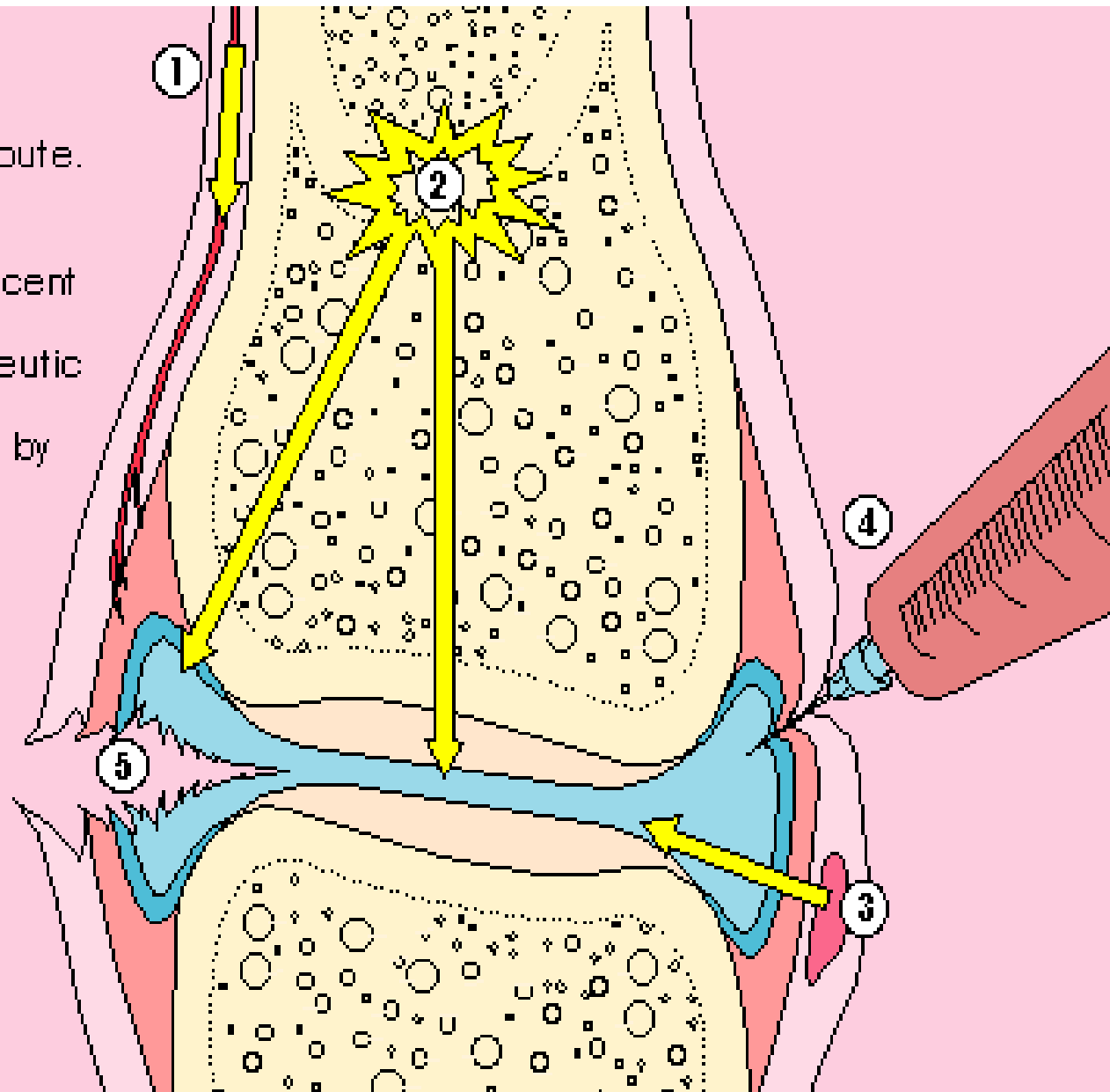
- Infection of the joint.

Septic Arthritis

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

ROUTES BY WHICH BACTERIA CAN REACH THE JOINT

- 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.



