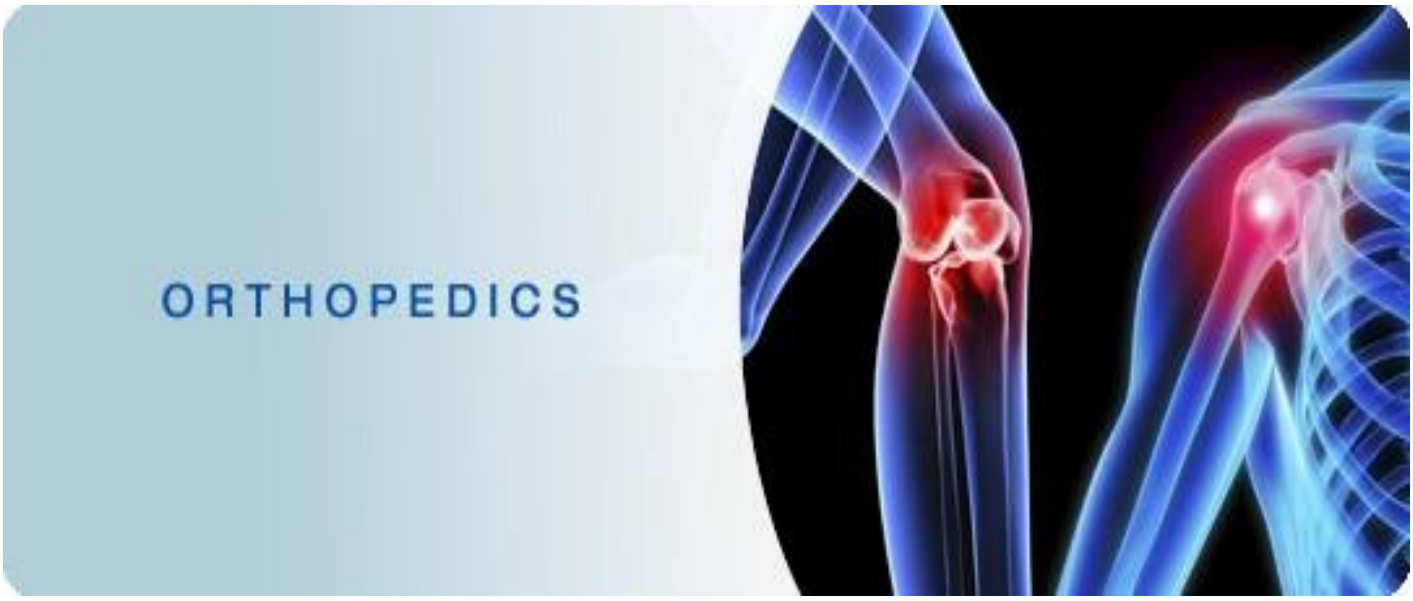
Orthopedic Teams

430 & 429

Isn't it funny how someone can say "I believe in Allah " but still follow the Satan who by the way also, " believes " in Allah…

430 ORTHOPEDICS TEAM



Lecture: Introduction to orthopedics.

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Team Leader:

Ayedah Al---Ruhaimi.

---The slides were provided by the doctor**.**

---Important notes in **Red**. –Medical dictionary in **blue**.

---Copied slides in **Black**.

---Doctor's notes in **green**.

ORTHO = Straight, Upright, Correct. Paios = Child.

First used by Nicolas Andry a French doctor (1841) in a book titled Orthopedia : the art to correct and prevent deformities in children.

Orthopedic Surgery = Not only Bone Surgery

- Orthopedic specialty is the branch of medicine which manage trauma and disease of Musculoskeletal system.
- It includes: bones, muscles, tendons, ligaments, joints, peripheral nerves, vertebral column and spinal cord and its nerves.

Orthopedic Specialty: Also Known as: Trauma and Orthopedic Surgery

Sub---Specialties in orthopedic include: Pediatric Orthopedic, Sport and Reconstructive Orthopedic, Orthopedic Trauma, Arthroplasty (It is a surgery to relieve pain and restore range of motion by realigning or reconstructing a joint, it has a rule in prosthetic joints), Spinal Surgery, Oncology orthopedic and Foot and Ankle surgery.

Red Flags: (It means be careful this case has something strange & need an immediate treatment).

- Red Flags = Warning Symptom or Sign
- Red flags should always be looked for and remembered
- Presence of a red flag means the necessity for urgent or different action/intervention

E.g. Patient has back pain but recently he can't pass urine this is red flag. We have to give him attention different from other patients with only back pain.

Examples of Red Flags: very imp

- **Open Fractures:** more serious and very high possibility of infection and complications because bone naturally is well saved in sterile environment but in open fracture there will be communication with outside (bacteria) to inside (bone) means this fracture is susceptible to sever possible communication and have to be treated immediately and in a special way other than closed fractures.
- **Complicated Fractures:** fracture with injury to major blood vessel, nerve or nearby structure. E.g. Patient who came with fracture but when we check the pulse there is no pulse. This mean that he has either: compression on the artery or there is a damage to the artery .So, we have to take him to the OR immediately within 2---3 hours not like other fractures which we used to treat them within 24 hours.

Case: Child who came with supracondylar fracture of the elbow due to falling on his arm, his arm was swollen & we can't feel the radial pulse.

- **Compartment Syndrome:** increase in intra---compartment pressure which endangers the blood circulation of the limb and may affect nerve supply.

Muscles, nerves and blood vessels they all covered by fascia which has the ability to expand when there is a pressure but to very little extend. So, when there is a swelling in the lower limb usually below the knee (very rarely in upper limb), the fascia will expand a little bit but pressure still there and it will increase slowly until the blood can't go in or out & this will lead to more swollen. With time the muscles around will become infracted due to the absence of the blood supply & this may lead to lose the limb (necrosis). That's why when we have a fracture with too much swelling and too much pain & in advanced cases no pulse, pallor this mean this case require a treatment priority over the other cases.

- **Cauda Equina Syndrome:** compression of the nerve roots of the Cauda Equina at the spinal canal which affect motor and nerve supply to lower limbs and bladder (also saddle or peri---anal area).
  ---When there is a back pain + difficulty in passing urine or numbness or reduced sensation (altered or absence) at sacral or peri---anal area this mean a very serious condition & we have to do urgent surgery.

- **Infection of Bone, Joint and Soft Tissue:** All the infections especially the acute once are considered as Red Flag.

  --- Osteomyelitis: Infection of the bone (from inside & outside). Osteo: bone myle: bone marrow.

  ---Septic Arthritis: Infection of the joint. If you don't treat it very quickly, it will destroy the structure of the bone. The cartilage & the articular surface will destroyed & the ligaments may tear & the capsule may punctured.

  ---Cellulitis: spreading (not localized) Infection of the soft tissue, skin May cause septicemia or irreversible damage.

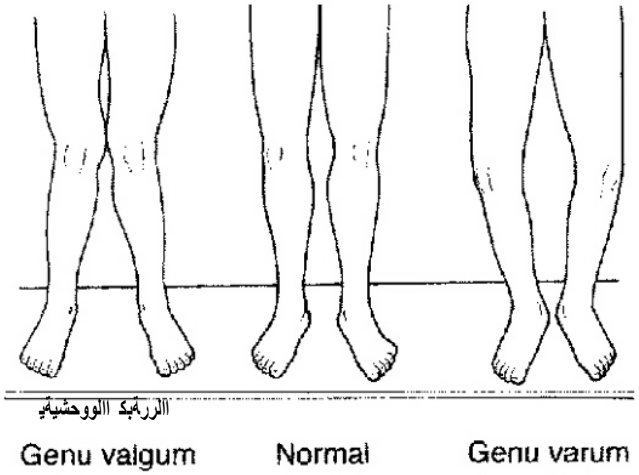
- **Multiple Trauma or Pelvic Injury:** more than one fracture or injury sustained at the same time consider massive blood loss and associated injuries.
  Why pelvic bone fracture is important? Because it's a big bone and bleeds a lot (could lead to blood loss about 45 units of blood inside). That's why we press the pelvic from outside (Pelvic tamponade) to stop the bleeding.

  ---Patient with multiple fractures or pelvic fracture has the priority of treatment over the one who have single fracture.

- **Acute joint Dislocations:** requires urgent reduction or may cause serious complications.

  Dislocation means that the two ends of the joint are no longer in contact. This requires immediate treatment & if we don't reduce it, the joint will deprive from blood supply (because the joint out of its place here) & this can lead to necrosis or infarction.

Alignment terminology:



Valgus: when the limb and the joint goes away from the midline.

Varus: when the limb and the joint goes toward the midline.

In the upper limb the elbow is called Cubitus. So, the same as the lower limb we call it either cubitus valgus or varus.

In examination you have to describe the alignment before you describe the swelling or small wound for example.

Congenital or Acquired:

---Acquired conditions include :

- Trauma
- Developmental: E.g. baby born normal but after that while he is growing, he start to develop the abnormality e.g. genu valgum or develop limping.
- Inflammation
- Infection.

What is the different between inflammation and infection? Infection caused by organisms but in inflammation not necessary there is organisms e.g. rheumatic disease (autoimmune or body rejection).

- Neuromuscular: e.g. cerebral palsy (1---2% of Saudi child have it) and muscular atrophy.
- Degenerative: Because of loss of content of hydration.
- Metabolic: The bone normally active, every day millions of bon cells destroyed by osteoclast and millions of cells built back by osteoblast.

- Tumor.(either: Benign or malignant & it's either primary or secondary or metastatic".

Congenital Anomaly: Talepoequinovarus TEV

Tale: foot , equino: horse , varus: goes toward midline

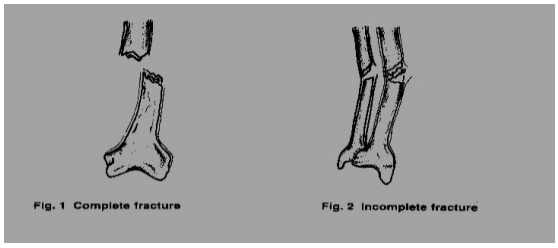
Traumatic Injuries:

- Fractures: Break in the continuity of bone.

  It could be:

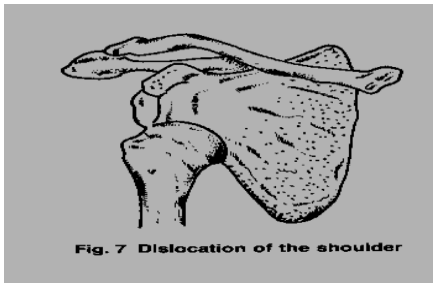
  1--- Complete displaced or not displaced (adult fracture).
  2--- Incomplete.

  Greenstick: fracture in children.



- Dislocations
- Soft tissues injuries: ligaments, tendons
- Nerve injuries
- Epiphyseal injuries

Dislocations: Complete separation of the articular Surface .



How to describe dislocation?

Distal to proximal fragment:

Anterior, Posterior, Inferior, Superior

This picture is inferior dislocation.

Dislocation with fracture of the bone:

We always have to get 2 views (e.g. Anterior Posterior and Lateral)

Always X-Ray Joint Above and Below

Fracture Dislocation Dorsal Spine:

---Fracture dislocation **of the cervical** spine can cause **tetraplegia (quadriplegia)**.

---Fracture dislocation of the **dorsal** spine (below the cervical) can cause **paraplegia**.

Avulsion Fracture:

Force due to Resisted Muscle Action: ---

"Avulsion" Transverse pattern.

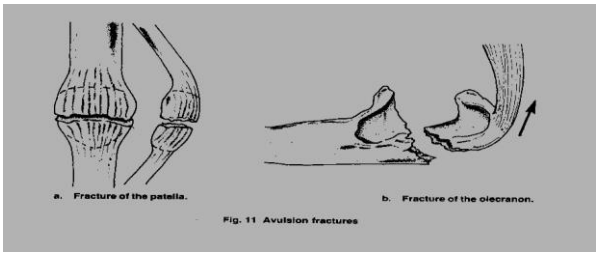
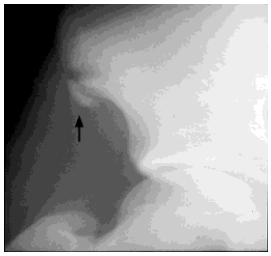


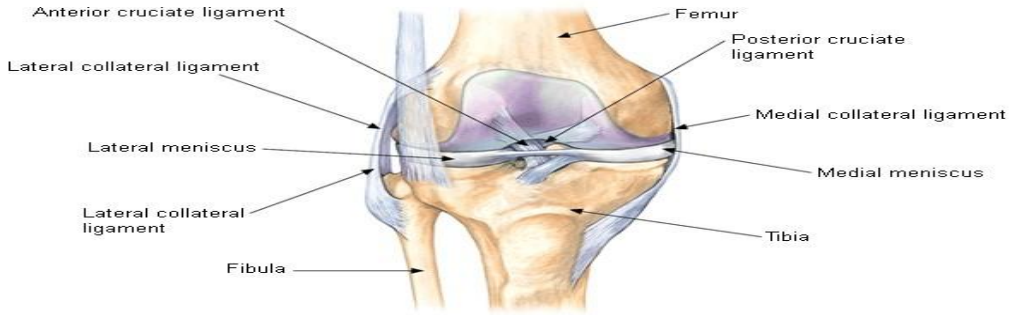
Fig. 11 Avulsion fractures



Usually tendons are attached to the bones .So, when someone has resistant action and tendon stronger than the bone it will cause avulsion of the bone from its normal place (e.g. football player throw the rock by mistake instead of throwing the ball). Treated by returning it to its normal place & fixing it

Soft tissue injuries of the knee:

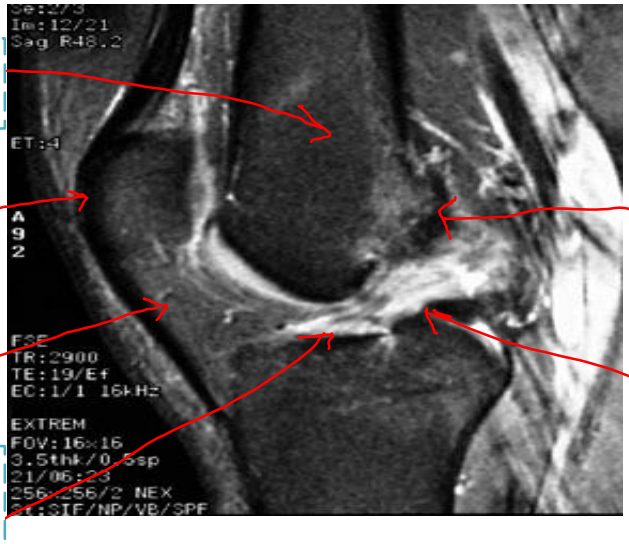
Some of the soft tissues are extra articular and the others are intra articular. They are separated by the capsule.



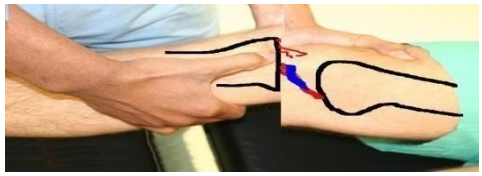
- We use Hyaluronic Acid as Joint Injection because it's similar to the synovial fluid. It helps in the lubrication & early moderation of osteoarthritis.

Anterior Cruciate Ligament injury: MRI

(Doctor said this MRI could come in exam or other one similarly)



Lachman's test: to determine if there is tearing of anterior cruciate ligament or not (you will be asked about it in OSCE in knee examination).



Medial Collateral Ligament (MCL): Extra articular

We do stress test for the knee to determine if there is injury of the collateral ligaments or not. It appears normal in x---ray.

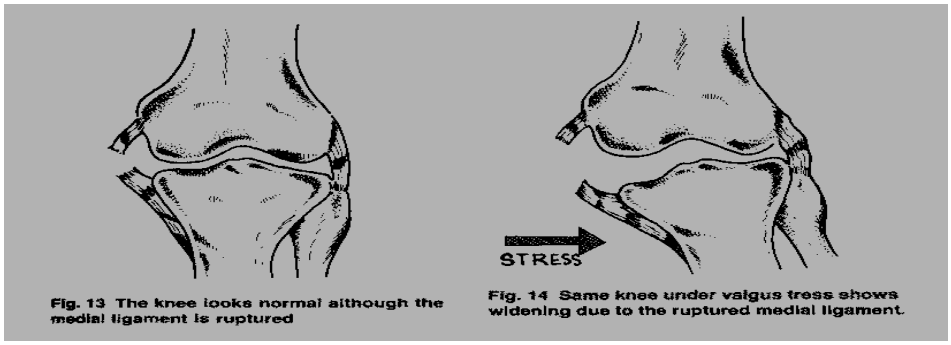


Fig. 13 The knee looks normal although the medial ligament is ruptured

Fig. 14 Same knee under valgus tress shows widening due to the ruptured medial ligament.

(Developmental Dislocation of Hip) DDH:

---The mother complains of difficulty in changing the baby diaper. At the beginning we do US because it's easier but if the baby age become few months, we do x---ray.

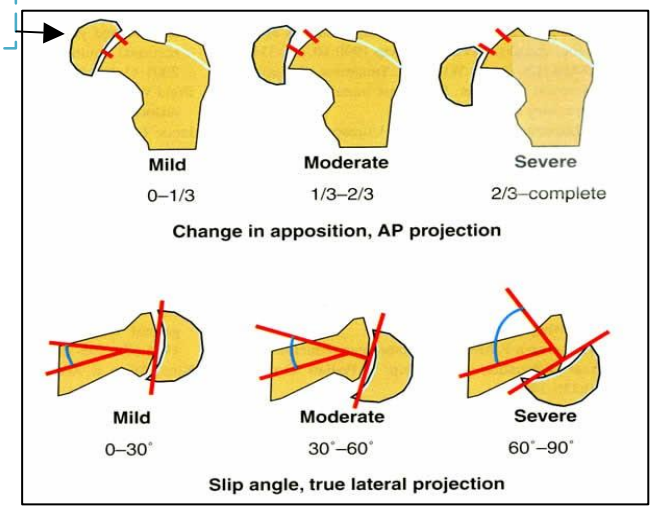
Orthosis : Pavlick Harness

Foot deformity: Hallux Valgus (big toe goes away from midline) (**acquired**)

Forefoot become wide then when patient wearing tight shoes it becomes more deviation.

SCFE (Slipped Capital Femoral Epiphysis):

Epiphysis

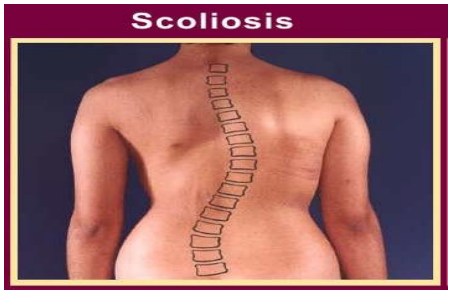


This is a rare condition but it's important to know how to diagnose it.

The children when they reach the puberty age, they feel hip pain (sometimes they feel it in the knee also) which cause restriction of hip movement. So, what happen is that the ligaments which attach the epiphysis with the main shaft become affected by the hormones & become lax. Along with the effect of weight this will move the epiphysis from its place.

This condition will lead to an early joint replacement.

Scoliosis:



---It is the lateral deviation of the spin from the mid line.

--- Most of the time it's painless and developmental (but it could be congenital).

---Mostly affect female more than male.

Degenerative Disorders: the most common cause is losing of hydration.

- Occur at any joint
- Can be primary (due to aging) or secondary (other problems e.g. infection).
- Increased wear and tear
- Can lead to pain and/or deformity and/or loss of function
- Increase with advancing age
- Management depends on type and age

Osteoarthritis of Hip:

The changes which can happen in osteoarthritic hip:

---Decrease in the joint space because the cartilage becomes thinner.

--- There maybe sclerosis of the hip.

---There will be an osteophyte.

OA Knee:

There are:

---Decrease medial joint space.

--- Osteophytes formation.

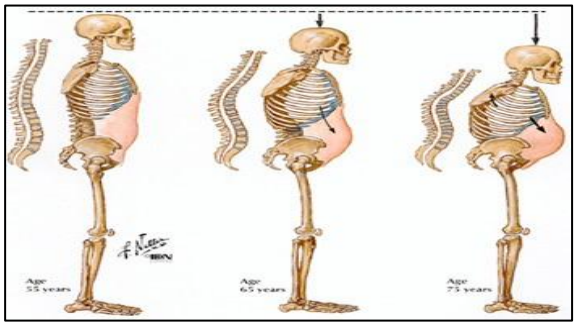
--- Sclerosis.

