



2-bone and joint infection

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

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References: 435 team , notes , slides

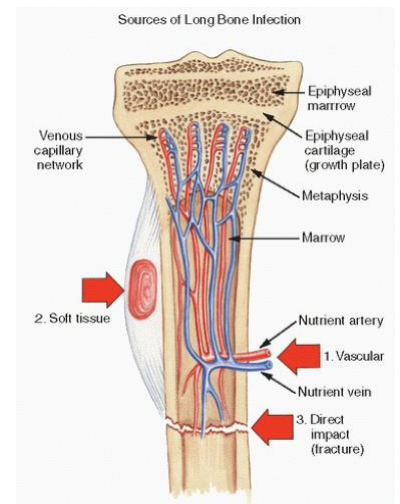
introduction

- Bones and joint infections are red flag (like open fractures, compartment syndrome...etc) If we don't diagnose or manage early, the patient may have problems all of his life or it may destroy or deform a limb or a joint
- Terminology:
 - Sequestrum (Dead Bone): 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. [click here](#)

osteomyelitis

[osmosis](#) [Toronto note](#)

- is an inflammation of bone and bone marrow caused by an infecting organism.
- Classification:
 - Acute hematogenous OM.
 - Acute OM.
 - Subacute OM.
 - Chronic OM.
- Routes of spread:
 - 1- Hematogenous.(blood borne)
 - 2- Direct Spread by nearby tissue.
 - 3- After open fracture.
- Duration:
 - 1- Acute less than 3 weeks
 - 2- Subacute between 3 to 6 weeks
 - 3- Chronic more than 6 weeks.



Determination of the offending organism is not a clinical diagnosis; Deep culture is essential.

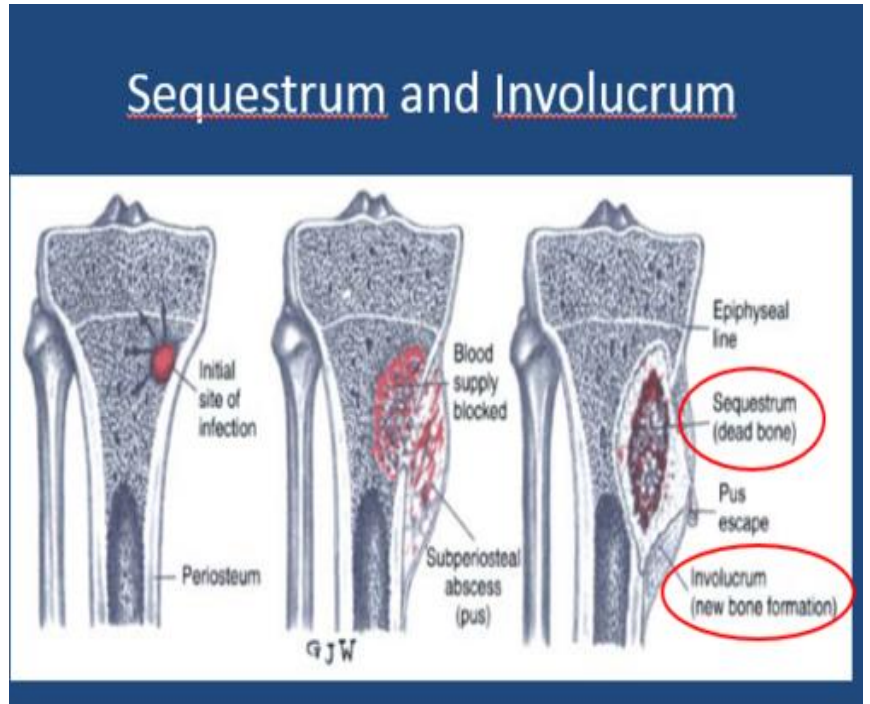
Acute hematogenous osteomyelitis

Clinical Features:

- Caused by blood-born organisms.
- More common in children.
 - Boys > girls
 - most common in long bone metaphysis or epiphysis
 - Lower extremity >> upper extremity.
- Pain, malaise, restlessness.
- Loss of function of the involved extremity.
- Soft tissue abscess and swelling.