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Septic Arthritis

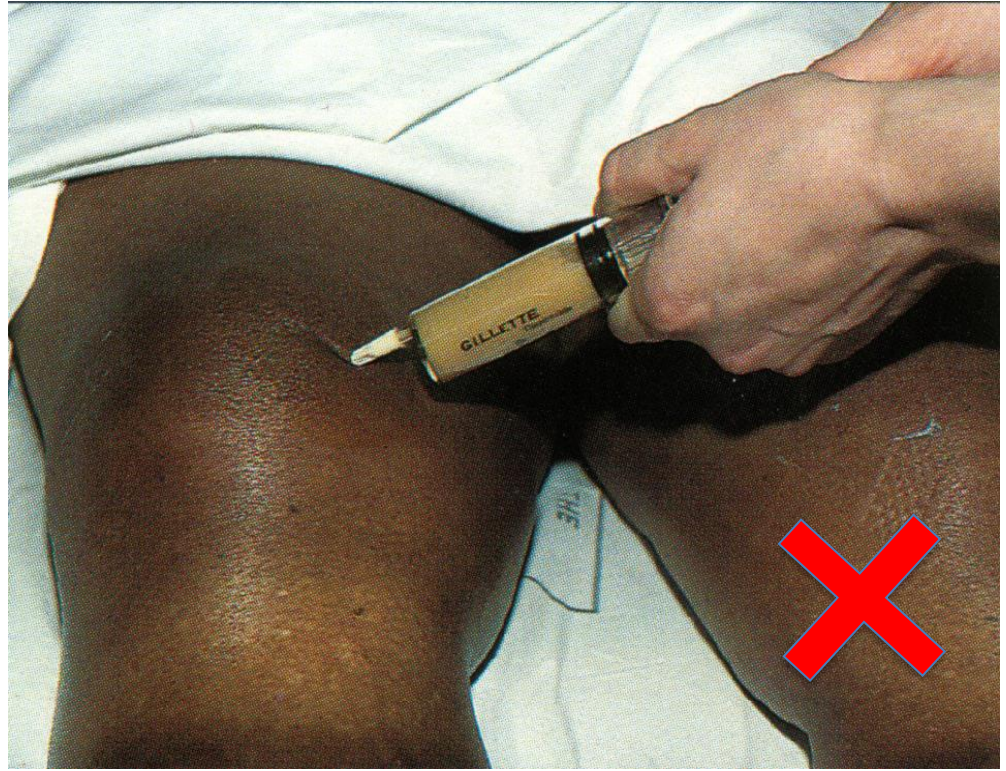
- Symptoms : like Acute Osteomyelitis.
- Signs: hot swollen joint which is painful to any motion, inability to bear weight.
- Joint is fixed in the position of ease.

Septic Arthritis



Investigation

- Basic lab for infection (CBC,ESR and CRP) and Blood cultures.
- Plain films and Ultrasound.
- Joint aspiration: WBC >50,000 (>90%PMNL), damaged WBC and No crystals .
- Organisms: similar to Acute Osteomyelitis.
- Rx: Admission for Emergency arthrotomy and washout, broad spectrum IV antibiotics and splintage.
- Main DDx: transient synovitis of the hip.



Differential diagnosis

- Acute osteomyelitis.
- Transient synovitis (<10 years).
- Reactive arthritis.
- Vasculitis , eg: Henoch-Schonlein purpura.
- Traumatic haemarthrosis.
- Haemophilic arthritis

Management of Septic Arthritis

- Emergency drainage of the septic joint:
 - Either arthroscopic.
 - Or Open.
- Joint should receive lavage and debridement, and a drain should be left at joint till discharge is clear and minimal.
- IV antibiotics should be administered for 4 weeks.

Complication

- Septicemia.
- Abscess.
- Osteomyelitis.
- Joint destruction.
- Joint subluxation and dislocation.
- Ankylosed joint.
- Avascular necrosis of the femoral head.
- Growth disturbance

Granulomatous bone infection=TB

- Tuberculosis is chronic bone infection.
- May affect any age.
- Causative organism is: Mycobacterium Tuberculosis.
- It is acid fast bacillus.
- Can be diagnosed sometimes by direct smear.
- When bacillus is seen it is diagnostic of TB.
- It takes up to 6 weeks to culture.