Metabolic Disorders (Rickets):

---It's due to vitamin D, calcium deficiency or insufficient exposure to the Sunlight (nutritional & sun exposure).

---Sometimes the cause is the kidney disease & it's called renal rickets.

Spinal Osteoporosis:

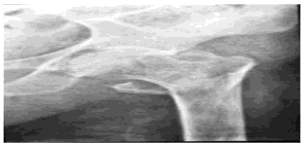


---Mainly affect female more than male due to the decrease of the level of estrogen after the menopause.

---It's painless & can cause the fractures.

---Osteoporotic fractures are painful & can affect the patient's life & he may die from it (especially hip fracture).

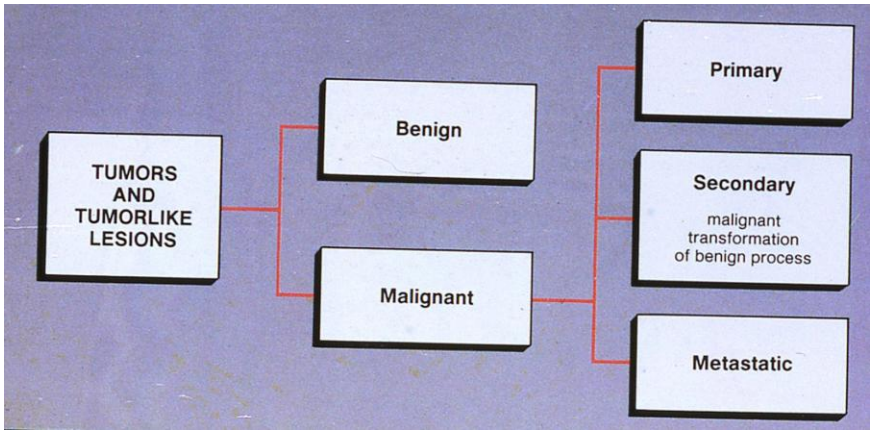
Osteoporosis: Fractured NOF (Neck of the Femur) the most dangerous complication especially in old people)



Hemi---Arthroplasty Lt Hip

Osteoporosis: Colles fracture

Bone Tumors:



In the x---ray there are:

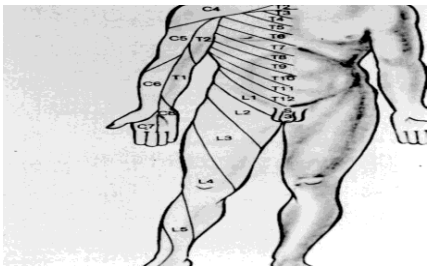
---Bone destruction.

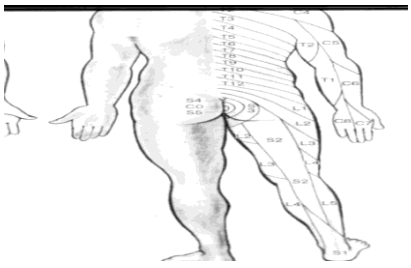
---Pathological fracture.

---Ill defined lesion.

Most likely it's malignant tumor.

Neurological Evaluation: Sensory





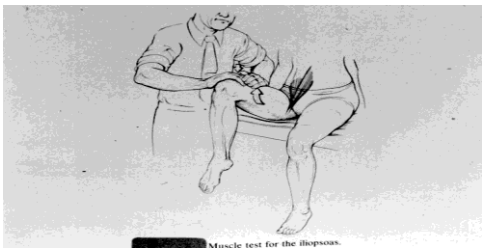
Muscle wasting:

There are differences between the R &L side:

---Difference in the shoulder's shape (the left one has normal contour while the right one is slipped).

---There is atrophy of the muscle at the right side due to nerve damage.

Muscle Power Testing: Iliopsoas



Muscle Power testing:

0 = no power.

1= simple contracting.

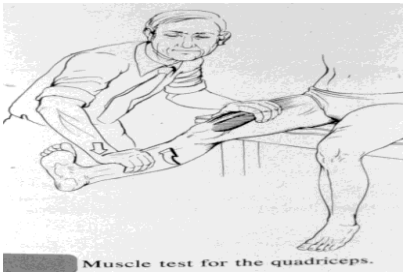
2= slight contraction within the gravity.

3= muscle power against gravity

4= against gravity with resistance

5= against gravity with normal resistance

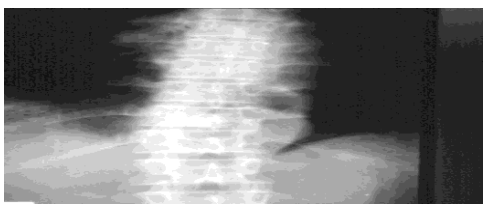
Muscle Power Testing : Quadriceps



Neuromuscular disorder: Polio

Chronic Osteomyelitis : discharging sinus

Spinal Infection: Tuberculosis



Chronic Osteomyelitis : Sequestrum

Clinical Skill: Cast application

External Fixator : Ilizarove

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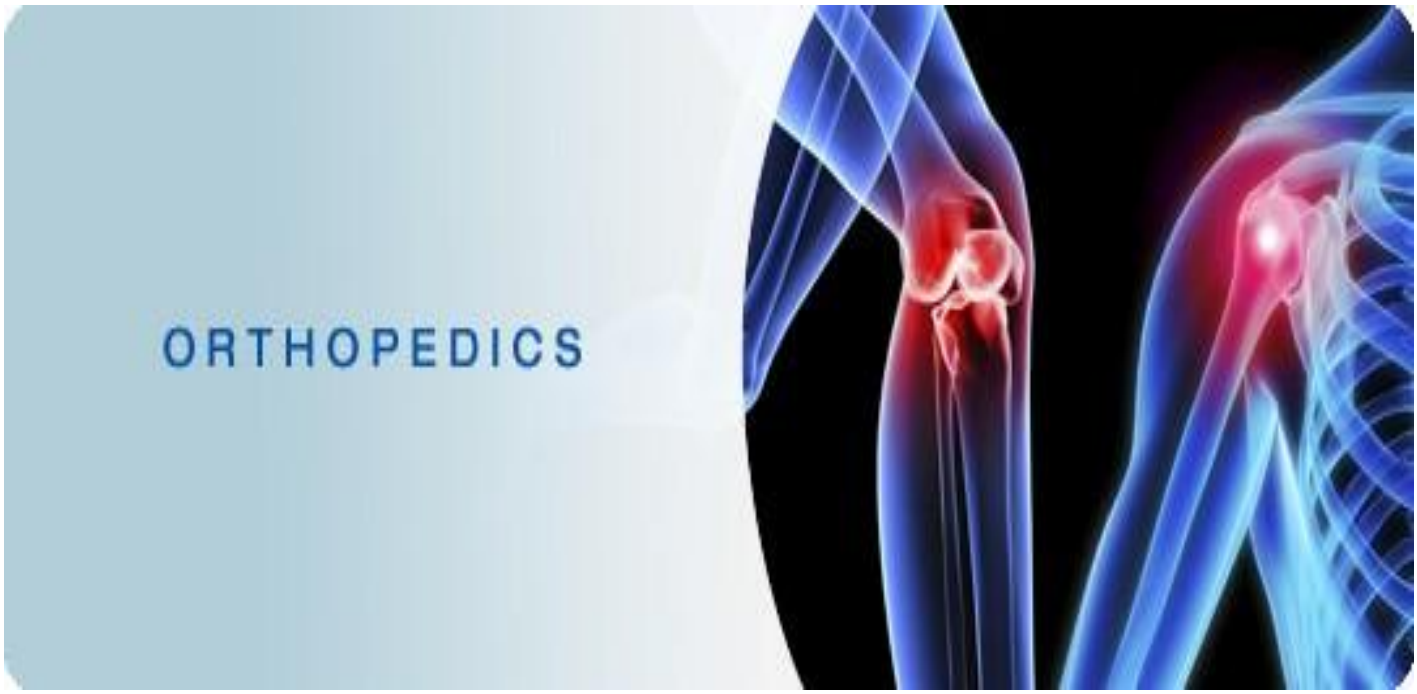
430 ORTHOPEDICS TEAM



Lecture: Bone and Joint Infections

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Team Leader:

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---The slides were provided by the doctor**.**

---Important notes in **Red**. ---429 (A) in **orange**.

---Copied slides in **Black**. ---Doctor's notes in **green**.

Introduction:

--- Bone infections are considered one of the red flags because if you ignore them, they may affect patient's life (he may die). Also, they are easily preventable just by giving the right treatment at the right time & they are very obvious (clear to identify).

- Initial treatment →→ based on presumed infection type →→ clinical findings and symptoms.
- Definitive treatment →→ based on final culture.

✓✓ **Glycocalyx:** [It's a polysaccharide formed by the bacteria around metal implants (e.g. prosthetic knee) to protect themselves against the immunity, usually the treatment is not completed unless the metal is removed.

- exopolysaccharide coating.
- envelops bacteria.
- enhances bacterial adherence to biologic implants.

Bone Infections:

1. **Osteomyelitis.**[oste= bone , myel= bone marrow , itis= inflammation]
2. **Septic arthritis.**
3. **Infected Total Joint Arthoplasty**.

---Mostly OM is treated medically by Abx unless there is pus.
---While waiting for the culture results (take 3---5 days) always start with broad spectrum empirical Abx depending on the most common organism in this area.

1] Osteomyelitis [OM]:

- Infection of bone and bone marrow.
- Route of infection.
  - Direct inoculation →→ Open fractures, e.g. inserting the bacteria while you are giving an injection to a patient with tendonitis.[from the environment]
  - Blood---borne organisms →→Haematogenous.[most common]
- Determination of the offending organism
  - ***A.*** NOT a clinical diagnosis.[It's →→Microbiological diagnosis , that is why deep culture is essential. So, before you start giving the empirical Abx, you have to take a sample for culture because after 2---3 days if the patient isn't responding, you can adjust your Abx according to the culture that you send 5 days ago]
  - ***B.*** DEEP CULTURE is essential.
- Classification:[It's important to know the severity & to choose the right treatment]
  - ***A.*** Acute hemotagenous OM.
  - ***B.*** Acute OM.
  - ***C.*** Subacute OM.
  - **D.**Chronic OM

A. Acute Hematogenous OM: [No Hx of trauma , open wound or injections (nothing from outside) before 2 weeks]

Case: child, Hx of sore throat 2 weeks ago. He was ok but 5 days ago he started to limp then unable to walk. He is febrile & look sick [acute presentation]

❖❖ 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.

b/c they are rich blood supplied areas.

- Pain.[localized]
- Loss of function of the involved extremity. (e.g. if it's in the upper extremity he will not be able to shake hands, eat,wave &move…)
- Soft tissue abscess.[Redness/swelling][localized to the site of infection especially at the beginning].
- Fever.

❖❖ Radiographic Changes:[x---ray is not a diagnostic tool]

- Soft tissue swelling (early sign).[the only sign you're going to see in acute presentation]
- Bone demineralization (10---14 days).
- ***Sequestra*** →→ dead bone with surrounding granulation tissue. which looks in the X-ray as a white area within a black area. The black area is the infection while the white area is the necrotic bone →→late sign.[It has to be removed in the OR b/c mostly it won't resolve by itself otherwise they will become a source of infection]
- ***Involucrum*** →→ periosteal new bone. which looks in the X-ray as if the cortex of the bone is doubled with a black space, separates the 2 layers →→late sign.

Taking a sample from the throat to know the organism doesn't help b/c it is usually different organism. Also, the culture will take 5 days either you take it from the bone or throat. So, there is no benefit.

❖❖ **Diagnosis:**

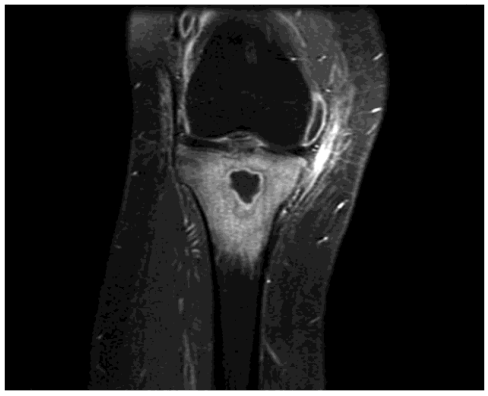
- Elevated WBC count.
- Elevated ESR.[takes almost 3 weeks to peak up]
- Blood cultures →→ may be positive.
- **C---reactive protein (CRP)**:[very important for diagnosis & follow up of treatment, it takes 5 days to peak up]
    - **Most sensitive monitor of infection course in children.**
    - Short half---life.
    - Dissipates in about 1 week after effective treatment

Case about CRP: If you have a young patient with a history of frequent travelling abroad (these people have tendency to have multiple organisms) & you gave him a broad spectrum first generation cephalosporin, in 5 days the patient still spiking fever & he doesn't look well (this mean that you don't treat the right organism with the right Abx) & the clinical examination suggesting that he isn't responding , what you are going to do??

---Request CRP & it will peak up within 5 days & if the patient isn't responding to Abx , you have to change it otherwise he will go into septic shock & die.

- Nuclear medicine studies (bone scan)→→ may help <u>when not sure.</u>[there will be high uptake(reactive area)but it is not specific (it just give a clue) b/c it could be soft tissue, bone infection or pathology other than infection like tumor]

- MRI:[the best diagnostic/sensitive tool but it takes time to arrange, children need to be anesthetized][MRI is the most sensitive for infection]
  - Shows changes in bone and bone marrow before plain films
  - Decreased T_1---weighted bone marrow signal intensity.
  - Increased postgadolinium fat---suppressed T_1---weighted signal intensity
  - Increased T_2---weighted signal relative to normal fat.



There is increase signal intensity of the proximal tibia which indicates OM of proximal tibia.

❖❖ **Treatment Outline**: [Mostly with broad spectrum Abx at first then change to specific Abx after the culture except in some indications. So, it's treated medically most of the time not surgery].

- Take samples for culture.
- Start empirical broad---spectrum Abx.
- Observe improvement with clinical parameters (Temp, pain) and blood tests (ESR,CRP).
- Review culture results within 3---5 days, if you find discrepancy between what you thought is the organism & the culture result then you have to think either you need to adjust your Abx or not and proceed accordingly.

Case:

Pt is suspected to have OM and you admit him & started to give him empirical Abx because you thought that it is S.aureus as it's the most common organism. However the culture showed that the organism is not covered by your Abx>> what should you do?

If the pt is improving clinically(symptoms) + Lab test (CRP going down) to your Abx don't change it even if the sensitivity test shows that the organism isn't sensitive to the ABx. If there is not improvement change it.

- Decide on duration of Abx (IV vs oral).

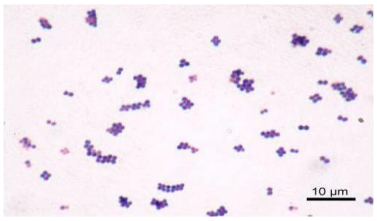
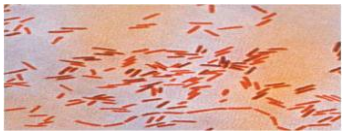
  [Duration mostly complete 6 weeks, sometimes start with IV for few weeks and then orally and sometime all the 6 weeks IV→→ depends on the severity ,immunocompromised pt,…ect]

  e.g.: young ,no medical problems barely acute presentation→→ 3 weeks is enough. While if he is old with HTN,DM and renal failure →→ max (6weeks).

○ **Empirical Treatment:**[is the one you give w/o definitive diagnosis or organism]

- Before definitive cultures become available.
- Based on patient's age and other circumstances.

  ---The most common organism in all age groups is S.aureus. So, what you need to think about is the second organism in each age.

	Organism	Empirical Tx	Notes
Newborn [0---4 months]	▪▪ *Staphylococcus aureus(most common)* ▪▪ Gram---negative bacilli. ▪▪ Group B streptococcus. 	Broad Spectrum Abx	▪▪ *Immunity is not fully Developed→→ so they may be Afebrile(don't have fever) ,Cry.[difficult to dx]* ▪▪ *70% positive blood Culture before Abx, not aspiration from bone or deep tissue.* .[other age groups are less] *---You may find some swelling.* *---can't localize the pain, wherever you touch the baby, he will cry.*
Children [>4 months]	▪▪ *S. aureus (most common).* ▪▪ *Coliforms →→ (uncommon→→ Vaccnine)*	Broad Spectrum Abx	▪▪ *Haemophilus influenza Boneinfections→→ almost Completely eliminated →→ due to Vaccination.*
Adults [≥21 years old	▪▪ *S. aureus(most common).* ▪▪ *Wide variety of other organisms have been isolated* [especially in people who have abnormal life style.]	Broad Spectrum Abx	
Sickle Cell Anemia	▪▪ *Salmonella is a characteristic (most specific) organism – but not the mo common* ▪▪ *S.aureus is still the most* common. 	Broad Spectrum Abx	
Hemodialysis and IV drug abuser	▪▪ *S. aureus* *S. epidermidis*[b/c usually the problem come from the skin] ▪▪ *Pseudomonas aeruginosa*	Broad Spectrum Abx	They are treated aggressively (combining 2---3 Abx or one but Very tough Abx)b/c they are considered as immunocimpramised patients.

- ***Operative Treatment:***

- Indications for operative intervention:

✓✓ Drainage of an abscess.

✓✓ Débridement of infected and necrotic tissues →→sequestrum→→ prevent further destruction.

✓✓ Refractory cases that show no improvement or the patient is getting worse after nonoperative treatment.

B. Acute OM:

- After open fracture or open reduction with internal fixation.[injections]

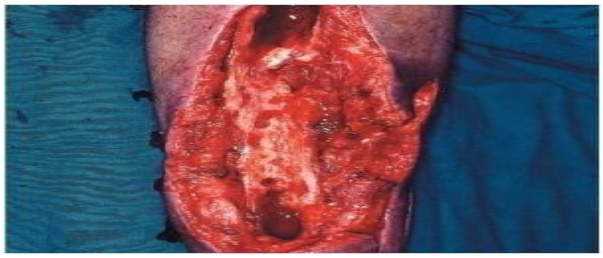
❖❖ Clinical findings→→similar to acute hematogenous OM.[same presentation the only difference is the treatment]

❖❖ Treatment:

✓✓ Radical I&D [Irrigation & Debridement],remove anything looks like dirty or died tissue→→SURGERY.[b/c infection after open fractures tends to be chronic also you want to prevent the infection before its happening that why you start aggressively by surgery].

✓✓ Removal of orthopaedic hardware if necessary.

✓✓ Soft tissue coverage for open wounds →→ if needed. [The bone must be covered to prevent infection and if it's infected it will get worse].



❖❖ **Most common offending organisms are:**

▪▪ S. aureus.

▪▪ P. aeruginosa.

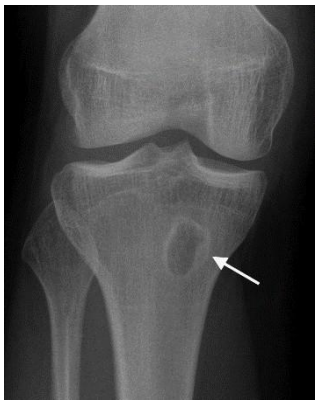
▪▪ Coliforms.

❖❖ **Empirical therapy** →→ Broad---spectrum Abx.

C. Subacute OM:

❖❖ **Diagnosis [Usually]:**

– Painful limp.[mild]
– **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: [usually results appear normal]
– WBC count.
– Blood cultures.

❖❖ **Usually useful tests:**

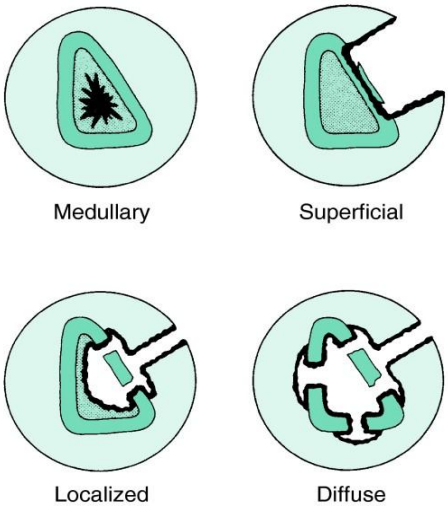
✓✓ ESR.
✓✓ Bone cultures.
✓✓ Radiographs →→Brodie's abscess (the arrow) →→ localized radiolucency seen in long bone [femoral,tibia]metaphyses→→ difficult to differentiate from Ewing's sarcoma.