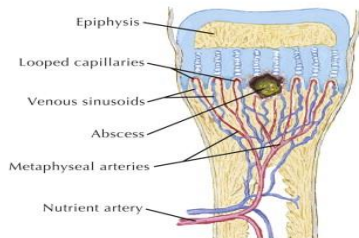
Radiographic Changes:

- soft tissue swelling (early).
- bone demineralization (10-14 days). (bone changes)
- sequestra(indication of OM) dead bone with surrounding granulation tissue (later).
- involucrum periosteal new bone (later)

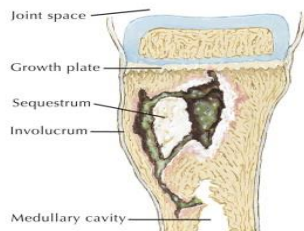


Extra

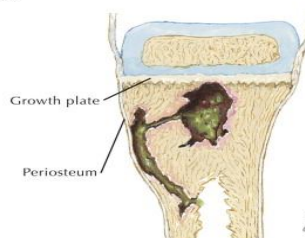
Pathogenesis



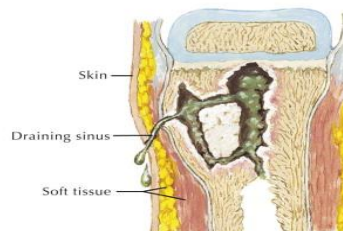
Terminal branches of metaphyseal arteries form loops at growth plate and enter irregular afferent venous sinusoids. Blood flow is slowed and turbulent, predisposing to bacterial seeding. In addition, lining cells have little or no phagocytic activity. Area is catch basin for bacteria, and abscess may form.



As abscess spreads, segment of devitalized bone (sequestrum) remains within it. Elevated periosteum may also lay down bone to form encasing shell (involucrum). Occasionally, abscess is walled off by fibrosis and bone sclerosis to form Brodie abscess.



Abscess, limited by growth plate, spreads transversely along Volkmann canals and elevates periosteum; extends subperiosteally and may invade shaft. In infants under 1 year of age, some metaphyseal arterial branches pass through growth plate, and infection may invade epiphysis and joint.



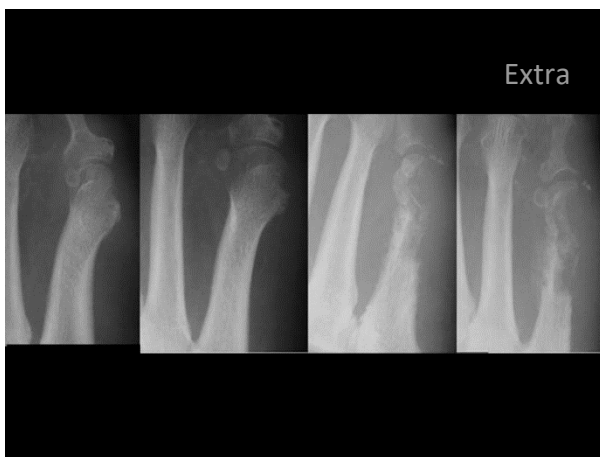
Infectious process may erode periosteum and form sinus through soft tissues and skin to drain externally. Process is influenced by virulence of organism, resistance of host, administration of antibiotics, and fibrotic and sclerotic responses.

Diagnosis: (blood work)

- ↑ WBC count **mainly neutrophils**
- ↑ ESR **not specific**
- blood cultures may be positive
- **C-reactive protein** **monitor response to treatment**
 - **most sensitive monitor of infection course in children** **respond very fast**
 - short half-life
 - dissipates in about 1 week after effective treatment
- **Plain X-Ray**
- **Ultrasound**
- **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

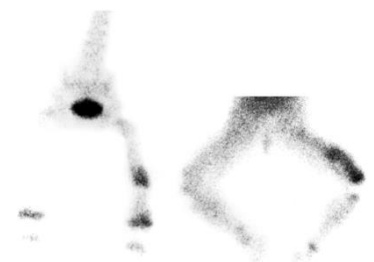
- Nuclear medicine studies may help when not sure.
- Plain X-Ray:

Early X rays may not reveal any findings except soft tissue swelling at site of infection. Bony changes take up to 10-14 days to show suspected bone involvement, but osteopenia may appear earlier **(not diagnostic)**. **REMEMBER** the patient can present with symptoms without bony changes in the X ray

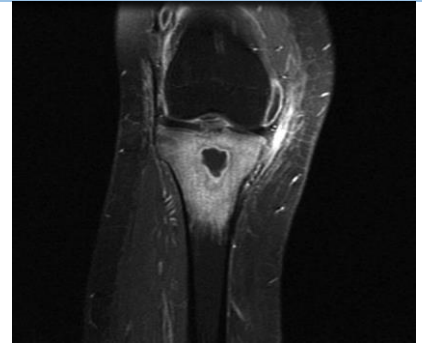


★ comment: First X image from the left was obtained in 2nd day with the patient experiencing symptoms. There are no changes seen in X ray. The 2nd image was taken in the 14th day, and it shows metaphyseal mottling and periosteal changes. The 3rd image shows most of the shaft involved.