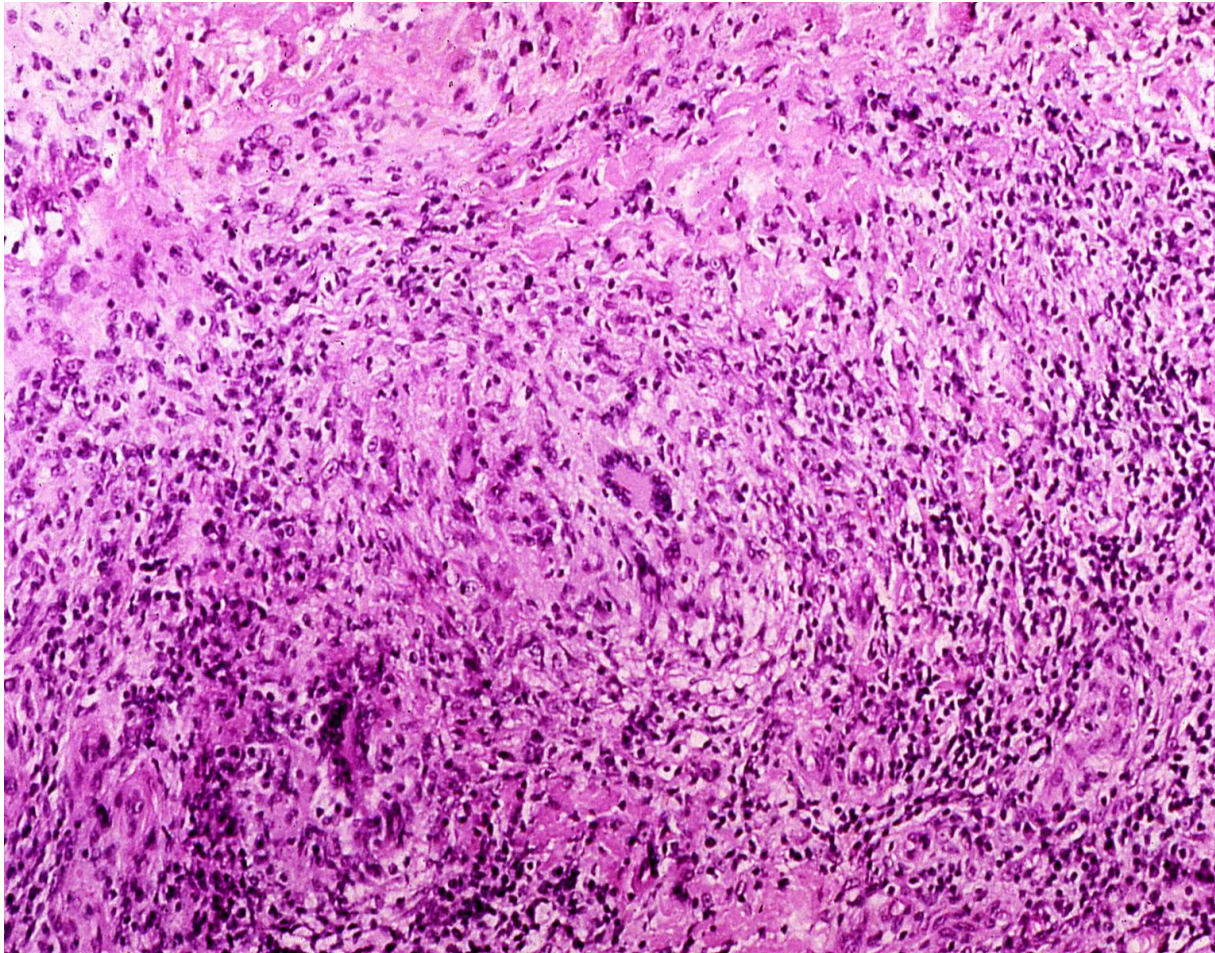
TB at current time

- Endemic in poor underdeveloped countries.
- Still present sporadically at Saudi Arabia.
- In developed countries TB patients are immunocompromised patients.(AIDS and drug addicts)

T.B Histopathology

- To confirm diagnosis: we need to see acid fast bacillus.
- Also to see: Langhans giant cells.
Or to see : caseation.
in a bed of lymphocytes and monocytes.