❖❖ **Treatment:**

• Most commonly involves femur and tibia.
• It can cross the physis even in older children.
• Metaphyseal Brodie's abscess →→ surgical curettage.

D. Chronic OM:

• Can arise from:
– Inappropriately treated acute osteomyelitis
– Trauma
– Soft tissue
• Anatomical classification →→ check fig.[not imp]



• Population at risk:
✓✓ Elderly.
✓✓ Immunosuppressed patients. (e.g. rheumatoid arthritis)
✓✓ Diabetic patients.
✓✓ IV drug abusers.
✓✓ Hemodialysis patient.

❖❖ **Most common organisms:**

- S. aureus.
- Enterobacteriaceae.
- P. aeruginosa.

❖❖ **Clinical Features:** [not acute presentation & mostly no fever/some pain/some loss of function]

- Skin and soft tissues involvement.[pus discharge]
- Sinus tract →→ may occasionally develop squamous cell carcinoma.[b/c of the chroni c irritation]
- Periods of quiescence →→ followed by acute exacerbations.[means they don't present the same for the whole period, they recover and then relapse …so on]

Sonogram: It is a special X---ray procedure that is done with contrast dye to visualize any abnormal opening (sinus) in the body. If the dye reaches the bone that means it is chronic OM.

❖❖ **Diagnosis:**

- Nuclear medicine →→ activity of the disease
- Best test to identify the organisms→→ Operative sampling of deep specimens from multiple foci.

❖❖ **Treatment:** [Should Be Based on the Culture]

- **Empirical Therapy →→**is not indicated. **MCQ [wait for the culture unless it is acute in---top if chronic]**

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

- **Surgical Debridement**: [imp to remove the implant]

- Complete removal of compromised bone and soft tissue
- Hardware:

– Most important factor.
– Almost impossible to eliminate infection without removing implant. [If you can't remove the implant e.g. patient with fractured ankle . You wait until the fractured heal & then take it out & then do your aggressive treatment & Abx. If you can't &the patient stared to develop septicemia or septic shock, you need to transform your implant by removing it & put external fixture but don't leave the fracture loose & mobile].
– 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.

---Treatment is to open & clean the abscess & if you can take culture.

2] Septic Arthritis: [mostly treated surgically b/c the cartilage is very sensitive to infection, So if it was leaved for a few hours to a day the cartilage will be gone forever→→ take the patient to the OR and wash it out]

- Route of infection:

– Hematogenous spread.
– Extension of metaphyseal osteomyelitis in children.
– Complication of a diagnostic or therapeutic joint procedure.

- Most commonly in infants (hip) and children.
- Metaphyseal osteomyelitis can lead to septic arthritis in: [areas where it's near the cartilage (within the joint capsule].

✓✓ Proximal femur [e.g. greater trochanter]→→ most common in this category.
✓✓ Proximal humerus.[suspect the shoulder is also affected].
✓✓ Radial neck.
✓✓ Distal fibula. (ankle).

- Adults at risk for septic arthritis are those with:

✓✓ RA →→Due to joint effusion, Synovium is always inflamed & the immunity is compromised.

– Tuberculosis →→ most characteristic

– *S. aureus* most common

Case: Pt has septic artharitis in the elbow →→ Suspect RA

✓✓ IV drug abuse →→*Pseudomonas* most characteristic , but not the most common.

❖❖ **Treatment Outline**: 1st→→ OR (surgery : open or orthoscopic & take sample for culture) 2nd →→Empirical Abx & after 3---4 days you will get the result & adjust according to it.

○ **Empirical therapy: [After the surgery]**[if the patient has OM and SA is suspected take him to the OR, SA has the priority}

- Prior to the availability of definitive cultures.
- Based on the patient's age and/or special circumstances.

➢➢ **Newborn (up to 3 months of age):**

✓✓ Most common organisms:

- *S. aureus.*
- Group B streptococcus.

✓✓ Less common organisms:

- Enterobacteriaceae.
- *Neisseria gonorrhoeae.*

– 70% with adjacent bony involvement.

– Blood cultures are commonly positive.

– Initial abx after sugical wash out →→ broad---spectrum Abx.

➢➢ **Children (3 months to 14 years of age)**

✓✓ Most common organisms:

- *S. aureus.*
- *Streptococcus pyogenes.*
- *S. pneumonia.*
- *H. influenzae →→ markedly decreased with vaccination.*
- *Gram---negative bacilli.*

– Initial treatment →→ broad---spectrum Abx.

➢➢ **Acute monarticular septic arthritis in adults:** [severity depends on how many joint is involved, if monarticular = less serious while if polyarticular = more serious].

✓✓ Most common organisms:

- *S. aureus*
- *Streptococci*
- *gram---negative bacilli*

– Antibiotic treatment →→ broad---spectrum Abx

➢➢ **Chronic monarticular septic arthritis**

✓✓ Most common organisms:

- *Brucella*
- *Nocardia*
- *Mycobacteria*
- *fungi*

➢➢ **Polyarticular septic arthritis:**

✓✓ Most common organisms:

- *Gonococci*
- *B. burgdorferi*
- *acute rheumatic fever*
- *viruses*

○ **Surgical Treatment**:

- Mainstay of treatment.

– Surgical drainage →→ open or arthroscopic.[Orthoscopic is used more b/c it is less invasive, can reach difficult places, same results as open]when you are asked what is better? Say the results are comparable and you can do either.

– Daily aspiration[not recommended].

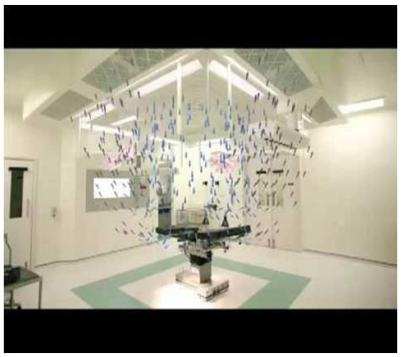
- Tuberculosis infections →→pannus→→ similar to that of inflammatory arthritis.[not imp]
- Late sequelae of septic arthritis →→ soft tissue contractures It's a problem even after cleaning the joint→→ may require soft tissue procedures (such as a quadricepsplasty to be able to bend the knee).[not imp].

---Just remember that the treatment of choice for SA is surgery (either open or arthroscopic) & give empirical Abx after the surgery.

3] Infected Total Joint Arthoplasty [TJA]: [always when there is a metal you are afraid of infection, most common knee then hip & shoulder].

❖❖ **Prevention:** [measures to avoid infection] [the best Treatment is prevention].

- Perioperative intravenous antibiotics →→ most effective method for decreasing its incidence.
- Good operative technique
- Laminar flow →→ avoiding obstruction between the air source and the operativewound.
- 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.[so if there is any sign of infection e.g scratch don't start TKA procedure]



Laminar flow

Special "space suits"

❖❖ **Most common pathogen:**

- *S. epidermidis* →→ most common with any foreign body.[b/c the problem comes from the skin].
- *S. aureus.*
- Group B streptococcus.

❖❖ Diagnosis:

- ESR →→most sensitive but not specific.
- Culture of the hip aspirate →→ sensitive and specific.
- CRP may be helpful.
- Most accurate test →→ tissue culture.
- Preoperative skin ulcerations →→↑↑ risk.

❖❖ Treatment Outline:

- ***Acute infections*** [within 2---3 weeks of arthroplasty]: [Just wash it out & take the insert out & replace it].

– Prosthesis salvage →→ stable prosthesis.
– Exchange polyethylene [a plastic material] components.
– Synovectomy→→ beneficial.

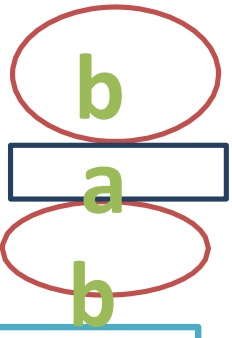
- ***chronic TJA infections*** [>3 weeks of arthroplasty]:

– Implant and cement remova.[to replace the metal , take it out & put a new one].
– Staged exchange arthroplasty.
– Glycocalyx:
  ✓✓ Formed by polymicrobial organisms.
  ✓✓ Difficult infection control without removing prosthesis and vigorous debridemen t.
– Helpful steps:
  ✓✓ Use of antibiotic---impregnated cement.
  ✓✓ Antibiotic spacers/beads.

1---Take out all the implant.
2---Put a. Polyethylene (to prevent softtissue contraction)and

b. Cement is mixed with Abx and placed in the joint.
3---After infection is over.

4---Place a new implant.



The doctor mentioned these scenarios at the end of the lecture:

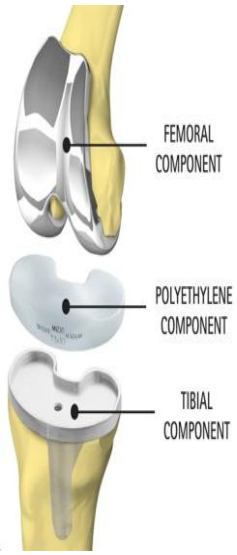
1--- You have a patient who is 30 years old , drug abuser came to the ER because of limping , inability to walk, fever & pain. What you are going to do?

--- Hx. --- Physical EX. BP=80/40. The doctor mention that he is in septic shock . So, he will start very aggressive Abx & IV fluid & take the patient to the OR ASAP.

Let us assume that the patient was taken to the OR , it was septic arthritis with distal femur OM , you washed it out & you debris the joint . everything was good & the patient stabilized a little bet & you took him back to his room . what you are going to do now??

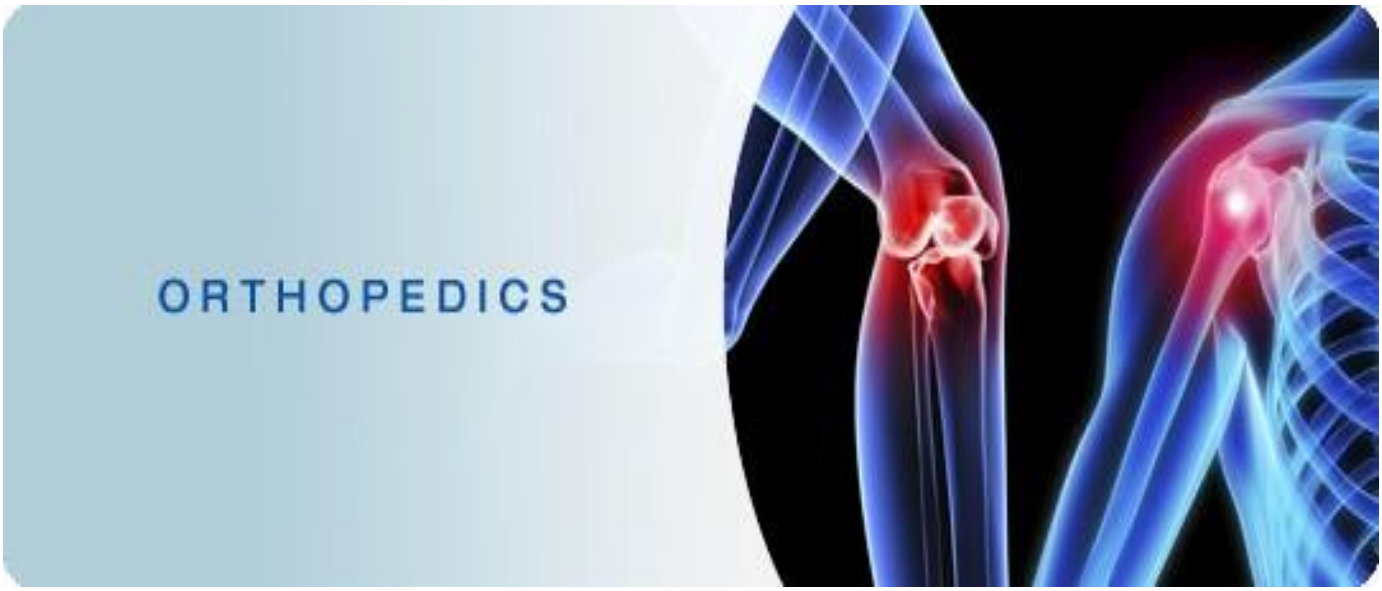
---continue on Abx & monitor his response by clinical exam , vital signs , WBC, ESR, CRP.

--- The second day you find the patient looks better than before but the vital sign is still spiking fever & CRP is still high . So, you give broad spectrum ABx or add another Abx to the one you already gave.



Isn't it funny how someone can say "I believe in Allah " but still follow the Satan who by the way also, " believes " in Allah…

430 ORTHOPEDICS TEAM



Lecture: X---ray interpretation.

Team Members:

Faten Al---Mohideb.	**Hanan Al---Salman**.	Aliya Al---Awaji.
Hadeel Al---Ghamdi.	Ghadeer Al---Wuhayd.	Hissa Al---Balla.
Lujain Al---Yousef.	Nouf Al---Hammad.	Jawaher Al---Faraydi.
Hiba Al---Rahiem.	Nour Al---Enezi.	Wejdan Al---Swayyid.
Arwa Abudawood.	Leena Al---Shaman.	Areej Al---Qunaitir.

Team Leader:

Ayedah Al---Ruhaimi.

---The slides were provided by the doctor.

---Important notes in **Red**.

---Copied slides in **Black**.

---Doctor's notes in **green**.

Objectives

- Review a systematic approach to interpreting orthopedic x---rays
- Review the language of fracture description

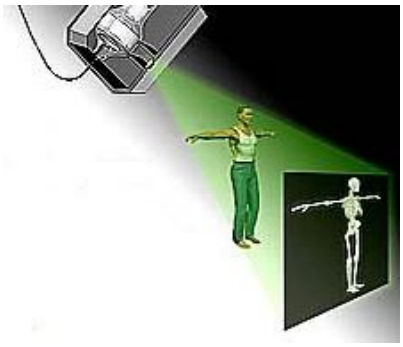
Medical Decision Making is a Triad of:

- History – from patients/records
- Physical Examination
- Confirming Studies – Imaging, Labs, etc.

Imaging

- X---ray
- Ultrasound
- CT Scan
- MRI
- Nuclear Medicine

X---RAY



- Radiation Source
- Patient Exposed
- Capture Image
- Interpret Image
- Ionizing Radiation
- Radiation damages cells
- Patient Blocks Transmission of Radiation
  - Soft tissues Less
  - Bones More
- Capture Image
  - Films
  - Digital
- Interpret Image
  - Radiologist
  - Orthopaedist
- Best for:
  - Hard tissue
  - Bones
  - Often combined with other imaging

Ionizing radiation hazard:
1) DNA damage incompatible with life →→ apoptosis.
2) DNA damage which is fixable →→ cell return normal.
3) DNA damage which leads to transformation either non harmful or harmful, if harmful →→ tumor.

ABCs APPROACH:

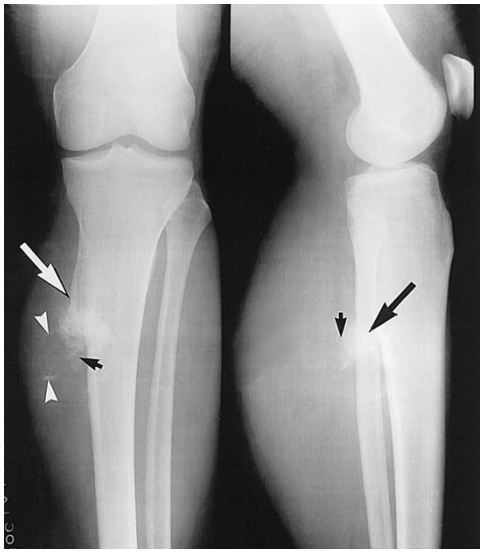
- **Pre ABC:** identify pt, read provided info (the most important to confirm the x---ray belongs to him/her and avoid mistakes).

A	---Adequacy. ---Alignment.
B	---Bones.
C	---Cartilage.
S	---Soft tissues

- Apply ABCs approach to every orthopedic film you evaluate.

ADEQUACY

- All x---rays should have an adequate number of views.
  - Minimum of 2 views—AP and lateral (optimally two orthogonal views '' 2 perpendicular views'' at least).
  - 3 views preferred (to enhance our brain to reconstruct a 3D image).
  - Joint above and joint below (if x---ray of joint: distal half of the proximal bone and proximal part of the distal bone. If x---ray of bone: the proximal and distal joints should be included).
- All x---rays should have adequate penetration (not the concern in this lect.)



Inadequate: 2 orthogonal views (A---P and lateral). The distal half of femur is not shown. So, it's not adequate.

Note: in A---P view fibula is lateral. In lateral view fibula is posterior.

ALIGNMENT

- Alignment: Anatomic relationship between bones on x---ray
  - Bone alignment vs other side
  - Bone alignment relative to proximal and distal bones
- 2 things to comment on alignment, first the distal part of the bone relative to the proximal (e.g. tibiovara→→ means the distal part of tibia is medial in relative to the proximal part of tibia) , second at the level of the joint, the distal bone relative to proximal bone (e.g. genu valgus→→ tibia is lateral in relative to femur. Genu=knee).
- Normal x---rays should have normal alignment
- Fractures and dislocations may affect the alignment on the x---ray
- In alignment you describe the distal part in reference to the proximal part.
  (Example: valgus means the distal part is lateral to the proximal part)
- 5---10 degree valgus in the knee is normal.

BONES

1. Identify bone
2. Examine the whole bone for
    1. Discontinuity →→ fractures or lytic changes

    2.Change in bone shadow consistency →→ change in density
3. Describe bone abnormality
    1. Location (because treatment differ).
    2. Shape

In deformity we describe two elements:

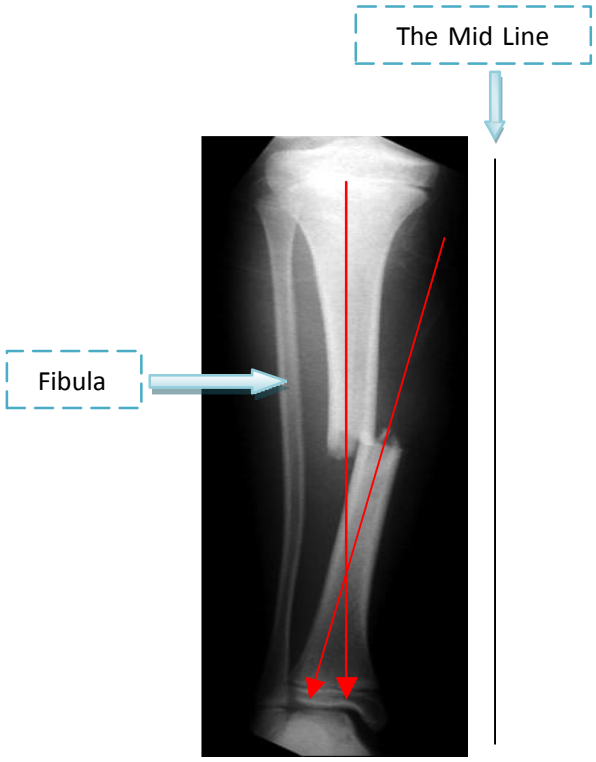
1) angulation
2) translation which has 2 components:

--- magnitude

---direction, if A---P view →→ medial or lateral translation. If lateral view →→ ant. & post. remember: we describe distal relative to proximal.

In AP view: deformity is described as either varus or valgus, if apex of angle lateral →→varus deformity. If apex medial →→ valgus deformity.

In lateral view: deformity is described as either extension or flexion. If apex of angle anterior →→ extension deformity, if apex post. →→ flexion deformity.

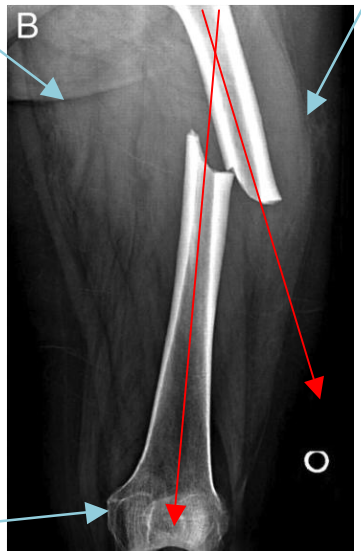


Pre ABCs: Patient identity unknown. No history or examination information. X---ray of right tibia

A: Not adequate because only one view(AP). And joint above is not fully visible.

B: Transverse fracture (one cortices is opposite to the other cortices) in mid shaft of tibia,
Distal part of tibia is going away from the mid line →→ valgus deformity, angulation 30 (always proximal is the reference & distal is the one which we are checking).
Apex of the angle is medial.
Translation (It's the displacement of distal fragment relative to the proximal one. If it's AP view we say either medial or lateral while if its lateral view we say either anterior or posterior): medial displacement 75---80%.