- Nuclear medicine studies may help when not sure. **Bone scan > gallium scan, WBC labeled bone scan**
- **“increase uptake in femur bone, due to increase activity, so it’s possibly infection or maybe tumor we don’t know”**
- useful in delayed cases, when we want to check if there is more than one focus of infection “if we treated one place but the child is not improving”

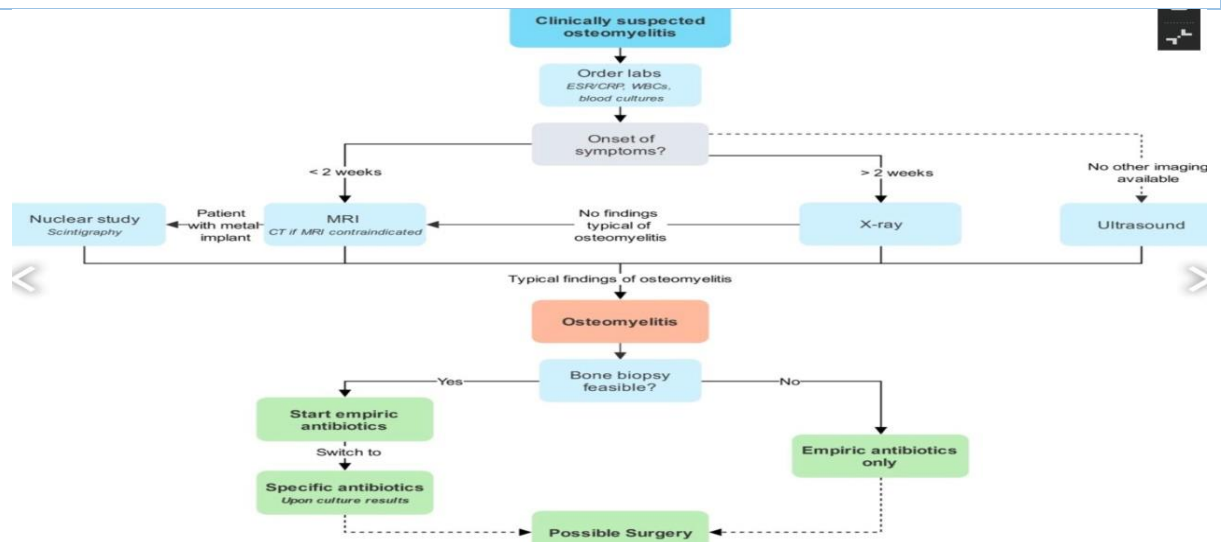


- MRI imaging: MRI bone changes appear before x-ray “best tool for radiological diagnosis as it is sensitive and specific, but difficult in young children as they require general anesthesia”
 - shows changes in bone and bone marrow before plain films
 - decreased T₁-weighted bone marrow signal intensity
 - increased post-gadolinium fat-suppressed T₁-weighted signal intensity
 - increased T₂-weighted signal relative to normal fat.



Confirm Diagnosis

- ★ Ultrasound guided aspiration from site of swelling or abscess.
- ★ X-ray guided aspiration of suspected bone involvement (according to MRI).
- ★ 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. Early results of smear doesn't give the exact bacteria but it will say yes there is infection
- ★ Histopathology examinations are recommended as well. **Definite Diagnosis By histopathology**, depends on seeing organisms at direct smear, or culturing organisms. It's important but usually result is late




Extra

Treatment Outline:

- identify the organisms. (take culture)
- select appropriate antibiotics.
- deliver antibiotics to the infected site.
- halt tissue destruction.
- Empirical Treatment is initiated Before definitive cultures become available, based on patient's age and other circumstances. (before reach exact organism which cause the patient conduction by culture)