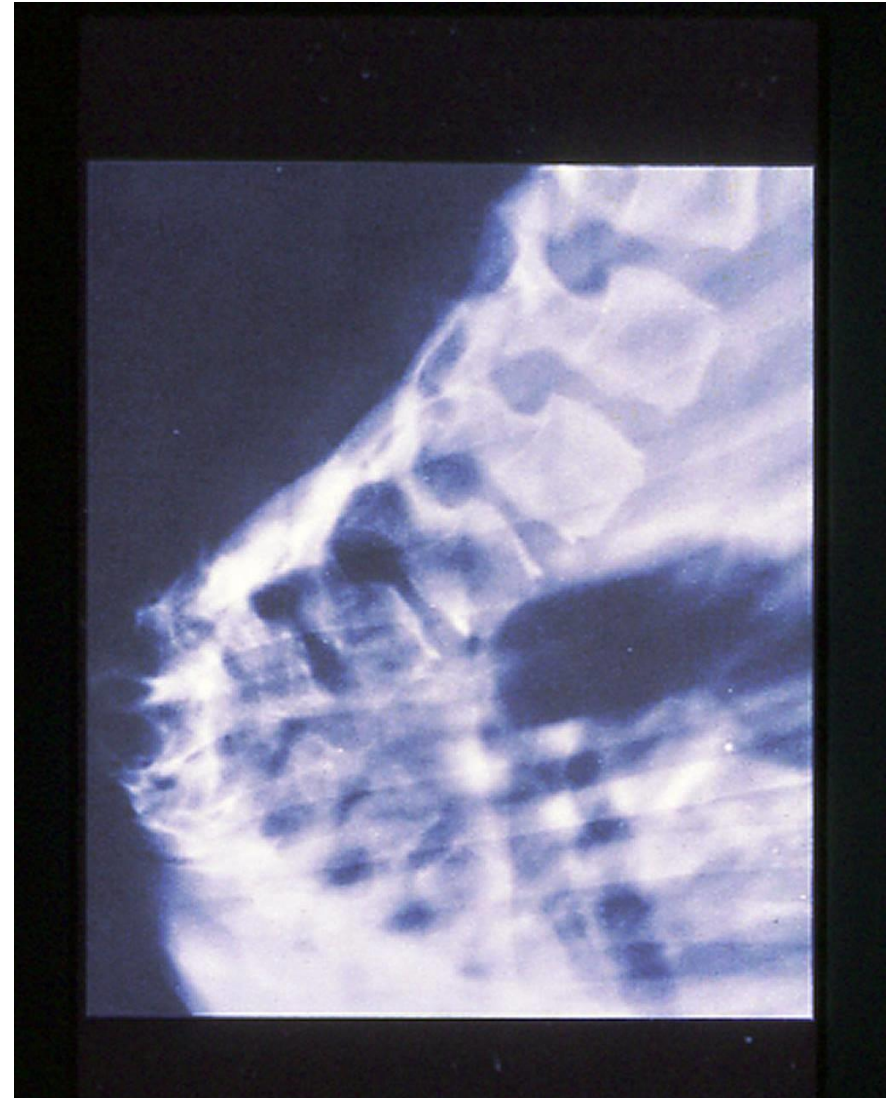
TB Follicle



TB spine: Pott's Disease

- Affect any part of spine; most commonly dorsal spine.
- Can lead to dorsal kyphosis.
- Famous for causing psoas abscesses and para spinal abscesses.
- TB spinal abscess may compress spinal cord= Pott's paraplegia.

TB spine= Dorsal kyphosis



T.B of The Spine: (Pott's disease)

- Infection spreads to adjacent level under the longitudinal ligaments and hematologically
- Eventually a kyphotic deformity occurs
- Para vertebral abscess is common and may be distant as well
 - Cervical > retropharyngeal abscess
 - Lumbar > psoas abscess
- Compression of the spinal cord is more likely to occur at the thoracic level