C: insignificant **S:** insignificant



Landmarks:

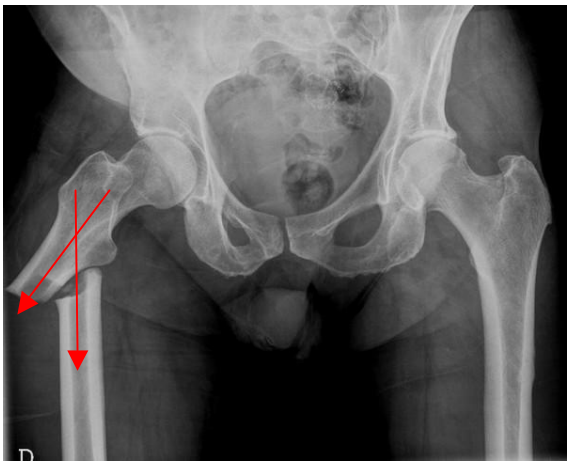
1) Femur curve.
2) Gluteal line.
3) Medial epicondyle larger than

Pre ABCs: Patient identity unknown. No history or examination info. X---ray of right femur.

A: not adequate because only one view and the knee and hip joints are not visible.

B: short oblique fracture in mid shaft of right femur, apex of the angle is lateral, varus deformity, angulation 40---50.Translation: medial displacement of 90% approximately (or 10% apposition),

C: insignificant **S:** insignificant

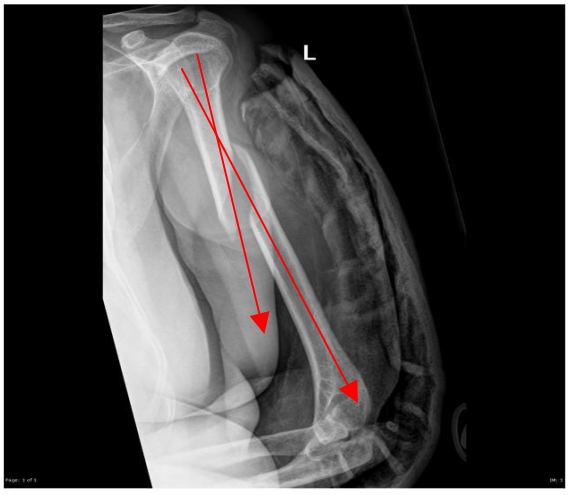


Pre ABCs: Patient identity unknown. No history or examination information. X---ray of the pelvis.

A: not adequate because only one view and the distal femur is not fully visible.

B: short oblique fracture in the upper third of right femur, apex of angle is lateral, varus deformity, angulation 600.
Translation: 100% medial displacement.

C: insignificant **S:** insignificant



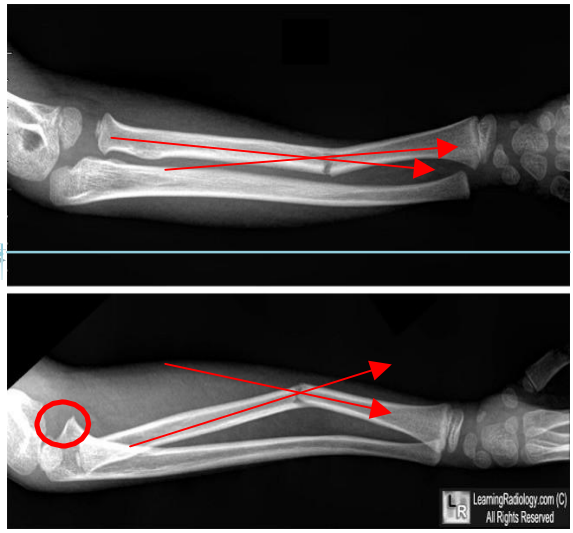
Pre ABCs: Patient identity unknown. No history or examination information. X---ray of left humerus.

A: not adequate because only one view.

B: complete spiral fracture at shaft of left humerus. Apex of angle anterior . Extension deformity,we can't say here varus or valgus because its lateral view not AP view.

Translation: 100%posterior displacement.

C: insignificant **S:** insignificant



The Mid Line

Pre ABCs: Patient identity unknown.No history or examination information. X---ray of forearm.

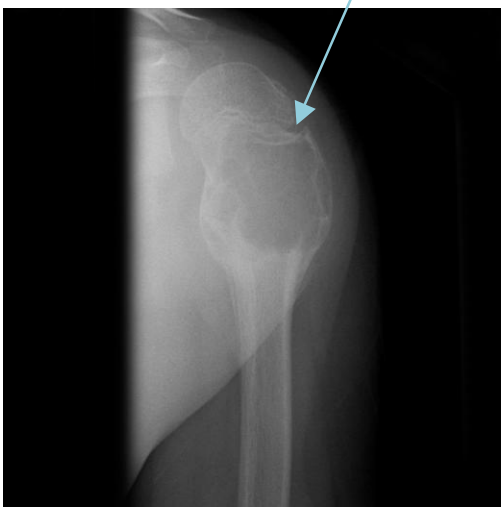
A: adequate x---ray

B: transverse fracture in lower third of radius,
A) A---P →→ apex of angle medial. Valgus deformity (distal part away from midline). Angulation of 20---300.
B) lateral view→→ apex of angle is anterior, extention deformity, angulation 30^0.
N.B. in lateral view you describe the deformity as extention/flexion not varus/valgus.

C: insifnificant **S:** insignificant

Landmarks: thumb and coronoid process (red circle) is always anterior. Olecranon is posterior.

it's a growth plate not a fracture.

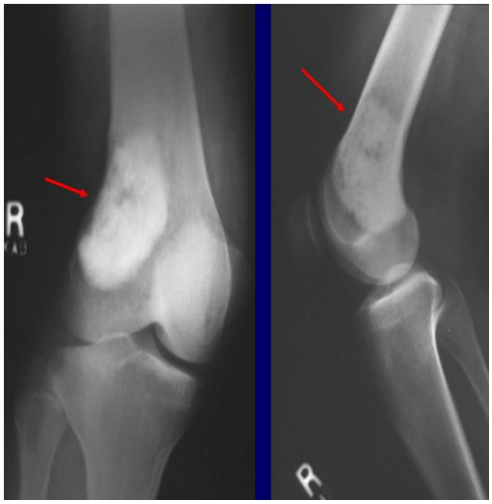


Pre ABCs: Patient identity unknown. No history or examination information. X---ray of proximal humerus.

A: not adequate because only one view and no joint above joint below.

B: Hypodense well circumscribed lesion with septae and ballooning, not clear if there is a fracture or not.

C: Cartilage can't be seen in x---ray because it's less dense. So, instead of that we look to the joint space if its decrease this means that the cartilage is gone (e.g. in osteoarthritis). But if you see increase in the joint space this means there is instability (the collateral ligaments aren't there.
S: insignificant



Pre ABCs: patient identity unknown.No history or examination information. X---ray of right femur.

A: not adequate because above and below the joint is not fully visible.

B: AP view: hyperdense well circumscribed lesion with some hypodense areas in metaphysis of distal right femur.
lateral view: lesion is occupying the full thickness.

C: decreased joint space at the lateral side.
S

CARTILAGE

- Cartilage
  - joint spaces on x---rays
  - you cannot actually see cartilage on x---rays
- Widening of joint spaces →→ signifies ligamentous injury and/or fractures
- Narrowing of joint spaces →→ arthritis

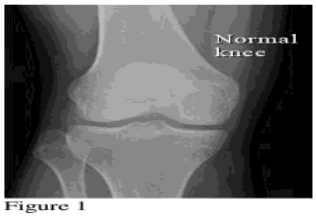


Figure 1

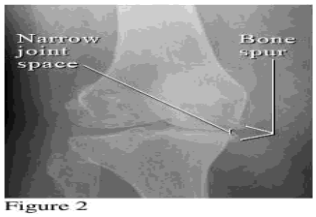
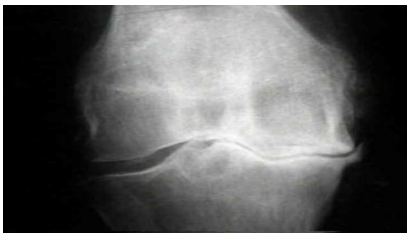


Figure 2



Pre ABCs: Patient identity unknown. No history or examination information. X---ray of pelvis.

A: not adequate because only one view.

B: left femoral head is deformed and distorted.

C: left femoral head is deformed and distorted, no joint space, cartilage is worn out, sclerosis**,** multiple osteophyte.
The right side has arthritis but not as bad as the other side.
S: insignificant

SOFT TISSUES

- Soft tissues implies to look for soft tissue swelling and joint effusions
- These can be signs of
  - Trauma
  - occult fractures
  - Infection
  - Tumors

REVIEW: ABCs

A	--- Assess *adequacy* of x---ray which includes proper number of views and penetration. --- Assess *alignment* of x---rays.
B	--- Examine *bones* throughout their entire length for fracture lines and/or distortions.
C	--- Examine *cartilages* (joint spaces) for widening.
S	--- Assess *soft tissues* for swelling/effusions.

EXAMPLES:

EXAMPLE # 1

- Inadequate x---ray only one view disatl and proximal not visualized.
- This x---ray demonstrates a lateral elbow x---ray.
- Bone is normal
- There is swelling anteriorly which is displaced known as a pathologic anterior fat pad sign
- There is swelling posteriorly known as a posterior fat pad sign
- Both of these are signs of an occult fracture although none are visualized on this x---ray
- Remember, *soft tissue swelling* can be a sign of occult fracture!

Capsule of joint is pushed by fluid: what could be the cause?

1) Septic arthritis
2) Trauma (hemarthrosis)
3) RA (effusion from inflammation)

EXAMPLE # 2… WHERE ARE THE FRACTURES?

- If you follow ABCs, you will notice there is are problems with alignment on this x---ray (A)
- (B)…You will notice there are fracture lines through the 2nd, 3rd, and 4th metacarpals
- These are 2nd, 3rd, and 4th, mid shaft metacarpal

fractures.

- A teaching point: Notice the ring on this film. Always remove rings of patients with fractured extremities because swelling may preclude removal later.

LANGUAGE OF FRACTURES

- Important for use to describe x---rays in medical terminology.
- Improves communication with orthopedic consultants
- Things you must describe (clinical and x---ray):
  - Open vs Closed fracture
  - Anatomic location of fracture
  - Fracture line
  - Relationship of fracture fragments
  - Neurovascular status

OPEN VS CLOSED

- Must describe to a consultant if fracture is open or closed
- Closed fracture
  - Simple fracture
  - No open wounds of skin near fracture
- Open fracture
  - Compound fracture
  - Cutaneous (open wounds) of skin near fracture site. Bone may protrude from skin
  - Open fractures are open complete displaced and/or comminuted

OPEN FRACTURES

- Orthopedic emergency
- Requires emergency orthopedic consultation
- Bleeding must be controlled
- Management
  - IV antibiotics
  - Tetanus prophylaxis
  - Pain control
  - Surgery for washout and reduction

ANATOMIC LOCATION

- Describe the precise anatomic location of the fracture
- Include if it is left or right sided bone
- Include name of bone

- Include location:
  - Proximal…Mid…Distal
  - To aid in this, divide bone into 1/3rds

FOR EXAMPLE....WHERE IS THIS LOCATED?

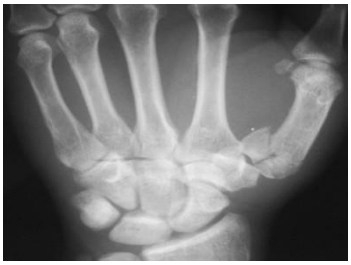
Pre ABCs: patient identity unknown. No history or examination information. X---ray of femur.
A: not adequate because no joint below joint above
B: metaphyseal spiral fracture with comminution, (or fracture in the distal shaft of femur). Apex of angle medial, valgus deformity, angulation 200. 100%lateral translation.
C: insignificant **S:** insignificant

- This is a closed L distal femur fracture.
- The main thing I want you to take from this example is the description of location.

ANATOMIC LOCATION

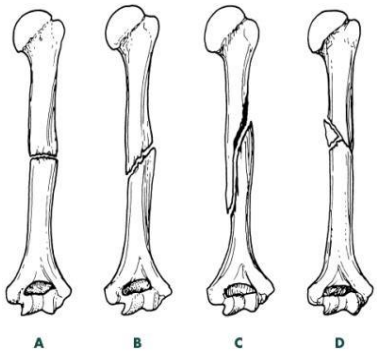
- Besides location, it is helpful to describe if the location of the fracture involves the joint space—intra---articular

INTRA---ARTICULAR FRACTURE OF BASE 1ST METACARPAL



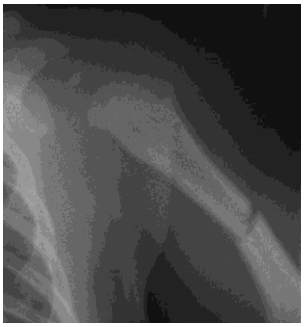
Pre ABCs: patient identity unknown. No history or examination information. X---ray of hand.
A: inadequate because only one view.
B: multiple fragmental fracture of base 1st metacarpal bone.
C: insignificant
S: insignificant

FRACTURE LINES



- Next, it is imperative to describe the type of fracture line
- There are several types of fracture lines
- A is a transverse fracture
- B is an oblique fracture
- C is a spiral fracture
- D is a comminuted fracture
- There is also an impacted fracture where fracture ends are compressed together

WHAT TYPE OF FRACTURE LINE IS THIS???



ANS: TRANSVERSE FRACTURE

- Transverse fractures occur perpendicular to the long axis of the bone.
- To fully describe the fracture, this is a closed midshaft transverse humerus fracture.

ANOTHER EXAMPLE OF FRACTURE LINE…

ANS: SPIRAL FRACTURE

- Spiral fractures occur in a spiral fashion along the long axis of the bone
- They are usually caused by a rotational force
- To fully describe the fracture, this is a closed distal spiral fracture of the fibula

ONE MORE EXAMPLE…

ANS: COMMINUTED FRACTURE

- Comminuted fractures are those with 2 or more bone fragments are present
- Sometimes difficult to appreciate on x---ray but will clearly show on CT scan
- To fully describe the fracture, this is a closed R comminuted intertrochanteric fracture

FRACTURE FRAGMENTS

- Terms to be familiar with when describing the relationship of fracture fragments
  - Alignment
  - Angulation
  - Apposition
  - Displacement
  - Bayonette apposition
  - Distraction
  - Dislocation

ALIGNMENT/ANGULATION

- Alignment is the relationship in the longitudinal axis of one bone to another
- Angulation is any deviation from normal alignment
- Angulation is described in degrees of angulation of the distal fragment in relation to the proximal fragment—to measure angle draw lines through normal axis of bone and fracture fragment

20 DEGREES OF ANGULATION

OTHER TERMS

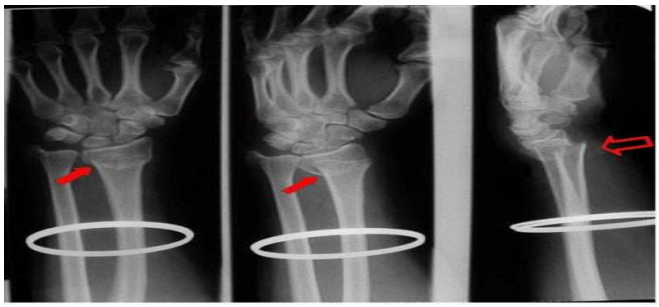
- Apposition: amount of end to end contact of the fracture fragments
- Displacement: use interchangeably with apposition
- Bayonette apposition: overlap of fracture fragments
- Distraction: displacement in the longitudinal axis of the bones
- Dislocation: disruption of normal relationship of articular surfaces

DESCRIBE FRACTURE FRAGMENTS

ANSWER

- This is a closed midshafttibial fracture….But how do we describe the fragments?
- This is an example of partial apposition; note part of the fracture fragments are touching each other
- Alternatively you can describe this as displaced 1/3 the thickness of the bone
- Remember aposition and displacement are interchangeable—we tend to describe displacement
- Final answer: Closed midshafttibial fracture with moderate (33%) displacement

ANOTHER ONE…

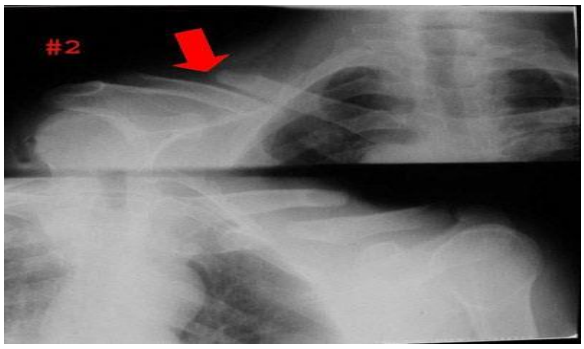


ANSWER

- There are 2 fractures on this film

- Closed distal radius fracture with complete displacement. Also there is an ulnar styloid fracture which is also displaced
- The displacement is especially prominent on the lateral view highlighting the importance of multiple views.
- There may be intra---articular involvement as joint space is close by
- Remember, remove all jewelry from extremity fractures

BAYONETTE APPOSITION



DISLOCATION

- Note the dislocation; the articular surfaces of the knee no longer maintain their normal relationship
- Dislocations are named by the positioin of the distal segemnt
- This is an Anterior knee dislocation.

Landmarks to help identify the direction of dislocation: Fibula always posterior, patella anterior & condyles posterior.

NEUROVASCULAR STATUS

- Finally when communicating a fracture, you will want to describe if the patient has any neurovascular deficits
- This is determined clinically

LANGUAUGE OF FRACTURES

- To review, when seeing a patient with a fracture and the x---ray, describe the following:
  - Open vs closed fracture
  - Anatomic location of fracture (distal, mid, proximal) and if fracture is intra---articular
  - Fracture line (transverse, oblique, spiral, comminuted)
  - Relationship of fracture fragments (angulation, displacement, dislocation, etc)
  - Neurovascular status

DESCRIBE THIS R MIDDLE PHALANX FRACTURE

ANSWER

- Oblique fracture of midshaft of R 4th middle phalanx with minimal displacement and no angulation
- Remember to comment if open vs closed & neurovascular status

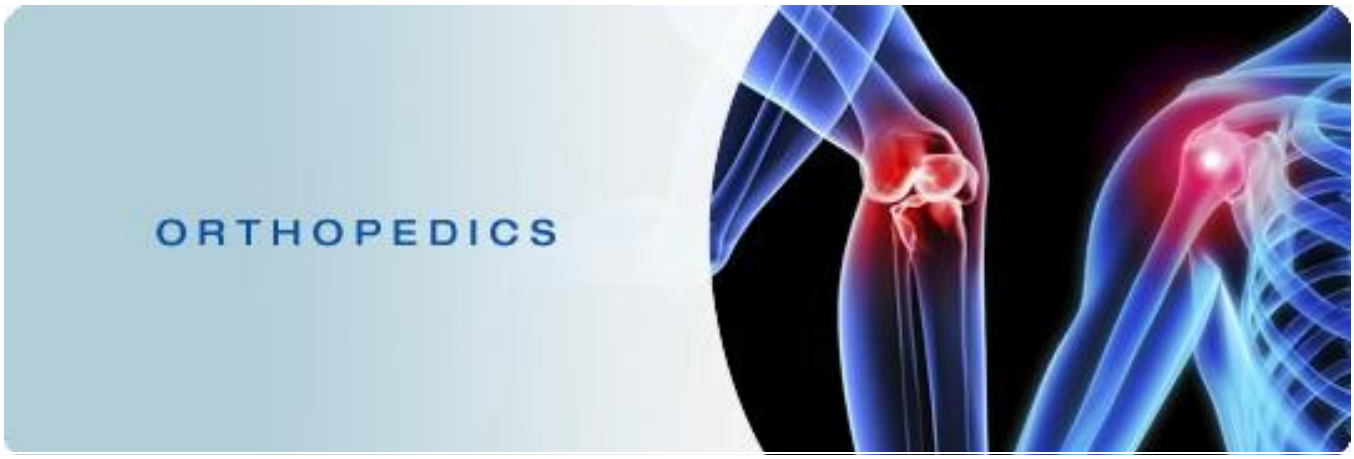
DESCRIBE TO ORTHO ATTENDING…

ANSWER

- This one is a bit more challenging!
- R midshaft tibia fracture displaced ½ the thickness of the bone without angulation; also there is bayonetteappositioning of the fracture fragments
- R midshaft fibular fracture with complete displacement and
- Also comment if the fracture is open vs closed & neurovascular status

Isn't it funny how someone can say, "I believe in Allah " but still follow the Satan who by the way also, " believes " in Allah…

430 ORTHOPEDICS TEAM



Lecture: Principles of Fractures and Common Adult Fractures.