Empirical Treatment

<p>Newborn (up to 4 months of age)</p>	<ul style="list-style-type: none"> • The most common organisms <ul style="list-style-type: none"> – <i>Staphylococcus aureus</i> – gram-negative bacilli – group B streptococcus after URI • Newborns crying, swollen <ul style="list-style-type: none"> – may be afebrile weak immunity – 70% positive blood cultures • Primary empirical therapy includes <ul style="list-style-type: none"> – oxacillin (penicillin)+ 3rd-generation cephalosporin
<p>Children 4 years of age or older</p>	<ul style="list-style-type: none"> • most common organisms <ul style="list-style-type: none"> – <i>S. aureus</i> – group A streptococcus – coliforms (uncommon) • empirical treatment <ul style="list-style-type: none"> – oxacillin or cefazolin cephalosporins – If suspecting gram-negative organisms 3rd-generation cephalosporin • <i>Haemophilus influenzae</i> bone infections almost completely eliminated due to vaccination
<p>Adults 21 years of age or older</p>	<ul style="list-style-type: none"> • Organisms <ul style="list-style-type: none"> – most common organism <i>S. aureus</i> – wide variety of other organisms have been isolated • Initial empirical therapy oxacillin or cefazolin
<p>Sickle cell anemia</p>	<div style="display: flex; align-items: flex-start;">  <div style="flex-grow: 1;"> <p><u>MCQ</u></p> <ul style="list-style-type: none"> • <i>Salmonella</i> is a characteristic organism • The primary treatment fluoroquinolones (only in adults) can't be given to children • alternative treatment 3rd-generation cephalosporin </div> </div>
<p>Hemodialysis and IV drug abuser</p>	<ul style="list-style-type: none"> • Common organisms <ul style="list-style-type: none"> – <i>S. aureus</i> – <i>S. epidermidis</i> – <i>Pseudomonas aeruginosa</i> • treatment of choice penicillinase-resistant synthetic penicillins (PRSPs) + ciprofloxacin • alternative treatment vancomycin with ciprofloxacin

Operative Treatment:

- started after cultures.
- indications for operative intervention:
 - drainage of an abscess, if we're sure there's pus (as a result of our investigations) we need to drain!!!
 - debridement of infected tissues to prevent further destruction.
 - refractory cases that show no improvement after nonoperative treatment.
- In case of presence of sequestrum it must be removed.

Acute Osteomyelitis

- After open fracture or open reduction with internal fixation.
- Clinical findings like acute hematogenous OM

Treatment:

- radical I&D
- removal of orthopedic hardware if necessary
- rotational or free flaps for open wounds if needed
- Most common organisms:
 - *S. aureus*
 - *P. aeruginosa*
 - Coliforms
- Empirical therapy before doing culture oxacillin + ciprofloxacin

Complications:

- 1- Septicemia and distant abscesses.
- 2- Septic arthritis.
- 3- Growth disturbance in skeletally immature and deformity.
- 4- Pathological fracture.
- 5- Chronic osteomyelitis.

Chronic Osteomyelitis**Common in:**

- inappropriately treated acute OM presences of sequestrum “source of bacteria” antibiotics cannot reach it
- trauma
- immunosuppressed they will present with sinus discharging pus without fever
- diabetics
- IV drug abusers.
- Anatomical classification:
 - 4 types: Medullary, superficial, Localized and Diffuse.

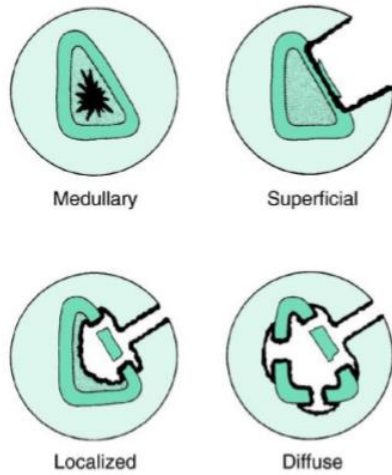


Table 2.2 Staging for adult chronic osteomyelitis

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

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. anything that wasn't useful in acute is useful here: plain x rays, CT scans
- **Best test to identify the organisms** → Operative sampling of deep specimens from multiple foci
- **Most common organisms:** S. aureus, Enterobacteriaceae, P. aeruginosa

Treatment:

- Empirical therapy not indicated because bone dead

___Glycocalyx (the sneaky bacteria when there's a cell coming to attack them or when they sense an Abx, they form a circular shield around them. Most commonly under the plate and screws, so if it happened we have to remove them). This happens after surgery and after total knee replacement. exopolysaccharide coating that envelops bacteria and enhances bacterial adherence to biologic implants What to do? Hardware has to be removed, but stability should be maintained (consider Ex-Fix)