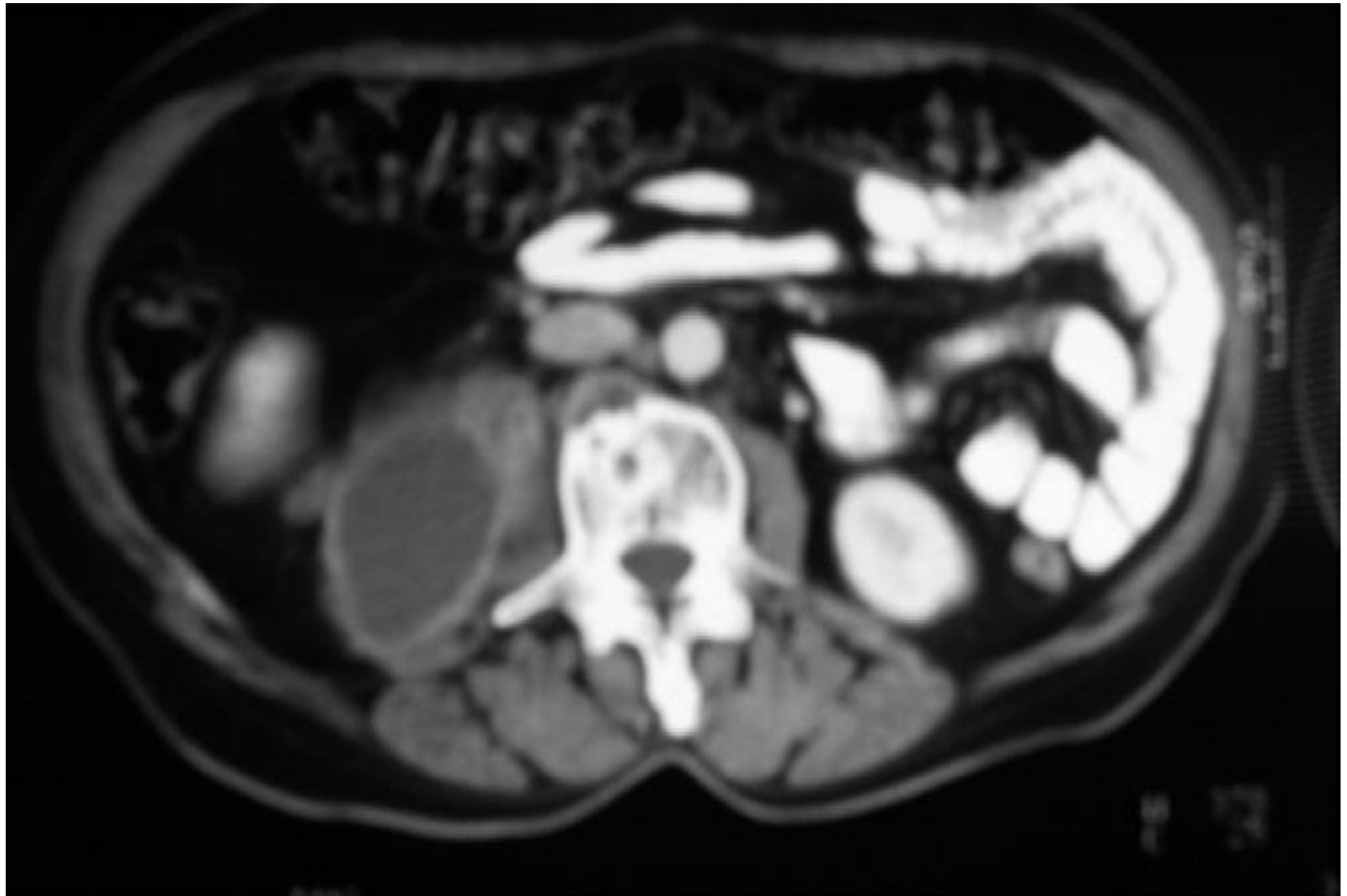
T.B of The Spine: (Pott's disease)

- Neurological deficits occur due to the compression secondary to the deformity or compression from the abscess.
- Paraplegia may occur.
- Reversible if treated early.
- Mostly treated non-surgically.

MRI: TB lesion of dorsal spine



TB spine with Psoas abscess



Diagnosis

- Radiology:
 - Plain x-rays:
 - Spine:
 - Erosion and destruction of end plates.
 - Narrowing of disc space.
 - Soft tissue mass shadow.
 - Anterior wedging of vertebrae.
 - Kyphus deformity.

Diagnosis

- Special tests:
 - Tuberculin(Mantoux)skin test.
 - Spine:
 - CT guided needle biopsy
 - Joints:
 - Synovial aspiration----- low yield
 - Should get bone/soft tissue

Send for aerobic/non-aerobic bacteria, fungal, AFB,
enriched culture media

Takes up to 4-6 weeks

TB of musculoskeletal system

- Usually lesion is secondary to TB at lung, kidney, bowel and lymph nodes.
- Famous symptoms :
Fever, malaise, weight loss and night sweat may not be present these days.
- Suspicion of disease , previous history of TB presence of osteopenia and loss of joint space.



Management of TB

- Usually non surgical by Triple or Quadruple drugs=
Isoniazide(INH), Rifampicin, Ethambutol,
Pyrazinimide.
- Drug therapy to continue up to 18 months.

Surgery in TB

- Surgery to be done :
- to evacuate abscess
- or decompress spinal cord
- or to stabilize joint or spine.

Brucellosis

- Milk and milk products
- Now less incidence in Saudi Arabia due to milk pasteurisation and awareness about not consuming unboiled camel's milk
- Back pain and stiffness
 - Muscle spasms
 - Fever (mild)
- **Sacro-iliac joint**
- Less destructive than TB, CT guided aspiration
- **Brucella titer: Diagnostic if > 1/640**
- Antibiotics:
 - e.g. Rifampicin – Doxycycline- Septrin

A patient suspected of having Brucellosis Right Sacro-iliac joint

- Young patient= 17 years old.
- Complaining of severe Low Back Pain radiating to right buttock.
- Has antalgic gait right lower limb.
- Very tender over Right S-I joint.
- ESR= 35mm/1st hour
- CRP= 45
- Drinks camel milk every weekend.

A patient suspected of having Brucellosis Right Sacro-iliac joint



CT guided needle Aspiration Right Sacro-Iliac Joint



CT guided needle aspiration Right Sacro-iliac joint



After 4 weeks

- Patient is pain free.
- Normal gait.
- ESR=4
- CRP=2

Thank u