Team Members:

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Hadeel Al---Ghamdi.	Ghadeer Al---Wuhayd.	Hissa Al---Balla. Lujain
Al---Yousef.	Nouf Al---Hammad.	Jawaher Al---Faraydi.
Hiba Al---Rahiem.	Nour Al---Enezi.	Wejdan Al---Swayyid.
Arwa Abudawood.	Leena Al---Shaman.	Areej Al---Qunaitir.

Team Leader:

Ayedah Al---Ruhaimi.

---The slides were provided by the doctor**.**

---Important notes in **Red**.

---Copied slides in **Black**.

---Doctor's notes in **green**.

Principles of Fractures:

A fracture is a break in the continuity of bone. And it can be **complete**(fig.1) or **incomplete fracture**(fig.2)

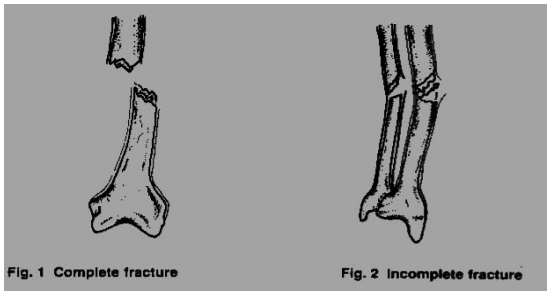
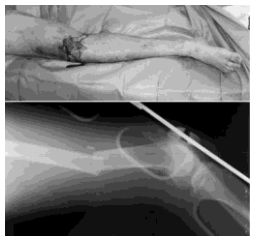


Fig. 1 Complete fracture

Fig. 2 Incomplete fracture

Definitions:

1. **Closed fracture (simple):**Does NOT communicate with external environment (skin is intact).
2. **Open fracture (compound):**Communicate with external environment (at higher risk of infections).
3. **Complicated fracture:**Associated with damage to nerves, vessels or internal organs.
4. **Dislocation:**Complete separation of the articular surface. You describe the **distal to proximal** fragment (Anterior, Posterior, Inferior, and Superior).
5. **Subluxation:** Incomplete separation of the articular surfaces.
6. **Fracture Dislocation:** If there is dislocation anywhere we should always suspect a fracture.So,always order X---Ray for the joint above and the joint below.
7. **Pathological Fracture:** Fracture abnormal bone (Cyst, Tumour, and Infection).



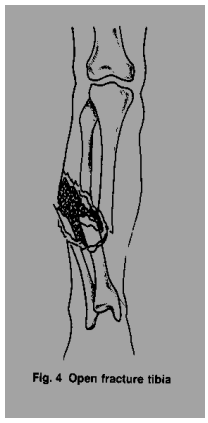


Fig. 4 Open fracture tibia

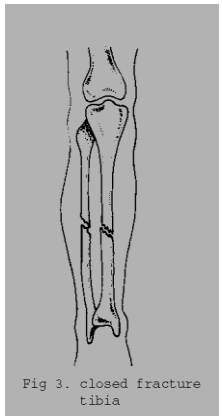


Fig 3. closed fracture tibia

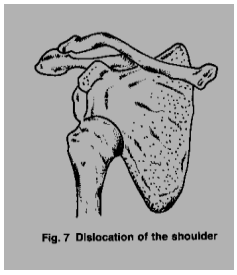


Fig. 7 Dislocation of the shoulder

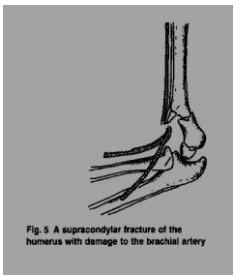
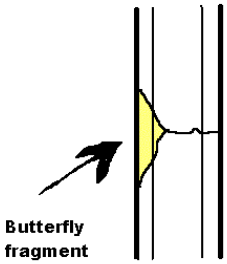


Fig. 5 A supracondylar fracture of the humerus with damage to the brachial artery

Mechanisms:

1. **Amount of Force:**
   a. Trivial force= Pathological
   b. Magnitude= Non---pathological
2. **Direction of Force:**
   a. Direct Force


Butterfly fragment


Transverse line


Spiral line

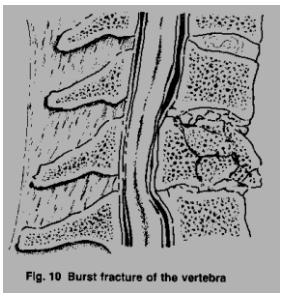

b. Indirect Force:

i. **On Long Bones:**

- **Twisting Force →Spiral Line**
- **Angulating Force→Transverse pattern**
- **Angulating + Axial compression→ Transverse line + Triangular "Butterfly"**
- **Angulating + Axial compression + Twisting forces→ Short oblique pattern**
- **Vertical compression→ Comminuted**

Comminuted fracture

Short oblique pattern

ii. **On CancellousBones**(Spongy bones)**:**

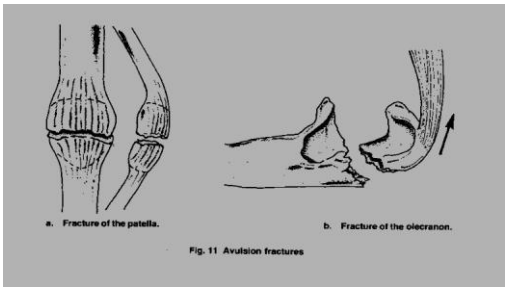
a. Direct force

b. Indirect force:

- **Comminuted Pattern**
- **Burst**

iii. **Force due to Resisted Muscle Action:**

- **Avulsion→ Transverse pattern**



Diagnosis:

i. History:

a. **Trauma:**
- Pathological (trivial)
- Non---pathological (magnitude)

b. **Mechanism:**
- Fall from height,
- RTA, pedestrian, Driver….?

c. **Complaint:**
- Pain sharp, increase by movement, Not radiating
- Loss of Function
- Deformity
- Symptoms of complications
- Other organs: head, chest, abdomen

ii. Examination:

a. **General examination:**
- Signs resulting from fracture or trauma:
  - Vital signs, Shock A,B,C
  - Associated Head, Chest, Abdomen

- Signs related to cause of fracture:
    - Pathological fractures …CA Lung, Prostate.

b. **Local examination:**

- **LOOK**: Skin damage (open fracture) , deformity, swelling
- **FEEL**: Localized tenderness
- **MOVE**: Abnormal movement, crepitus
- **DO:**
    - **Special tests:** neurovascular status
    - **Measurements:** shortening [Always compare]

iii. Investigations (X---RAY):

a.**Essential requirements:**

- **Two orthogonal views** (AP & Lateral).
- **Two joints** (Above & below #).

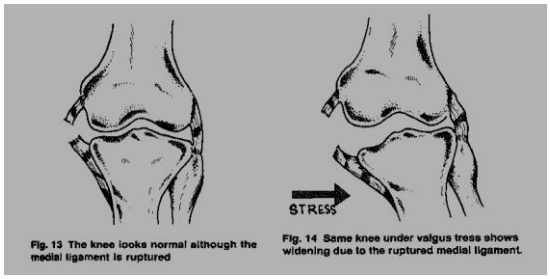


Fig. 13 The knee looks normal although the medial ligament is ruptured

Fig. 14 Same knee under valgus tress shows widening due to the ruptured medial ligament.

b.**Occasional Requirements:**

- Two Limbs " Compare "
- Two Occasions "Scaphiod"
- Special X---rays:Stress,CT..

c.**Description of X---ray:**

- **Situation:** side, site, localization
- **Pattern:** line of fracture
- **Displacement:**
    - **Shift:** lateral,medial,anterior,posterior
    - **Tilt:** angulations
    - **Twist:** rotation , internal, external
    - **Shortening:** overriding, impaction

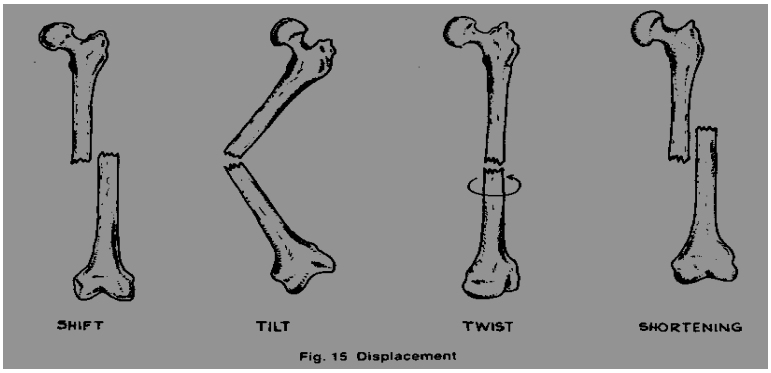
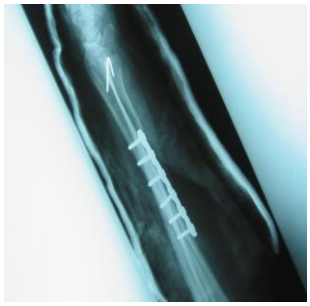


Fig. 15 Displacement

Repair of Fracture:

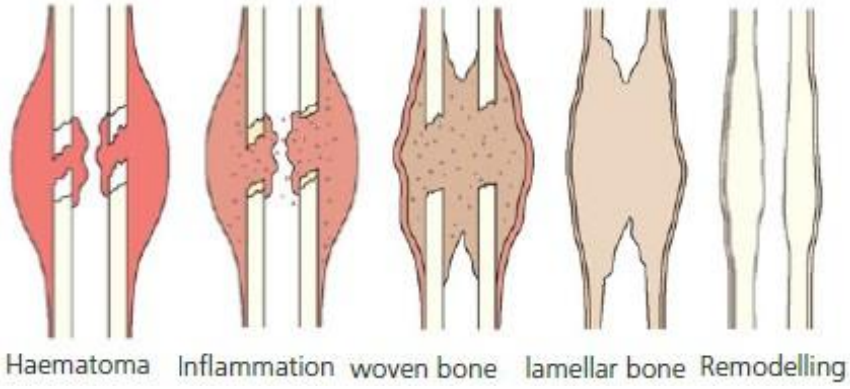
a. **Primary repair:**



- **With Rigid Internal Fixation** (open the fracture take out the hematoma and fix the bone in place)
- **No Callus formation**
- **Active Haversian remolding**
- **Long time of healing**

b.**Secondary repair:**

- **Without rigid fixation**(keep the hematoma and just do back slab or full cast and allow for healing)
- **<u>Commonest type</u> even with internal fixation** (In lower limp fractures, they usually put an implant in the medullary canal without opening the fracture "keep the hematoma"allowing secondary healing)
- **Stages:**



Time Factor--- Perkin's formula:

		Union	Consolidation
Upper limb	Spiral Transverse	3 weeks 6 weeks	6 weeks 12 weeks
Lower Limb	Spiral Transverse	6 weeks 12 weeks	12 weeks 24 weeks

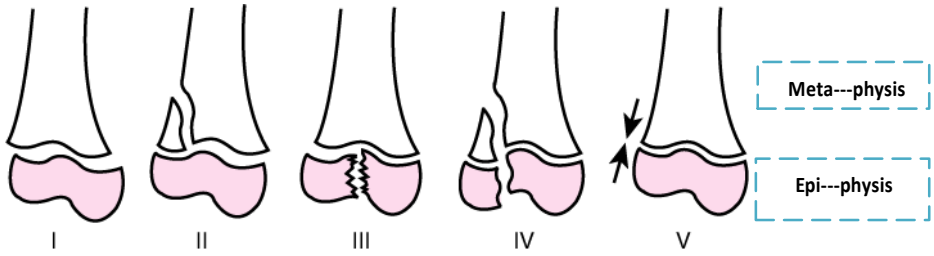
Fracture in children

- Different from those in adults.
- Children's bones are more malleable, allowing a plastic type of "bowing" injury.
- The periosteum is **thicker** than in adults and usually remains intact on one side of the fracture (**greenstick fracture**) which helps to:
    1. stabilize any reduction,
    2. decreases the amount of displacement, and
    3. Lower incidence of open fractures in children than in adults.
- Healing is more rapid.

- Open reduction is rarely indicated.
- High remolding rate.
- Growth disturbance.
- Often missed (poor communication).
- X---rays of both limbs for comparison.

Physeal Injuries:

- 30% of the fractures
- **Salter---Harris classification:** based on the radiographic appearance of the fracture

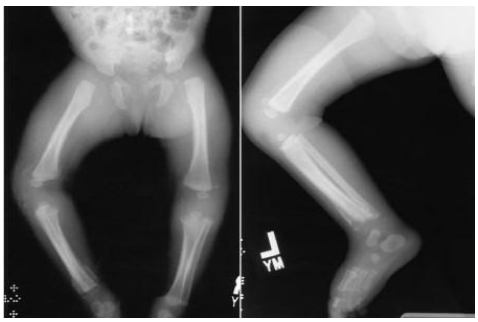


Birth Fractures:

- Most commonly in the clavicle, humerus, hip, and femur.
- They rarely require surgery but frequently are diagnosed as pseudopalsy, infection, or dislocation.

Fractures Caused by Child Abuse

- Between birth and 2 years of age.
- Multiple fractures in different stages of healing are almost always indicative of child abuse.
- Multiple areas of large ecchymoses in different stages of resolution (from black and blue to brown and green) also are pathognomonic of child abuse.
- The most common sites of fractures caused by child abuse are the humerus, tibia, and femur.
- Bone scan or a skeletal survey generally is indicated.



Pathological Fractures

- Fracture within an abnormal bone structure due to:
    1. **Congenital diseases** (Osteogenesisimperfecta).
    2. **Infection** (osteomyelitis).
    3. **Fracture through a cyst**.
    4. **Metabolic diseases** (Osteoporosis,Osteomalacia, Pagets disease).
    5. **Bone tumours** (primary or metastatic).

- Diagnosis:
  - History:
    1. Insignificant amount of trauma.
    2. Constitutional symptoms.
    3. History of malignancy.
- Examination:
  - **General:** signs and symptoms of malignancy or infection.
  - **Local:**
    1. Tenderness, pain, swelling.
    2. Muscle spasm and deformity is minimal.
- Investigation:
  - **Radiology:**
    1. X---rays of the lesion, MRI, CT---scan.
    2. X---ray/CT---chest (pulmonary Mets.)
    3. Bone Scan.
  - **Laboratory:**
    1. CBC w/ dif., ESR, C---RP.
    2. Acid phosphatase P, B J P
    3. LDH, etc.
- Management:
  - The aim is to make patient more functional and pain free for the remaining life span.
  - Early operative stability should be carried out.
  - Chemotherapy, Radiation, Hormonal.
- **Indications for prophylactic fixation**(surgical) **due to metastasis:**
  - Involvement of the cortex.
  - Increased pain.
  - Pure lysis.
  - Weight bearing area.

Fracture Management[Save life, save limb, save function]

- **GENERAL AIM:** To save the patient's life
- **LOCALAIM:**Rapid recovery of the injured part and its function
- **GENERAL management:**
  - Life threatening Injuries (Shock , Head, Chest, Abdomen)
- **LOCALmanagement** Dangers to viability:
  - Ischemia
  - Infection
- **How to save function?**
  1. Reduction
  2. Immobilization
  3. Soft tissue treatment
  4. functional activity & rehabilitation

Complications of fractures

- **Boney Complications:**
  - Delayed Union:
    1. Healing Slow but Active, Remove the cause!
    2. Fracture Site Tender

3. X--- Ray little Callus, Medulla Open

- Nonunion:
  1. Reparative process Stopped, Need Intervention
  2. Painless, Abnormal Movement, Psudoarthrosis!
  3. X--- Ray: Sclerosis, Blocked Medulla.

Delayed Union & Nonunion Causes:

Coxavara

- **Local:**
  1. Poor Blood Supply
  2. Soft Tissue Interposition
  3. Infection
  4. Inadequate Immobilization
  5. Over---Distraction
  6. Pathology, Tumors
- **General:**
  1. Nutritional status
  2. Bone Disease
  3. Old Age

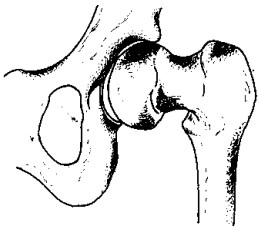


Fig. 43 Malunited fracture

Malunion:not healing properly in growth plate fractures is called ***coxavara***, in order to avoid it you have to detect it early.

Causes:

1. Primary Neglected fractures
2. After Reduction! Watch and get X---Ray after 10 days.
3. Epiphyseal Growth plate cause deformities with time.

Avascular Necrosis:

1. Death of bone tissue from; impairment or loss of blood Supply.
2. Most common anatomical sites are the **scaphoid**, **head of tallus** and **head of femur.**
3. Plane radiographs shows bone sclerosis and none or delayed union.

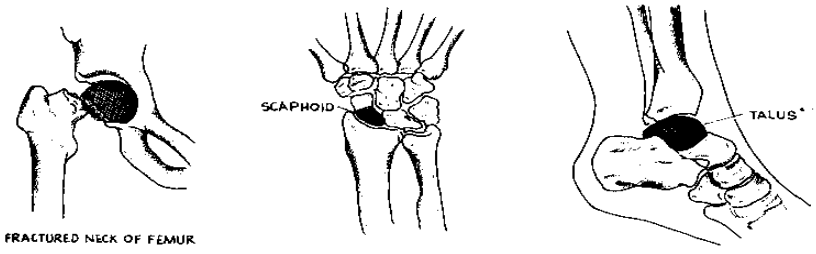


Fig. 44 Common sites of avascular necrosis

Myositis Ossificans:"not inflammation of the muscle! "
Sustaining a blunt injury that causes deep tissue bleeding which lead to bone formationoutside the bone. The patient complains of pain and limitation of movement at the site of previous trauma or fractures. (Usually present after 6 months to a year)

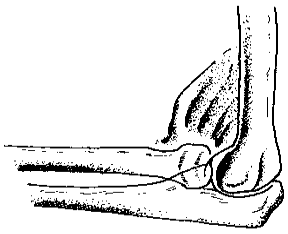
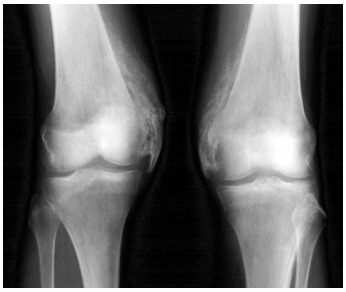


Fig. 45 Myositis ossificans of the elbow

- Heterotopic ossification (calcification) of muscle
- May follow minor blunt trauma
- **Elbow**, **Knee** and**Hip**are the most common affected sites
- Pain and limitation of movement is often seen
- X---Ray calcification then ossification
- After severe head Injuries in the *nonhereditary myositis ossificans*, the commonest type.
- Prevention: Avoid Passive Massage
- Rest susceptible site after injury
- May need excision when mature
- There is a primary congenital form"**Myositis OssificansProgressiva**."



Complex Regional Pain Syndrome (Reflex Sympathetic Dystrophy):

- A painful disorder in which there is evidence of overactivity of the sympathetic nervous system with trophic changes in skin.
- "Sudeck's Acute Bone Atrophy"it's an acute atrophy of a bone, usually one of the carpal or tarsal bones, following a slight injury such as a sprain.
- Commonest in hand and foot fractures arm or leg!
- Sever pain, swelling, restriction movement
- Skin: Glossy, Smooth, and Stretched.
- X---Ray: Osteoporosis
- Increased blood flow in the limb. It's a reflex to the sympathetic activity.
- Physiotherapy is tried first.
- If it fails, it could be managed by Sympathetic Block:
    - Medical : Drugs,
    - Surgical:
        - Regional Block
        - Sympathectomy

Compartment Syndrome:

Elevation of the interstitial pressure in a closed a compartment that results in microvascular compromise.