- **IV antibiotics must be based on deep cultures.**

- **surgical debridement:**

- **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 [Diabetes mellitus](#)

Subacute Osteomyelitis

Diagnosis Usually

- painful limp **not sever like acute**
- no systemic and often no local signs or symptoms
- Signs and symptoms on plain radiograph

May occur in :

- partially treated acute osteomyelitis
- Occasionally in fracture hematoma
- Frequently normal tests
- WBC count usually negative
- blood cultures

Usually useful tests: any infection you need to roll out tumor

- ESR
- bone cultures cyst , sclerosis > body is trying to prevent cyst formation
- radiographs **Brodie's abscess** localized radiolucency seen in long bone metaphysis difficult to differentiate from **Ewing's sarcoma**

Treatment:

- Most commonly involves femur and tibia lower limb
- it can cross the physis even in older children
- Metaphyseal Brodie's abscess surgical curettage



Septic arthritis

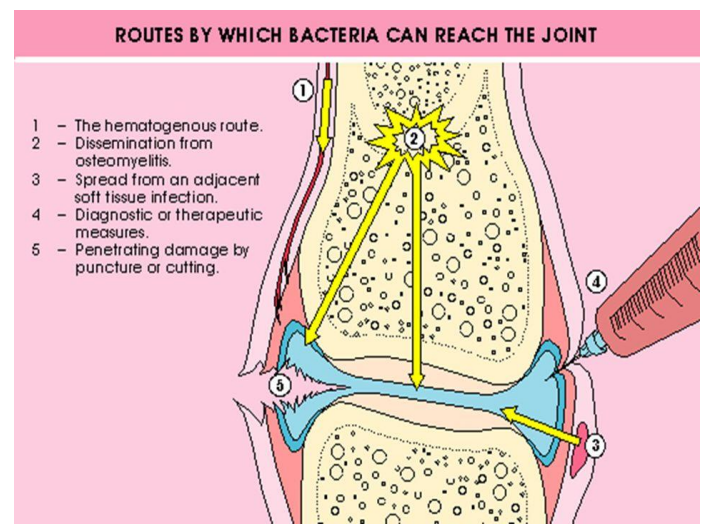
[osmosis](#) video

Introduction:

- Infection of the joint. **most critical**
- May affect any age and any joint. (the joint's function is movement) Infections starts at the synovium swollen synovium producing pus)
- Pathology: **hematogenous** or from adjacent bone.
- In neonates: transphyseal vessels or extension of metaphyseal osteomyelitis in children
- Common in the big joints hip , knee and shoulder
- In joints where the metaphysis is intracapsular (Hip, shoulder, proximal radius and distal fibula)
 - complication of a diagnostic or therapeutic joint procedure
 - **Most commonly in infants (hip) and children.**
 - metaphyseal osteomyelitis can lead to septic arthritis in:
 - proximal femur most common in this category.
 - proximal humerus, radial neck, distal fibula.

Route of transmission :

- 1- hematogenous spread
- 2- spreads from an osteomyelitis focus
- 3- spread from an adjacent soft tissue infection
- 4- Diagnostic or therapeutic measures
- 5- penetrating trauma by puncture or cutting.



Adults at risk for septic arthritis are those with :

MCQ

- **RA tuberculosis most characteristic**
- *S. aureus* most common
- **IV drug abuse Pseudomonas most common characteristic**

Clinical presentation:

- Symptoms: like Acute Osteomyelitis. General, and local REDUCED mobility. Position of rest even more here. He refuses any movements to the joint.
- Signs: hot swollen joint which is painful to any motion, inability to bear weight.
- Joint is fixed in the position of ease. . In the pictures we have septic arthritis of the shoulder and left hip. Rest position in the shoulder is internal rotation and adduction. The hip is flexion and external rotation.



Investigations:

- 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: like Acute Osteomyelitis.