Common Adult Fractures

Upper limb fractures:

1. Clavicle
2. Humeral(Proximal, shaft)
3. Both bone forearm(Radius, ulna)
4. Distal radius

Mechanism of Injury of the Upper Limb:

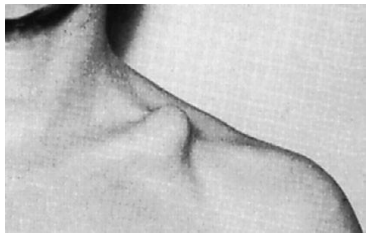
1. Mostly indirect (due to fall)
2. Commonly described as "fall on outstretched hand "or FOOSH injury.
3. Type of injury depends on
   - position of the upper limb at the time of impact
   - force of injury
   - Age

➢➢ **Fracture of the clavicle:**

- Common fracture (2.6%---12% of all fractures, 44%---66% of fractures about the shoulder)
- Commonest site is the middle one third (80%)
- Mainly due to indirect injury
- Direct injury leads to comminuted fracture

Clinical evaluation:

- splinting of the affected extremity, with the arm adducted (the patient is trying to support it with the other arm)
- Assess for skin integrity
- neurovascular examination is necessary
- The chest should be auscultated (pleura are near to fracture site→ pneumothorax)

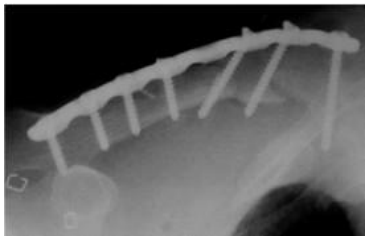


Radiographic evaluation:

- Anteroposterior radiographs

Treatment (depending on the x---ray findings)**:**

- **Conservative:**
  - arm sling or figure of eight sling
- **Operative fixation:**
  - indicated if there is:
    1. tenting of the skin
    2. open fracture
    3. neurovascular injury
    4. Nonunion

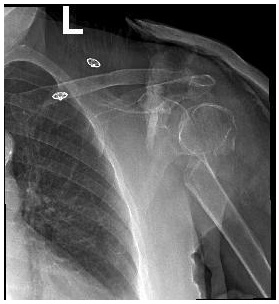


– Plates and screws are used in adult upper limb injuries, nails almost always used in lower limb injuries.

Complications:

1. Neurovascular compromise
2. Malunion
3. Nonunion(85% occurring in the middle third)
4. Posttraumatic arthritis (AC or **acromioclavicular** joint , SC or **Sternoclavicular** joint)

➢➢ **Proximal Humerus Fractures:**

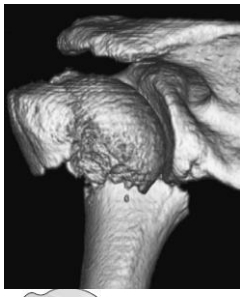


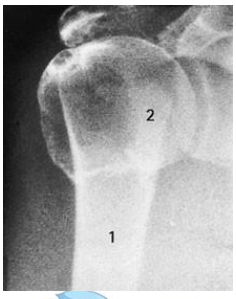
- Proximal Humerus (includes surgical and anatomical neck)
- comprise 4% to 5% of all fractures
- Represent the most common humerus fracture (45%)

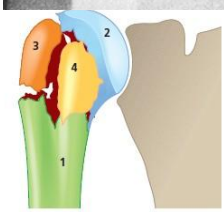
Clinical evaluation:

- Pain, swelling, tenderness, painful range of motion, and variable crepitus. (any patient with fracture will present with those symptoms)
- A careful neurovascular examination is essential, axillary nerve function.

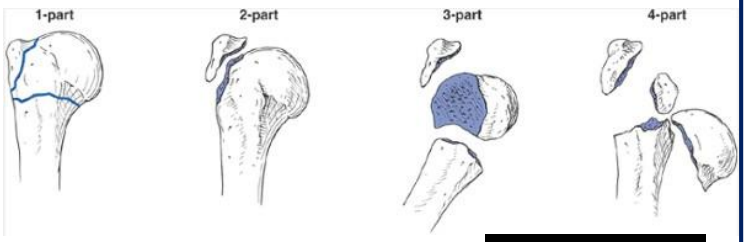
Radiographic evaluation:





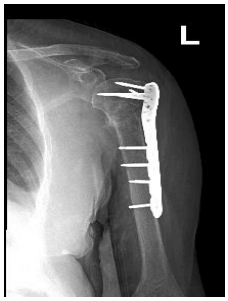


- AP and lateral views
- ***Computed tomography*** (**it is the best modality to assess intra---articular fractures**) MCQ!
- Rule out Fracture---dislocation (Four--- part)
- **Neer's classification**, has four parts:
  1. humeral shaft
  2. humeral head
  3. Greater tuberosity
  4. Lesser tuberosity
  - A part is defined as **displaced** if **(>0.5cm)** of fracture displacement or **(>45 degrees)** of **angulation**.



Treatment:

- **Conservative:**
  - Non--- or minimally displaced fractures (less than 5 mm)
  - 85% of fractures are minimally displaced or nondisplaced.
  - Sling immobilization.
  - Early shoulder motion at 7 to 10 days to prevent stiffness of the joint.



- **Operative fixation:**

  - Displaced more than 5 to 10 mm.
  - Three--- and four---part fractures.
  - Replacement of humeral head for four---part in elderly.

Complications:

- Osteonecrosis: four---part (13%---34%), three---part (3% to 14%), anatomic neck fractures.
- Vascular injury (5% to the axillary artery)
- Neural injury(Brachial plexus injury, Axillary nerve injury)
- Shoulder stiffness
- Nonunion, Malunion, Heterotopic ossification.

➢➢ **Fractures Shaft of the Humerus:**

- 3% to 5% of all fractures
- Commonly **Indirect** injury(Spiral or Oblique)
- Direct injuries(transverse or comminuted)
- May be associated with **Radial Nerve**injury

Clinical evaluation:

- Rule out open fractures
- Careful NV examination, with particular attention to radial nerve function.

Radiologic evaluation:

- AP and lateral radiographs of the humerus including the shoulder and elbow joints on each view.

Classification (Descriptive):

- Open vs. closed.
- **Location**: proximal third, middle third, distal third.
- **Degree**: nondisplaced, displaced.
- **Direction and character**: transverse, oblique, spiral, segmental, comminuted
- **Articular** extension.

Treatment:

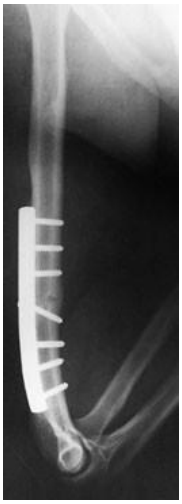
Conservative:

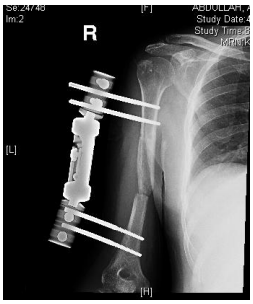
- Most of the time is conservatively because the bone is covered and stabilized by muscles.
- Closed Reduction in upright position.
- U---shaped Slab from the elbow to the shoulder and after one week change it to functional splint to prevent joints stiffness

- Few weeks later Functional Brace may be used

Surgical:

- Multiple trauma (fractures)
- Inadequate closed reduction
- Pathologic fracture
- Associated vascular injury
- Floating elbow (freely moving elbow because both humerous and forearm are fractured)
- Segmental fracture (fracture above or below. i.e the segment is not stable)
- Intraarticular extension
- Bilateral humeral fractures
- Neurologic loss following penetrating trauma
- Open fracture





Complications:

- Radial Nerve Injury (**Wrist drop)**: 12% of fractures
- 2/3(8%) Neuropraxia
- 1/3 (4%) lacerations or transection
- In open fractures; immediate exploration and ± repair
- closed injuries treated conservatively

➢➢ **Forearm (both bone) fractures:**

- Forearm fractures are more common in men than women.
- motor vehicle accidents, contact athletic participation, and falls from a height (high force energy)

Clinical evaluation:

- Gross deformity (dropping) of theinvolved forearm (think about compartment syndrome, it's the second most common site after the tibia).
- A careful NV exam
- Open wound
- Compartment syndrome

Radiographic evaluation:

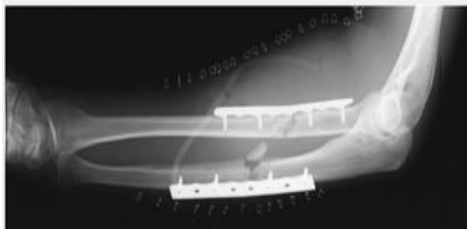
- Anteroposterior (AP) and lateral views(including the two joints)

Classification (Descriptive):

- Closed versus open
- Location
- Displacement

Treatment:

- Surgical treatment is the rule because of instability. No role of conservative treatment here.



Complications:

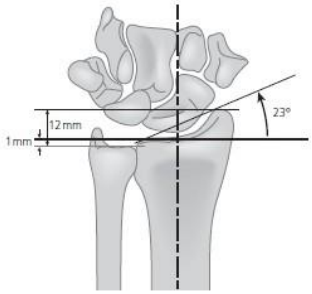
- Nonunion
- Compartment Syndrome
- Post---traumatic radioulnar synostosis radius and ulnar bones unite together and become one bone (unique for forearm fractures but not common)→(3% to 9%)
- malunion
- Infection
- Neurovascular injury

➢➢ **Distal Radius Fractures:**

- Distal radius fractures are among the most common fractures of the upper extremity.
- one---sixth of all fractures treated in emergency departments.

Clinical evaluation:

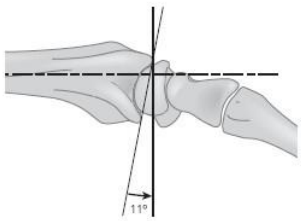
- Swollen wrist with ecchymosis, tenderness, and painful range of motion.
- neurovascular assessment: median nerve function(Carpal tunnel compression symptoms are common, 13%---23%)
- Look for open fracture.



Radiographic evaluation:

- Posteroanterior and lateral views.
- Radial **inclination**: averages 23 degrees (range, 13 to 30 degrees)
- Radial **length**: averages 11 mm (range, 8 to 18 mm).
- **Palmar (volar) tilt**: averages 11 degrees (range, 0 to 28 degrees).

Classifications:



- **Articular extension**:
  - *Extraarticular* Vs.*intraarticular*
- **Displacement**:
  - Colles' fracture (most common of extra articular) Vs.Smith fracture

Colles' fracture:

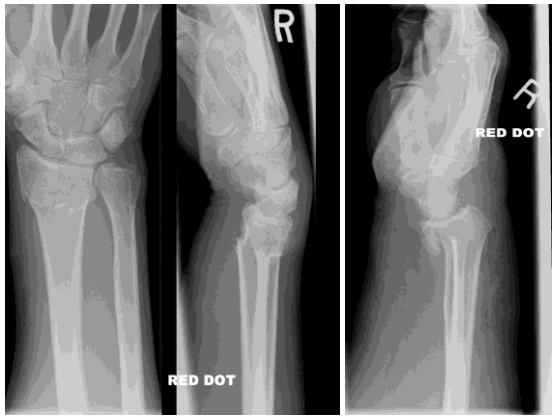
– Extraarticular fractures.
– 90% of distal radius fractures
– Fall onto a ***hyperextended wrist*** with the forearm in pronation.
– dorsal displacement and angulation (**apex volar**) dinner fork deformity

– Radial shift, and radial shortening.

Smith's fracture (reverse Colles' fracture):

"Rare"

– A volar displacement
– volar angulation (**apex dorsal**) of the distal radius (garden spade deformity).
– a fall onto a ***flexed wrist*** with the ***forearm fixed*** in supination.



Colles' #

Smith's #

Barton's fracture:

– Intraarticular fracture with dislocation or subluxation of the wrist (distal radius)
– Treated surgically to prevent stiffness, OA of the joint.
– Dorsal or volar rim of the distal radius is displaced with the hand and carpus.
– **Volar involvement** is more common
– fall onto a dorsiflexed wrist with the forearm fixed in pronation.

Barton's (lateral)

Barton's (AP)

Treatment:

Concevative:

- Acceptable radiographic parameters:
  - Radial length: within 2 to 3 mm of the contralateral wrist.
  - Palmar tilt: neutral tilt (0 degrees).
  - Intraarticular step---off: <2 mm.
  - Radial inclination: <5degrees.
- Below elbow cast

Surgical:

- Unacceptable reduction
- Secondary loss of reduction
- Articular comminution, step---off, or gap
- Barton's fracture

Complications:

- Median nerve dysfunction

- Malunion
- Tendon rupture, most commonly extensor pollicis longus
- Midcarpal instability
- Post---traumatic osteoarthritis
- Stiffness (wrist, finger, and elbow)

Lower limb fractures:

1. Pelvic
2. Proximal femoral fractures (femoral neck, intertrochantric)
3. Femoral shaft
4. Tibial shaft
5. Ankle

Mechanism of Injury of the lower Limb:

1. High energy trauma like MVA, fall, except in elderly people or pathological bone.
2. Types of fracture depend on position of the limb during impaction and magnitude of forces applied.
3. Look at the patient as whole, not to the injured limb alone!
4. Save life first, then save limb and finally save limb function.

➢➢ **Pelvic fractures:**

- High energy trauma, low energy(simple fall in elderly)
- *Life threatening fracture*
- Rule out open fractures(50% risk of death).

Classifications:

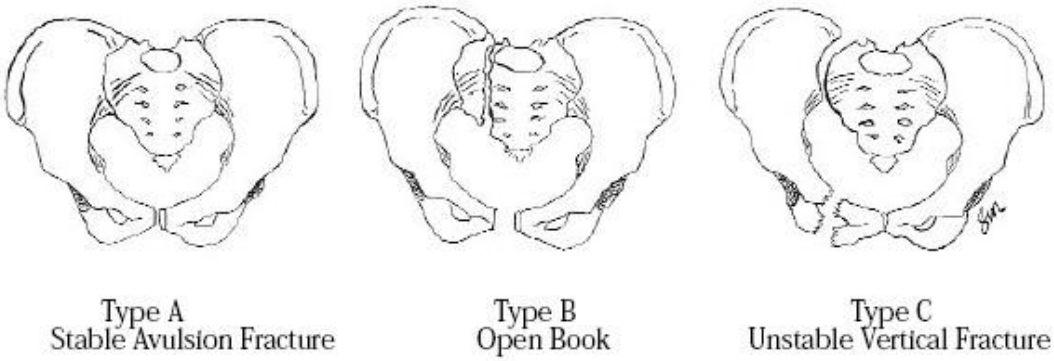
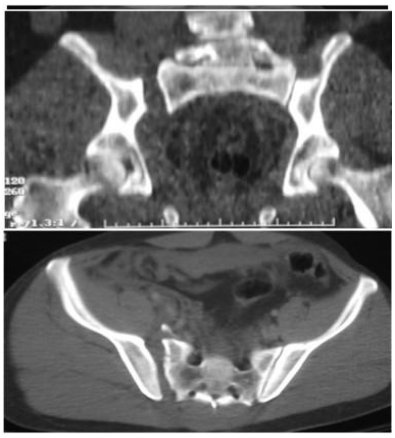
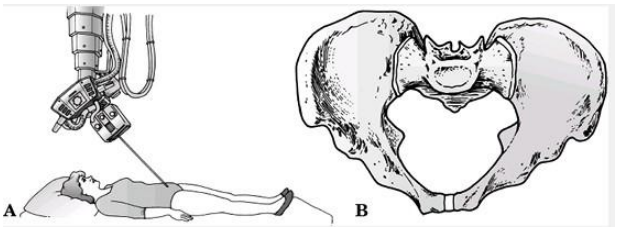


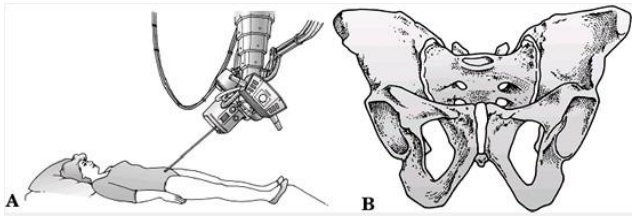
Figure 20. Illustration of the Tile Classification of Pelvis Fractures

Radiographic evaluation:

- AP of the pelvis
- Inlet radiograph <u>to see the ring from inside</u>
- Outlet radiograph
- CT

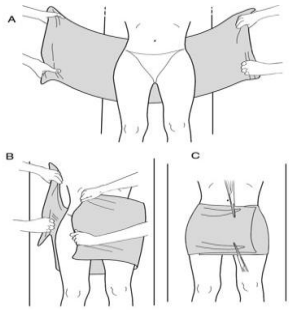




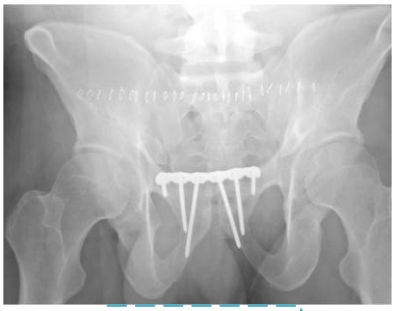


Management:

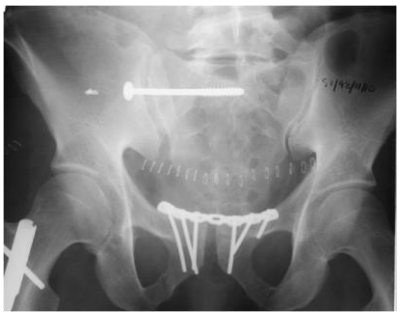
- ATLS guidelines
- **Type A:** Conservative treatment



- **Type B:** Anterior fixation
- **Type C:** Both anterior & posterior fixation



Type B



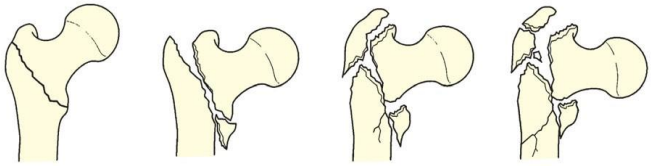
Type C

Complications:

- <u>Hemorrhage</u> (hypovolemic shock, life threatening)
- <u>Infection</u> up to 25%
- Thromboembolism
- Bladder (15%)/bowel injuries

- Neurological damage (L5---S1)
- Persistent sacro---iliac joint pain
- Malunion

➢➢ **Intertrochanteric fractures:**



- Extracapsular (low risk for AN)
- Heals well, low risk for osteonecrosis
- elderly, osteoporotic women
- Simple fall

Clinical evaluation:

- Inability to bear---weight
- Limb is short, abducted and externally rotated

Radiological evaluation:

- AP and lateral(cross---table)

Treatment:

- Usually operative:
  - Dynamic hip screw (DHS)
  - Proximal femoral nail

DHS

DHS

Nail

➢➢ **Femoral neck (transcervical) fractures:**

- Risk of ***osteonecrosis***
- High and low mechanism of injuries (young Vs. elderly)
- Evaluation as inintertrochanteric fractures.
- There is a capsule that surrounds the neck of the femur, and is attached, in front, to the intertrochanteric line; carrying blood supply to the bone.
- Fracture distal to the capsule will compromise the blood

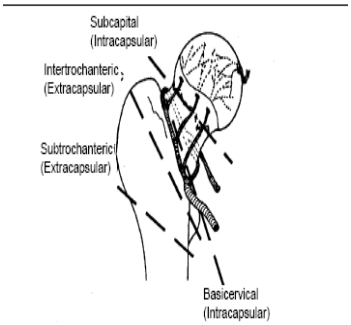
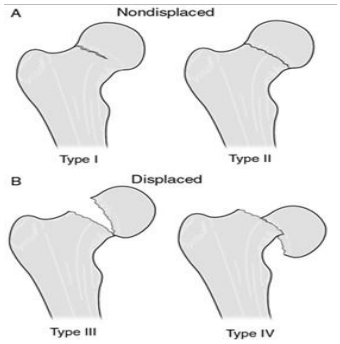


Figure 21. Blood Supply to Femoral Head and Fracture Classification

supply to leading to avascular necrosis of the femoral head.

- If proximal to the capsule, blood supply is intact.



Treatment:

- Only surgical
- **Fixation:**nondisplaced, displaced and young(45---55 yrs)
- **Replacement:** displaced and elderly

Complications:

- Nonunion(5% of nondisplaced, 25% of displaced fractures)
- Osteonecrosis(10% of nondisplaced, 27% of displaced fractures)
- Fixation failure(osteoporotic bone or technical problems).

Garden classification:(see the picture above)

1. **Type 1** is a stable fracture with impaction in valgus.
2. **Type 2** is complete but non---displaced.
3. **Type 3** is partially displaced (often externally rotated and angulated) with varus displacement but still has some contact between the two fragments.
4. **Type 4** is completely displaced and there is no contact between the fracture fragments.