Treatment:

- Empirical therapy:
 - prior to the availability of definitive cultures
 - Based on the patient's age and/or special circumstance

Empirical therapy

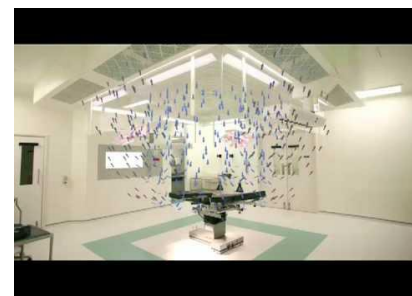
<ul style="list-style-type: none"> Newborn (up to 3 months of age) 	<ul style="list-style-type: none"> most common organisms almost same as acute OM newborn. <ul style="list-style-type: none"> <i>S. aureus</i> group B streptococcus less common organisms <ul style="list-style-type: none"> Enterobacteriaceae <i>Neisseria gonorrhoeae</i> 70% with adjacent bony involvement Blood cultures are commonly positive Initial treatment PRSP + 3rd-generation cephalosporin بعدين تحول على حسب الكالتشر
<ul style="list-style-type: none"> Children (3 months to 14 years of age) 	<ul style="list-style-type: none"> most common organisms <ul style="list-style-type: none"> <i>S. aureus</i> <i>Streptococcus pyogenes</i> <i>S. pneumoniae</i> <i>H. influenzae</i> markedly decreased with vaccination gram-negative bacilli Initial treatment PRSP + 3rd-generation cephalosporin alternative treatment vancomycin + 3rd-generation cephalosporin
<ul style="list-style-type: none"> Acute monoarticular septic arthritis in adults 	<ul style="list-style-type: none"> The most common organisms <ul style="list-style-type: none"> <i>S. aureus</i> MCQ Streptococci gram-negative bacilli Antibiotic treatment PRSP + 3rd-generation cephalosporin Alternative treatment PRSP plus ciprofloxacin
<ul style="list-style-type: none"> Chronic monoarticular septic arthritis Cartilage damage Polyarticular septic arthritis 	<ul style="list-style-type: none"> most common organisms <ul style="list-style-type: none"> <i>Brucella</i> <i>Nocardia</i> <i>Mycobacteria</i> fungi most common organisms <ul style="list-style-type: none"> Gonococci <i>B. burgdorferi</i> acute rheumatic fever viruses

Surgical treatment:

- mainstay of treatment
 - Surgical drainage open **or arthroscopic**.
 - daily aspiration
- 435 Treatment: ““Admission for Emergency arthrotomy and washout, broad spectrum IV antibiotics and splintage.
 - → Emergency drainage of the septic joint:
 - By **either arthroscopic Or Open**.
 - Daily aspiration
 - Joint should receive lavage(10 L of normal saline) and debridement, and a drain should be left at joint till discharge **is clear and minimal**.
 - IV antibiotics should be administered for 4 weeks.””
 - Tuberculosis infections lead to pannus like that of inflammatory arthritis
 - Late sequelae of septic arthritis soft tissue contractures may require soft tissue procedures (such as a quadricepsplasty)
 - Complication of Septic Arthritis: “only 435”:
 1. Septicemia 2- Abscess. 3- Osteomyelitis. 4- Joint destruction. 5- Joint subluxation and dislocation. 6- Ankylosed joint. 7- Avascular necrosis of the femoral head. 8- Growth disturbance.

Infected TJA**Infected TJA “total joint arthroplasty” – Prevention:**

- Perioperative intravenous antibiotics most effective method for decreasing its incidence
 - Good operative technique
 - Laminar flow avoiding obstruction between the air source and the operative wound. ([Video Explains Laminar Flow](#)) **air suction mechanism**
 - Special “space suits”
 - Most patients with TJA do not need prophylactic antibiotics for dental procedures
 - Before TKA revision knee aspiration is important to rule out infection.
- total knee aspiration**



Laminar flow

Diagnosis:

- ESR most sensitive but not specific
- Culture of the hip aspirate sensitive and specific
- CRP may be helpful
- Preoperative skin ulcerations risk **if you open that ulceration which is full of organisms you will make an access to bone**
- most accurate test tissue culture
- Most common pathogen :
 - ***S. epidermidis* most common with any foreign body**
 - *S. aureus*
 - group B streptococcus.

Treatment:

- **Acute infections within 2-3 weeks of arthroplasty Treatment:**
 - **prosthesis salvage stable prosthesis**
 - **Exchange polyethylene components**
 - Synovectomy beneficial
- **chronic TJA infections >3 weeks of arthroplasty :**
 - **Implant and cement removal**
 - staged exchange arthroplasty
 - Glycocalyx:
 - Formed by polymicrobial organisms
 - Difficult infection control without removing prosthesis and vigorous debridement
 - Helpful steps:
 - use of antibiotic-impregnated cement.
 - antibiotic spacers/beads.

Tuberculosis (Granulomatous bone infection)

- Tuberculosis is chronic bone infection that may affect any age. **reactivation of infection usually.**
- **Causative organism is: Mycobacterium Tuberculosis.** It is acid fast bacillus. When bacillus is seen it is diagnostic of TB. Can be diagnosed sometimes by direct smear.
- It takes up to **6 weeks** to culture.
- **In current time it's** Endemic in poor underdeveloped countries. Still present sporadically at Saudi Arabia.
- In developed countries TB patients are immunocompromised patients. (AIDS and drug addicts)

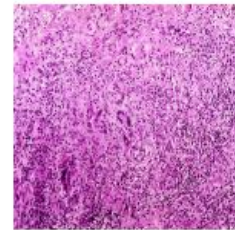
To Confirm Diagnosis

★ Histopathology

- **We need to see acid fast bacillus.** Also to see: Langhans giant cells.
Or to see: caseation in a bed of lymphocytes and monocytes. **Multinucleated cells, stroma of lymphocytes.**

We can diagnose TB either by direct smear, or by culture which takes 6wks.

TB Follicle



Pott's disease (TB in the spine)

- Affect any part of spine; **most commonly dorsal spine. Sacroiliac joint.**
- Can lead to **dorsal kyphosis.** **Destruction of vertebral body, there will be collapse.**
- Famous for causing psoas abscesses and paraspinal abscesses.
- TB spinal abscess may compress spinal cord= Pott's paraplegia.
- Compression of the spinal cord is more likely to occur **at the thoracic level.** Neurological deficits occur due to the compression secondary to the deformity or compression from the abscess.
- Infection spreads to adjacent level under the longitudinal ligaments and hematologically.
- Eventually a kyphotic deformity occurs
- Compression of the spinal cord is more likely to occur at the thoracic level
- Neurological deficits occur due to the compression secondary to the deformity or compression from the abscess
- Paravertebral abscess is common and may be distant as well, Cervical > retropharyngeal abscess, Lumbar > psoas abscess.
- **Reversible if treated early. Mostly treated non-surgically.**

TB spine, Dorsal kyphosis



Diagnosis

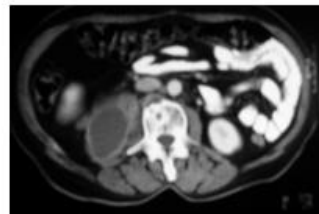
★ Radiology - Plain x-rays (Spine)

- Erosion and destruction of end plates.
- Narrowing of disc space.
- Soft tissue mass shadow.
- Anterior wedging of vertebrae.
- Kyphus deformity.

★ Special tests

- Tuberculin (Mantoux) skin test.
- Spine - **CT guided** needle biopsy
- Joints - Synovial aspiration, but it's 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 spine with Psoas abscess



MRI: TB lesion of dorsal spine



TB of the musculoskeletal system (parts other than the spine)

Clinical Picture:

Secondary to TB at lung, kidney, bowel and lymph nodes.

- ★ **Symptoms:** Fever, malaise, weight loss and night sweat → May not be present these days.
- ★ Suspicion of disease by previous history of TB presence of osteopenia and loss of joint space.



Management of TB

- ★ **Usually non surgical by Triple or Quadruple drugs=**
 - Isoniazid (INH), Rifampicin, Ethambutol, Pyrazinamide. We don't use streptomycin because it causes ototoxicity
 - Drug therapy to continue up to **18 months.**
- ★ **Surgery in TB** is done to relieve pressure
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.
- Less destructive than TB.
- Affects **Sacroiliac** joint.
- ★ **Symptoms:** Back pain and stiffness, Muscle spasm, Fever (mild).
- ★ **Diagnosis:** CT guided aspiration, Brucella titer: **Diagnostic if > 1/640**
- ★ **Treatment:** Antibiotics (Rifampicin – Doxycycline- Septrin)

★ Case - A patient suspected of having Brucellosis Right Sacroiliac 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.



After 4 weeks

Patient is pain free.

Normal gait.

ESR=4

CRP=2



CT guided needle Aspiration
Right Sacro-Iliac Joint

MCQs

1-A 32-year old man comes to the emergency department because of fever, worsening pain, and impaired range of motion in his right knee for 3 days. He states that he often has to clear small nails or glass splinters from the rough pavement of his construction site before kneeling to do work-related tasks. He has never had a prosthetic implant, there is no family history of rheumatoid arthritis or gout, and that he does not have unexplained skin lesions. Examination shows there is an obvious effusion in his right knee. It is visibly red and swollen, and warm and painful to touch. He refuses to bend it. His left knee is unaffected. Which of the following would be the most helpful test in establishing a diagnosis?