➢➢ **Femoral shaft fractures:**

- High mechanism of energy (e.g. RTA)
- Risk of thromboembolism/ fat embolism
- Inability to bear weight
- AP & lateral radiographs(knee and hip joins)

Treatment:

- Always **surgical**!
    - Intramedullary nail is the best!
    - Plate fixation (not ideal)

IM nail

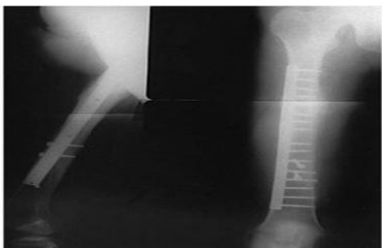


Plate fix(not the ideal).

➢➢ **Tibia shaft fracture:**

- High mechanism energy, crush injuries
- High risk of open fractures (no muscles anteriorly and lateral to the tibia) and compartment syndrome
- Inability to bear weight, assess skin and soft tissues
- AP & lateral radiographs(both joints)

Classifications:

- Open vs. closed
- Anatomic location: proximal, middle, or distal third.
- Displacement: percentage of cortical contact.
- **Spiral fracture**of distal tibia (***twisting*** injury)
- **Transverse fracture** of distal tibia (more soft tissues injury due to ***direct*** trauma)

Treatment:

- Open versus closed
- Both conservative and Surgical
- Surgical is the best (nails)

Conservative:

- Shortening **<1cm**
- Angulation in varus/valgus plane**< 5 degree**
- Angulation in anter---posterior plane **<10 degrees**
- Rotation neutral to slight external rotation.
- bone apposition >50%
- **Long leg cast** (5 degrees of flexion) for **4---6 weeks**
- patella---bearing cast(Sarmiento) or fracture brace.
- The average union time is **16±4 weeks**

Surgical:

- **Intramedullary (IM) Nailing** is the best treatment for mid shaft tibia fracture
- The most commen complication is anterior knee pain!!
- **External fixation**for open fractures with severe soft tissue injury.

Long Leg Cast

- **Plate fixation:**

– 97% success rates

– Complication: infection, wound breakdown, nonunion

– increase with higher---energy injury patterns.

➢➢ **Ankle Fractures:**

- Incidence increased in **elderly** women
- Most ankle fractures are isolated malleolar fractures
- Open fractures are rare < 2%.
- Mechanism of injury: position of the foot at time of injury, the magnitude, direction, and rate of loading.

Clinical evaluation:

- A dislocated ankle should be reduced and splinted immediately (before radiographs if clinically evident)

Radiographic evaluation:

- AP, Lateral and mortise views (the only joint that should have 3 views, beside the shoulder if you're suspecting dislocation)

AP view:

- Tibiofibula overlap of **<10 mm** is abnormal: **syndesmotic injury**.
- Tibiofibula clear space of **>5 mm** is abnormal: **syndesmotic injury**
- Talar tilt

Lateral view:

- The dome of the talus should be **centered** under the tibia and congruous with the tibial plafond
- Posterior tibialmalleolous fractures can be identified

Mortise view:

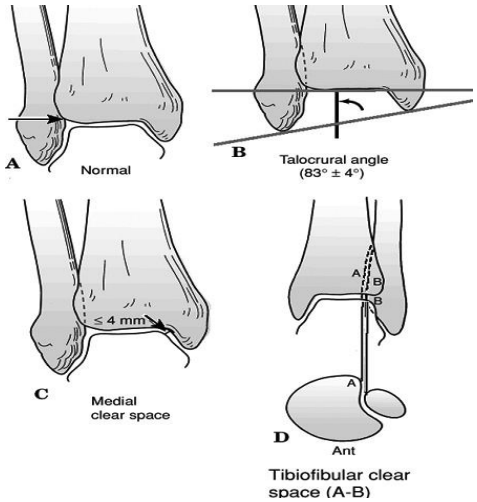
- Foot in 15 degrees of internal rotation
- A medial clear space
- Tibiofibular overlap
- Talar shift

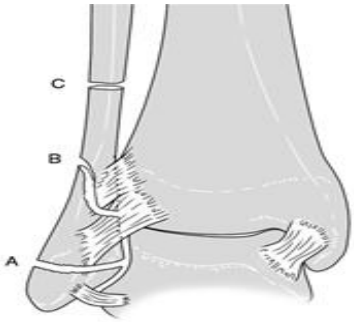
Denis –Weber classification:

A. **Infra---syndesmotic**. (No problem to the joint) conservative treatment.

B. **Trans---syndesmotic**. (May have disruption to the joint) conservative or surgical depending on the examination of the ligament if torn or not.

C. **Supra---syndesmotic**: usually syndesmosis is torn surgical treatment.





Treatment

- ☐ undisplaced fractures: NWB BK cast
- ☐ indications for ORIF
  - all fracture-dislocations
  - all type C fractures
  - trimalleolar (lateral, medial, posterior) fractures
  - talar shift or tilt
  - failure to achieve or maintain closed reduction

Complications:

- Post traumatic arthritis
- Stiffness
- Skin necrosis
- Malunion or nonunion
- Wound infection
- Complex regional pain syndrome

Isn't it funny how someone can say "I believe in Allah " but still follow the Satan who by the way also, " believes " in Allah…

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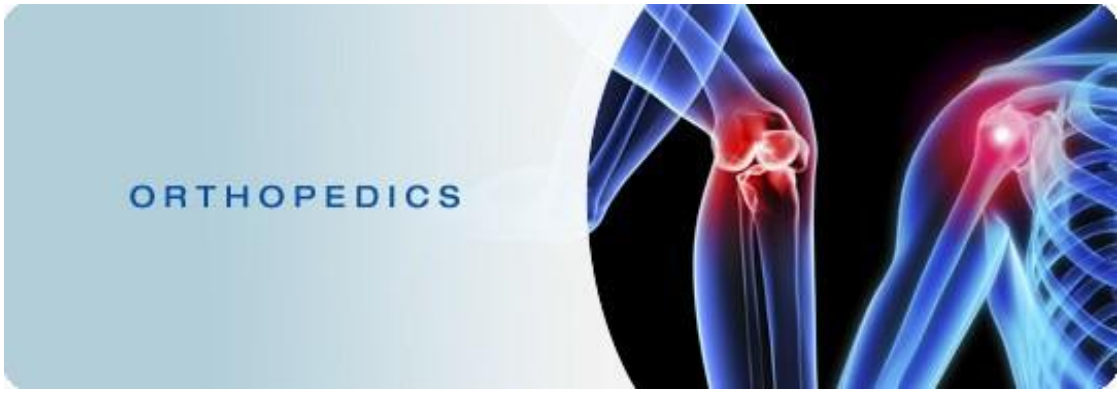


7- Orthopaedic Emergencies 2/ Red Flags (Open fracture, Fracture with Neurovascular compromise, Pelvic fracture)

Team Members:

Hissah Alballa

Team Leader:

Ayedah Al-Ruhaimi.

Sources:

- **Dr.Ahmad Bin Nasser's slides.**
- **Lecture's recording.**
- **429 team work (group A1).**
- **Wikipedia**
- **Notes from clinical skills:** Management of Open Fracture with Dr.Zaheer

Open Fractures:

- Definition:

- A fracture that at some point communicated with the environment (Even if it's not shown at the time of presentation, the bone might go back inside) (Not necessarily bone coming out. For example, if a nail get inserted into the knee<<open joint)
- An open joint is managed similarly
- Usually requires higher injure (energy) (Not always! e.g. an old osteoporotic patient with thin skin, who just tripped and as a result had an open fracture)
- Sometimes can be missed
- Commonly occurs in bones with minimal soft tissue coverage (tibia)
- Usually higher energy is required in deep bones (femur).

- Pathology:

- Traumatic energy to the soft tissue and bone.
- Inoculation of organisms (normal flora of the skin contaminate the bone>> infection)
- Necrotic tissue (source of infection)
- Injury to vessels and microvasculature (less blood delivered to the tissue -decrease of transfusion of O2 and nutrient- ischema and lack of immune response)
- Raised compartment pressure. The pressure will increase as a result of the swelling (less blood delivered to the tissue>>bone necrosis)
- Over all there will be ischemia and lack of immune response
- INFECTION:
  - Difficult to eradicate
  - Prolonged antibiotics
  - Multiple surgeries
  - Significant morbidity
  - Significant costs on the hospital and the country
  - infection will slow healing of the bone.

- Atrophy of the muscles

the patient will be depressed because of the long stay at the hospital

- An open fracture is a usually a “red flag” warning of significant trauma. Detailed assessment of the patient is necessary
- An open fracture is associated with significant morbidity. Must act quickly take fast detailed history.
- A delay in management is proven to increase the likelihood of complications. Give urgent priority while triaging (open fracture is code 1 while closed 3) , provide initial management and consult urgently. patient most be seen at least with in 20 min, if surgery is needed best with in 1 h maximum.

- Diagnosis:

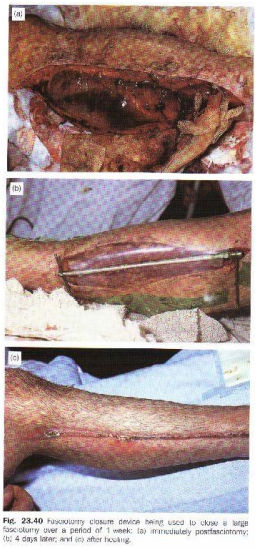
- Sometimes obvious!
- Other times, settle,,, be observant. The wound could be very small (need high suspension)
- A wound close to a fracture is an open fracture until proven otherwise.
- Whenever a fracture is diagnosed, go back and check the skin.
- A small wound continuously oozing blood bones are very vascular, especially, if you see fat droplets within the blood (diagnostic), is an open fracture!
- Not always close to the fracture, it may be around it. Especially the femur (the deeper the bone more coverage of soft tissue around the bone the far the opening)
- Don’t probe!!
- If in doubt, use good light, if there is a break in the dermis or fat is seen, call it an open fracture
- <u>If unsure that the fracture is open consider it open.</u> Better to overcall than miss it!

- Algorithm:

- Assess and stabilize the patient, ATLS principles
- Assess the condition of the soft tissue and bone to help grade the open fracture. Look for other injuries.
- Manage the wound locally

- Stabilize the fracture
- IV antibiotics
- Tetanus status

- Assessment:



- if polytrauma, apply ATLS principles
- if isolated injury:
- Hx:
  - Mechanism and circumstances of injury. Detailed Hx must be taken. If it was a RTA u need to know where was the patient siting (front or back), wearing belt?, or pedestrian.
  - Time since injury
  - PMH/PSH/Allergy/Drugs/Smoking
  - Tetanus vaccination status
- Examine the affected region for:
  - Soft tissue: skin loss may require skin grafting
    - Degree of contamination (look for dirt)
    - Necrotic and devitalized tissue
    - Size of wound
    - Coverage loss, muscle and skin
    - Compartment syndrome
  - Bone:
    - Comminution
    - Stripping of bone periosteum
    - Examine away from injury to joint above and below
    - X-rays to joint above and below
  - Neurovascular status distally:
    - On arrival and post reduction and splinting later.

- You need to document everything the patient came with to avoid any medico legal problems

- Open fracture grade: (take full Hx to grade correctly)

Grade 1: all those conditions have to apply

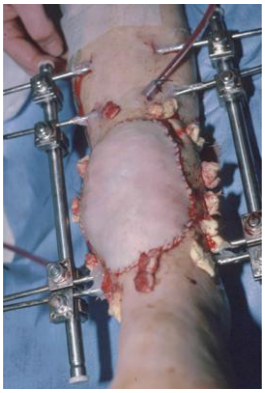
- Less or equal to 1 cm, it has to be : Clean wound (no direst, not swimming in the time of injury), Non-segmental NOR severely comminuted fracture,less than 6 hours since injury
  Grade I has low incidence of infection

Grade 2: same as grade 1 but the wound is >1 cm but no need for soft tissue coverage procedure

- >1cm wound, not extensive soft tissue injury or contamination, non segmental nor severely comminuted fracture, no bone stripping and with adequate soft tissue coverage

Grade 3:

- 3A: (if not 1 or 2) Any size with extensive soft tissue contamination or injury but not requiring soft tissue coverage procedure, or with a segmental or severely comminuted fracture, or late presentation more than 6 hours
- 3B: Any open fracture that requires soft tissue coverage procedure
- 3C: Any open fracture that requires vascular repair



- Management:

I. Local: 1st step : Analgesics

- Take a picture. you don't want to open it every time another doctor (intern, registrar, consultant, ortho team) wants to examine
- If dirty, irrigate with normal saline to remove gross contamination. Don't use water even if sterile, the osmolarity of the water is more so the tissue will loss fluid due to the concentration gradient. Just irrigate, if there is a big piece u can remove it by sterile equipment.
- If bone sticking out try to reduce gently then immobilize and re-check neurovascular status. Realignment in the ER to: decrease further damage. decrease pain, decrease fat emboli.
- Cover with sterile wet gauze. If it becomes bloody use another one above it. Wet because u don't want to cause any injury when removing it.
- If bleeding apply direct pressure on wound. Never use a tourniquet, it will compromise the blood supply.
- No culture swabs in ER. There are studies that say it's useless.

II. Antibiotics:

- First generation Cephalosporin for gram positives (Ex: Cefazolin) in all open fractures
- Aminoglycoside to cover gram negatives (Ex: Gentamicin) sometimes not required in grade 1 but in general it is safer to give in all grades, gram + is most common but u can't guarantee it's only gram +. If it's grade 1 and u said I will only cover gram +, or u said I'll cover both + -, both answers are considered correct.
- Add penicillin or ampicillin or clindamycin for clostridium (will cause gangrene) in grade 3 open fractures and all farm and soaked wounds. Also, if >6 h

III. Tetanus prevention: Tetanus vaccine is a vaccine composed of deactivated tetanus toxins. Passive immunity

Wound types:

- Clean wounds:
  1. <6 hours from injury

2. Not a farm injury
3. No significant devitalized tissue
4. Non immersed (soaked, e.g. if the injury accrued while swimming) wound
5. Non contaminated wound

- Other wounds

<table>
<tr><th colspan="3">Clean wounds</th><th colspan="3">Other wounds</th></tr>
<tr><td colspan="2">Completed vaccination</td><td>Not completed or unknown (pt doesn't know or unconscious)</td><td colspan="2">Completed vaccination</td><td>Not completed or unknown</td></tr>
<tr><td>Booster < 10</td><td>Booster >10</td><td rowspan="2">Td 0.5ml IM</td><td>Booster < 5years</td><td>Booster > 5</td><td rowspan="2">TIG 250U
And
Td 0.5ml IM</td></tr>
<tr><td>nothing</td><td>Td 0.5 ml IM</td><td>nothing</td><td>Td 0.5ml IM</td></tr>
</table>

- As soon as patient is stable and ready, alert the OR, and talk to the pt get consent for surgery
- Plan: Irrigation w normal saline, debridement and fracture stabilization
- The sooner the less risk of further morbidity (more time>>more complications)

IV. In the OR: move to the OR as soon as the pt is stable enough.

- Extend wound if necessary. If small wound & the surgeon is unable to reach the bone.
- Thorough irrigation to the bone.
- Debride all necrotic tissue (source of infection). start layer by layer from the skin, subcutaneous tissue then muscle. How will you know the muscle in dead? from the difference in colour, the muscle will not contract with mechanical or electrical stimulation .
- Remove bone fragments without soft tissue attachment (it will die>>source of infection) except articular fragments. Deal with it later, the most imp thing now is to stablize the fracture and prevent infection.
- <u>Usually requires second look or more every 48-72 hours. Necrotic tissue may not appear the first time.</u>

- Generally do not close open wounds (Except clean wound with <6 h) on first look. Only approximate it to allow drainage so there won't be a sudden infection. But actually most of the time pts will come<6 h, the wound will be clean properly, so the doctors will close the wound. Safe answer is to not close the wound completely.

V. Fracture management:

- Generally avoid internal fixation (plate and screw)
- Generally external fixator is used.
- Femur and tibia shaft fractures can usually be treated immediately with IM nail except severe injuries and contamination except severe injuries and contamination
- Observe for compartment syndrome post- operatively

- Results:

If all principles applied, in ideal senario where the pt was transferred immediately to the hospital, the management was immediate and proper:

- 2% complication rate in grade 1
- 10% complication rate in grade 2
- Up to 50% complication rate in grade 3

Fractures with nerve or vascular injuries

- Don't miss it !!!!
- Always perform an accurate (distal to the fracture) assessment at presentation, post manipulation and reduction, post surgical fixation, serially until condition stabilizes
- Serial examination helpful in deciding line of treatment
- Serial examination helps avoid confusion
- High correlation between vascular injury and nerve injury. Proximity (anatomically near each other)

- Mechanisms:

- Penetrating trauma

- High energy blunt trauma
- Significant fracture displacement
- Keep in mind tissue recoil at presentation

Vascular injuries:

- Direct laceration
- Traction and shearing

Blunt trauma. Fracture of the proximal tibia, the popliteal artery is cut. Common site of vascular injury.

Penetrating trauma. Gun shot. Sudden interruption of the artery.

Assessment:

- Always check serially until 48 h later (there might be an injury to the intima which usually take time): Pulse, Color, Capillary refill, Temperature, compartment pressure. Compare it to the other side.
- Keep high index of suspicion: High energy trauma
- Associated nerve injuries
- Fractures/ Dislocations around the knee
- Hard signs > realignment of limb > if persistant > vascular intervention
- Hard signs > realignment of limb > improved > Close observation every 1-2 h
- Realignment can result in unkincking of vessels, lowering compartment pressure, relaxation of arterial spasm
- ABI: The Ankle Brachial Index (ABI) is the ratio of the blood pressure in the lower legs to the blood pressure in the arms. Normal range 1.0 - 1.2. We do it because the presence of a pulse doesn't exclude vascular injury.
  - = or < 0.9 associated with vascular pathology. If .8 in the fractured lime and in the normal side 1, consider it vascular injury even if there is no pallor, no parasthesia, pulse present, warm.
  - Rarely can give false negative result (Ex. Profunda femoris)
  - Always used in high risk fractures (knee)
  - If positive > Urgent vascular intervention
- Angiography, CT angiography: Gold standard But always

Table 1

Hard and Soft Signs of Vascular Injury Associated With Extremity Trauma

Hard signs
Pulselessness
Pallor
Paresthesia
Pain
Paralysis
Rapidly expanding hematoma
Massive bleeding
Palpable or audible bruit
Soft signs
History of bleeding in transit
Proximity-related injury
Neurologic finding from a nerve adjacent to a named artery
Hematoma over a named artery

start with simple tests

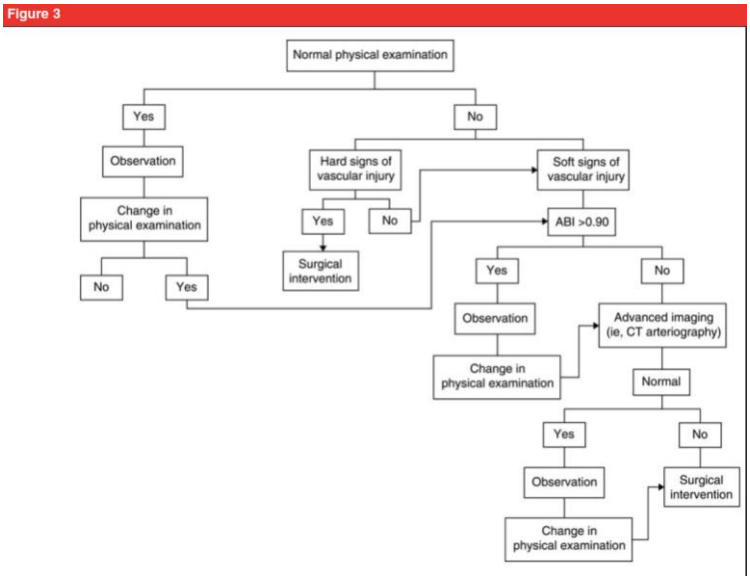
- Not without risks
- Vascular surgeon to arrange with interventional radiologist

- Management:

- Once vascular injury is confirmed:

  - Coordination between: Vascular surgeon, Orthopedic surgeon, General surgeon. (All AIM to save the Limb)The principle is that fixing the artery should be first. But what if after after fixing the artery the bone moves (it's unstable) and damage it again? so there should be collaboration between the surgeons. most of the time the orthopaedic surgeon will quickly stabilise the fracture fast by an general fixator.