- A-CBC and culture.
- B-Joint fluid analysis and culture.
- C-right knee film
- 4-right knee ultrasound

Ans: B

2-A 12-year-old boy comes to the office because of a painful right knee and sore ankles for 3 days. He states that the pain came on gradually, and cannot remember sustaining any injuries. His temperature is 38.3°C (101.5°F), pulse is 94/min, respirations are 18/min, and blood pressure is 115/72 mm Hg. Physical examination shows an unwell-appearing child. His right knee and both ankles are swollen, red, and tender. Laboratory investigation shows elevated leukocytes. Joint aspirate shows mildly elevated leukocytes, and a grossly elevated lactate level. Which of the following is the most likely diagnosis?

- A- acute osteomyelitis.
- B-septic arthritis
- C-gout
- D-rheumatic fever

Ans: B

3-An 8-year-old girl comes to the emergency department with her mother because of right ankle pain. Her mother states that the pain started two weeks earlier and subsequently became worse. She also reports fever for the last week, and pain around the joint. Physical examination shows the right ankle is erythematous, warm, swollen and tender to palpation over the lateral malleolus. Radiographs of the ankle show soft tissue edema and a large radiolucency in the distal fibula. Which of the following is the most likely organism involved?

- A-group A streptococcus _
- B-staphylococcus aureus
- C- gram negative bacilli

Ans: B

4-A 58-year-old man comes to the clinic because of a recently developed fever and pain in his right foot. He has a history of poorly controlled diabetes mellitus type II. His most recent hemoglobin A1c is 9.4%. His temperature is 38.8°C (101.8°F), pulse is 88/min, respirations are 20/min, and blood pressure is 142/76 mm Hg. Physical examination shows his right foot has a 2 cm ulcer on the lateral aspect of the 5th metatarsal. This location is positive on probe to bone testing. A radiograph of the right lower extremity is unremarkable. Which of the following is the most appropriate next step in the management of this patient?

- A- IV fluid
- B-clindamycin
- C-IV vancomycin

Ans: C

5-A patient with chronic osteomyelitis and the question was about complications That require urgent intervention.

- A. Large sequestrum
- B. Severe osteoporosis
- C. Epiphysis involvement
- D. Pathological fracture

Ans: A

6-Indian driver who uses steroids for his asthma came with mid-back pain he lost weight and reported poor appetite. His temperature is 39. Blood works showed: WBC 14.000, CRP 200 and high ESR. He reports that his sister is taking TB drugs.MRI spine and chest x-ray were done and shown below. What is the next step in manage?

- A. Kyphoplasty
- B. Anti-TB medications
- C. Steroids
- D. Physiotherapy

Ans: B

7-Brucella titer is not diagnostic in this case (i think it was 1/460) what is the next step in diagnosis?

- A. Culture
- B. X-ray
- C. CT guided biopsy

Ans: C

8-DiabeticPatient came with gangrene in 5th toe and controlled by oral antibiotics, which one of the following is important to manage him?

- A-IV antibiotic
- B-Repeated Dressing.
- C-Local antibiotics.
- D-Back slap.

Ans: A

9-31-4-year-old child brought with his mother to OPD clinic complaining of fever, loss of appetite and failure to thrive. His mother said that he does not move his left upper limb and his wrist appears to be swollen. Lab investigations were done; WBC (14000) and Alkaline Phosphate (400). What is the most likely diagnosis:

- A-Active tuberculous arthritis
- B-Active juvenile idiopathic arthritis.
- C-Osteoarthritis
- D-Rachitic arthritis

Ans: A

10-4 years old male came with severe pain at the left thigh for months and discharge sinus since that time. He reported that he has a history of trauma several times on the same site for which he took antibiotics but no response because of recurrence of the same symptoms. Femur x-ray is shown below. Beside the course of 6 weeks long IV antibiotics. What should be a further management?

- A-Corrective osteotomy
- B-Sequestrectomy
- C-Discharge patient with oral antibiotics
- D-Fasciotomy

Ans: B

11-Patient with brucellosis the titer was high. What is the next step in management?

- A-Take culture
- B-start Antibiotics

Ans: B

12- Which of the following titers is considered diagnostic for Brucella?

- A. 1/160
- B. 1/640
- C. 1/460
- D. 1/110

Ans: B

13-what the benefit of ordering c-reactive protein for osteomyelitis?

Ans: monitor the response for treatment