- To emergently re-establish perfusion and protect repair with skeletal stabilization
- Warm ischemia (the hand is still attached to the body. cold ishemia is when the amputated part was in a bag ice. In cold ishemia can wait longer)time dictates treatment (Ex, the injury was 30 min ago, the orthopaedic surgeon can start before the vascular)
- Most times, a quick external fixator is applied, followed by vascular repair
- Avoid prolonging warm ischemia to do
- Prolonged warm ischemia >6 hours —>Prophylactic fasciotomy. Sometime after vascular repeat there will be re perfusion reaction>> edema in the muscle>> compartment syndrome.
- Grade 3C open fractures have the worst outcome

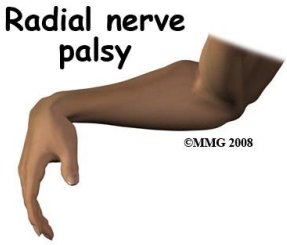


- Amputation may be necessary in severe cases

Nerve Injury:

Radial nerve run in the spiral groove

Distal redial fracture, cause radial nerve palsy(common)

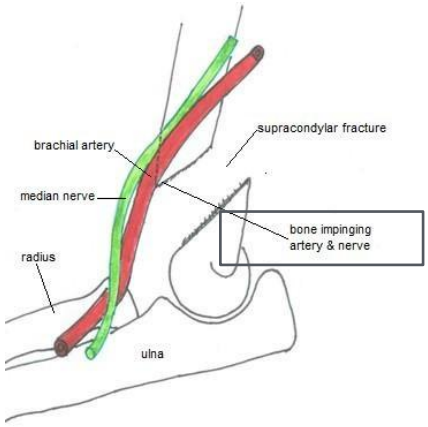


- Cause of medico-legal concern
- Accurate assessment and documentation at presentation, post reduction, post surgery is essential
- <u>Remember to examine for motor and sensation prior to sedation</u>
- Closed fractures not requiring surgery with nerve injuries high chance that the nerve injury will be reversed without intervention:
  - Usually good outcome >80%
  - Usually managed conservatively in the early stages
  - Recovery may take more than 6 months. If not, do something.
- Intact nerve before reduction, absent after reduction:
  - Controversial management
  - Usually observe
  - It's acceptable if u say u will redisplace the fracture. But it been proven that it's not always useful, just leave it. For us, go with redisplacement.
- Fracture requiring surgery with nerve injury, <u>what dictate the need of surgery is the fracture not the nerve injury:</u>
  - Limited exploration. Don't perform another incision.
- Open fracture with nerve injury:
  - Here we have to explore the nerve, tag nerve ends for later repair.

Follow up:

- If no surgery was done.
- Clinically

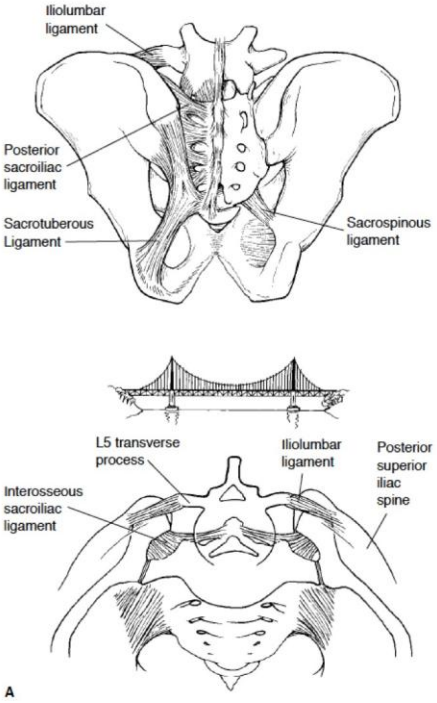
- Electrodiagnostic assessment start at 6 weeks (base line) then serially every 6 weeks during this time give Splint to hold the limb in its position
- If no improvement:
  - Nerve exploration: neurolysis / repair / grafting
  - Tendon transfers with an intact nerve function to preserve function. Done when the nerve grafting is expected to not succeed or if it already failed. Ex, if foot drop we take a tendon from one of the planter flexors.

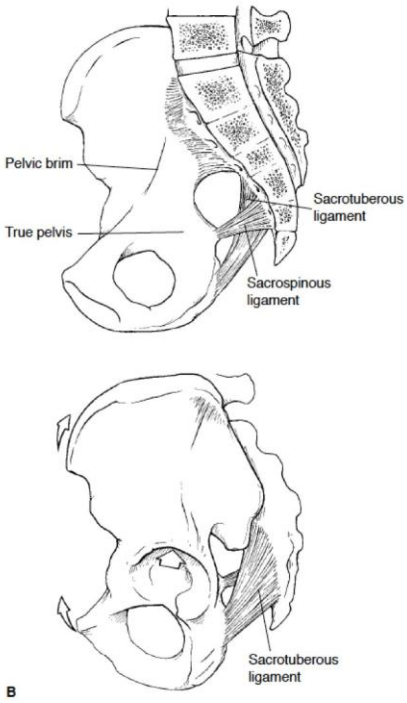


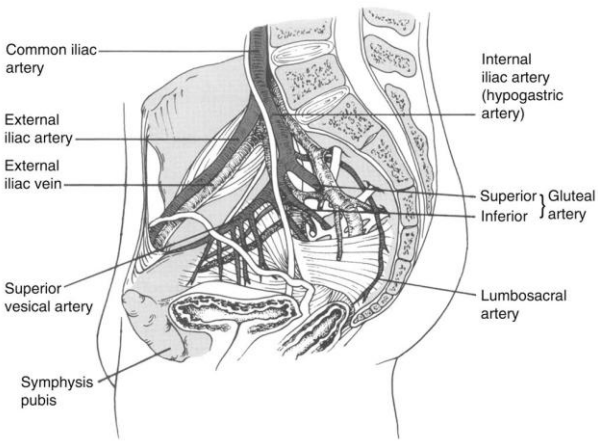
- Common Sites:
- Shoulder fracture / dislocation > Axillary nerve
- Distal humeral shaft fracture > Radial nerve
- Elbow fracture / dislocation > Median>>radial>>ulnar
- Hip fracture / dislocation > Sciatic nerve
- Knee fracture / dislocation > Peroneal nerve

Pelvic trauma In the poly trauma patient

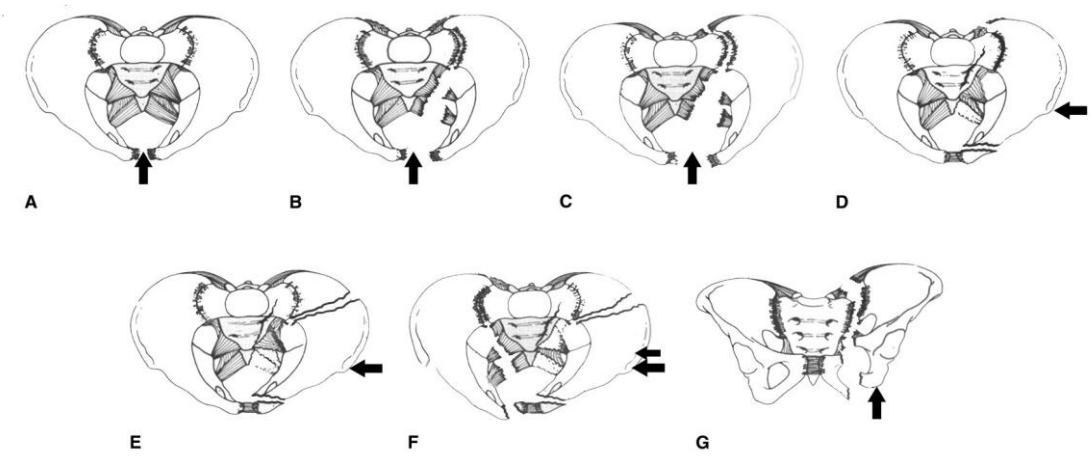
- PELVIS ANATOMY:







- Pathology:



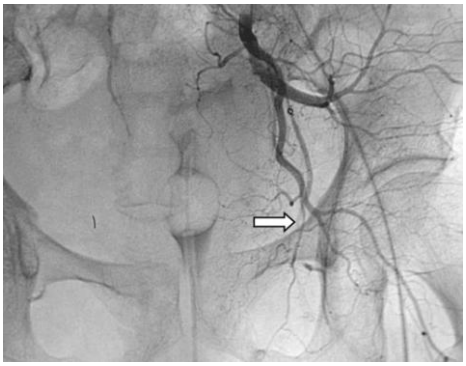
A- anterior force causing a little opening in the sacro-illiac joint.

B- anterior force causing opening in the sacro-illiac joint and instability

C- More force cause open book pelvis. In this kind of injury, the left and right halves of the pelvis are separated at front and rear, the front opening more than the rear, i.e. like opening a book.

D, E and F lateral compression. e.g. car accident

G- Vertical shears pelvic fracture. Extremely unstable.



- Pelvic fractures / instability may cause <u>life threatening bleeding.</u> The bleeding will be from the internal iliac artery and it will be retroperitoneal so it's hard to see in US. When given blood I.V the blood pressure will increase for a while then drop again.
- <u>Diagnosing pelvic instability can save lives</u>

- Diagnosis:

- History: High vs. Low eneregy trauma
- Mechanism of injury: Anterior vs. Lateral vs. Axial force
- Pelvic skin contusion, bruising

- Short extremity
- Careful neurologic assessment
- Primary survey : part of "C". Circulation. If the pt showing signs of shock (tachycardic, hypotension).
- Assess stability by gentle compression on the ASIS
- Traction on the leg and assess pelvic instability. the pt in supine position.
  - traction in the leg while your hand in the lilac crest if it moves>>sheer.
- If unstable or painful:(pelvic binder)
  - Apply sheet around hips and close the pelvis gently
  - This results in decreased intra-pelvic volume leading to tamponading the bleeding by increasing the pressure around the injured vessel.>>BP will rise
  - Traction on the leg to stabilize vertical instability.
  - This minimizes ongoing vasculature injury and bleeding
  - When the pt is stable enough arrange with the radiologist for radiological studies.
- Rectal exam:
  - Bone fragments (be careful)
  - High riding prostate
  - bleeding
- Blood at the meatus
- Labial or scrotal echymosis
- Vaginal exam

- Management:

- Stabilize pelvis with binder
- If vertically unstable apply traction
- IV resuscitation
- Look for other injuries
- Check response
- If partial response, may require angiography for embolization of bleeders

- May require external fixator and/or pelvic clamp

● Early diagnosis:

Aggressive resuscitation

Coordinated team effort>> Save lives

in the right pic, the binder is too tight that it may block the external iliac artery. the binder should be around the level of the femoral head

Isn't it funny how someone can say "I believe in Allah " but still follow the Satan who by the way also, " believes " in Allah…

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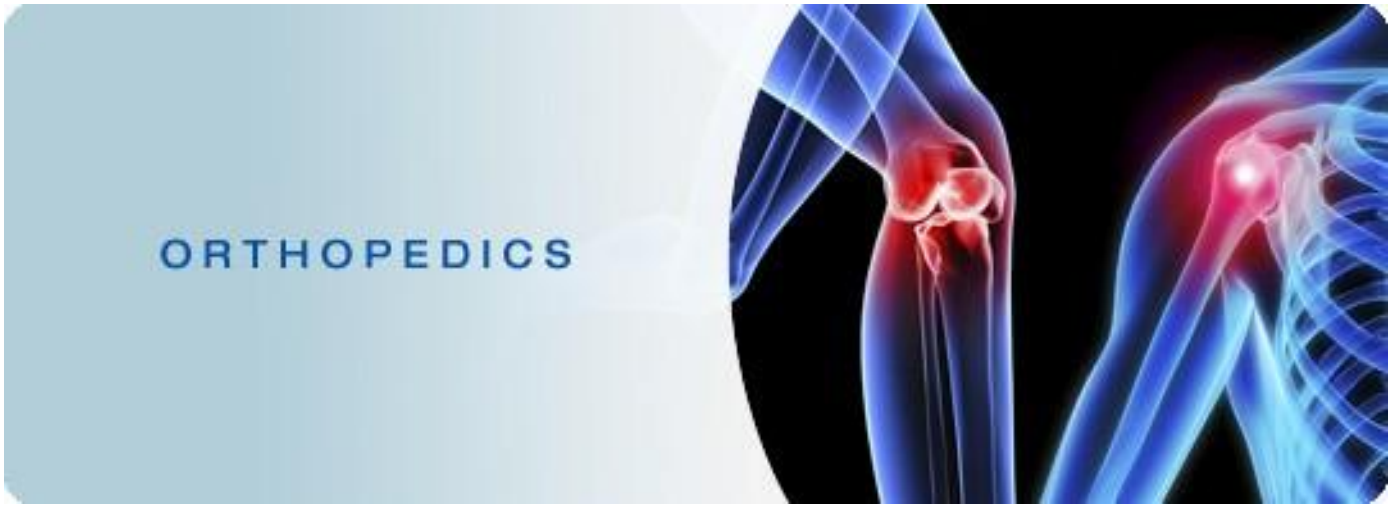


Lecture: Compartment Syndrome/Acute Joint Dislocation.

Team Members:

Faten Al---Mohideb.	Hanan Al---Salman.	Aliya Al---Awaji.
Hadeel Al---Ghamdi.	Ghadeer Al---Wuhayd.	Hissa Al---Balla.
Lujain Al---Yousef.	Nouf Al---Hammad.	Jawaher Al---Faraydi.
Hiba Al---Rahiem.	Nour Al---Enezi.	Wejdan Al---Swayyid.
Arwa Abudawood.	Leena Al---Shaman.	Areej Al---Qunaitir.

Team Leader:

Ayedah Al---Ruhaimi

---The slides were provided by the doctor.

---429 team group A---1.

---Important notes in **Red**.

---Copied slides in **Black**.

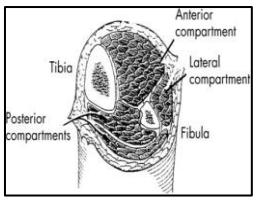
---Doctor's notes in **green**.

Compartment Syndrome/Acute Joint Dislocation

- **Objectives:**
  1. To explain the pathophysiology of CS
  2. To Identify patients at risk of developing CS
  3. To be able to diagnose and initially manage patients with CS
  4. To be able to describe the possible complications of CS

- **What is a compartment?**

- Area surrounded by fascia and contains muscles, bones, nerves and vessels.



- **What is the tissue pressure normally?**

- Resting compartment pressure: 0-8 mmHg.
- Pressure difference between the tissues in the compartment and capillary bed is what drives the gas exchange/diffusion. Therefore, when there is an increase in the tissue in the compartment, an ischemia occur.

• ***Artery>arteriol>capillary bed (diffusion/exchange)>venule> vein***

- **Pathophysiology:**
  - risk factor
  1. Elevated tissue pressure
  2. Absence of diffusion at the capillary bed
  3. Cell damage and swelling
  4. Further increase in tissue pressure
  5. Lack of oxygenation
  6. Vicious circle

- **Threshold pressure: (IMP)**
  1. 30 mm Hg (rigid), (Intracompartment pressure)
  2. Less than 30 mm Hg difference between compartment pressure and diastolic pressure (clinically relevant)

  Note: patient with hypotension they will have high compartment pressure and more to get compartment syndrome.

- **Risk factors (local):**
  - Trauma, crush, fracture (open/closed)
  - Injection
  - Bleeding
  - Prolonged vascular occlusion (reperfusion injury)
  - Burns
  - Venomous bite

- Intra-osseous fluid replacement
- IV fluid extravasation
- Tight bandage
- Post-surgery : most common factor.

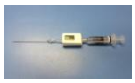
✓✓ **Notes:**

- The risk with open fracture is higher than others, as it requires a high energy force.
- Reperfusion injury is when the blood flow ceases transiently, the flow of the blood the second time can cause leakage of the arterioles →→ increases intracompartment pressure.
- Burns →→ fluid collection in third space (interstitial) →→ increases pressure of the compartment
- Post-surgery: bleeding, DVT (reperfusion injury)
- Heavy weight lifters (body builders) might be a risk factor.

- **Risk factors (general):**
  1. Head injury →→ decreased consciousness!
  2. Decreased conciseness →→ late diagnosis
  3. Hypotension

✓✓ **Note** : Unconscious patients can't alert you when they feel pain (due to compartment syndrome). So, check their compartment pressure every hour.

- **Diagnosis:**



- **Early: >> all about pain**
  - **Pain!!!**
  - Pain increase with stretching the involved compartment
  - Presence of risk factor
  - High index of suspicion
  - Measurement of compartment pressure is high
  - The affected limb will be **stiff**
- **Late: (IMP)**
  - Paresthesia
  - Paralysis
  - Pallor

  • Severely high pressure:
  - Pulselessness (RARE!)

  Note: this happened when the compartment pressure is equal to the systolic pressure.

  • Tight, woody compartment

  • Tender compartment

- **Measurement:**
  - Rarely necessary
  - Must be done at area of highest expected pressure
  - May give false low result
- **Management: (IMP)**

  - Initial (undeveloped CS):
    - Maintain normal blood pressure
    - Remove any constricting bandage
    - Keep limb at heart level
    - Regular close monitoring (15-30 minute intervals)
    - Avoid nerve blocks, sedation and strong analgesia to obtain patients feed back
  - Fully developed CS
    - Maintain normal blood pressure
    - Remove any constricting bandage
    - Keep limb at heart level
    - Diuresis to avoid kidney tubular injury if late.
    - ***Urgent surgical decompression (Fasciotomy).***
    - Muscle injury →→release of myoglobin →→toxic to kidney →→Acute Tubular

- **Fasciotomy: (IMP)**
  - Releasing the compartment fascia
  - Allows swollen muscles to expand in volume
  - Results in decreased compartment pressure
  - Avoids further damage
  - Does not reverse already occurred damage
  - Ideally should be done as soon as diagnosis is made
  - Should be done as long as there is still viable tissue
  - Should not be done if there is no expected viable tissue, Otherwise infection is likely

•Debridement of all necrotic tissue is necessary
•Second and third look surgeries are often required
•Closure of skin is usually achieved after swelling has subsided
•Skin grafting is often required

- ***Indications: (IMP)***
  - 6 hours of total ischemia time (ex: arterial embolism)
  - Significant tissue injury
  - Worsening initial clinical picture
  - Delayed presentation with a picture of developed CS
  - Absolute Compartment pressure >30 mmHg or <30 mm Hg difference from diastolic pressure

- Is a prophylactic procedure
- Does not reverse injury to permanently damaged tissue

- So better to have a low threshold!

✓✓ **Notes**:

- The goal of fasciotomy is prevent further damage and not to regain the function of the affected cells (reperfusion injury)
- The ischemic muscles and nerves will be affected after one hour of the ischemia; however permanent damage will occur after 6-8 hours.

• *Complications: (IMP)*

1. Myonecrosis>Myoglobenemia>Myoglobinuria>Kidney tubular damage
2. Loss of function of the involved compartment:
   - Flexion contracture
   - Paralysis
   - Loss of sensation

✓✓**Note:**

The muscle will be replaced by a fibrous tissue (irreversibly damaged limb is not amputated). However, it's prone to infection if it was cut open.

3. Leg**:**
   - Anterior compartment:
     - Drop foot
   - Deep posterior compartment:
     - Clowed toes
     - Loss of sensation in the sole
4. Forearm**:**
   - Volar compartment
   - Volkman contracture

✓✓ **Notes**:

Volkmann's ischemic contracture is a permanent flexion contracture of the hand at the wrist, resulting in a claw-like deformity of the hand and fingers.

"Acute Joint Dislocation"

- ***Objectives:***

1. To describe mechanisms of joint stability
2. To be able diagnose patients with a possible acute joint dislocation
3. to be able to describe general principles of managing a patient with a dislocated joint
4. to describe possible complications of joint dislocations in general and in major joints such as the shoulder, hip and knee

- ***Joint stability:***

1. Bony stability
   - Shape of the joint (ball and socket vs. round on flat)

2. Soft Tissue:
   - Dynamic stabilizer: Tendons/Muscles
   - Static stabilizer: Ligaments ± meniscus/labrum
3. Complex synergy leading to a FUNCTIONAL and STABLE joint
4. It takes higher energy to dislocate a joint with bony stability than a joint with mainly soft tissue stability
5. Connective tissue disorders may lead to increased joint instability due to abnormal soft tissue stabilizers.
6. Dislocation of a major joint should lead to considering other injuries.

✓✓ **Notes:**

- Shoulder is round on flat (the glenoid surface persay is flat, however the labrum on top of the surface renders it a round-like structure) →→ prone to dislocation.
- Connective tissue disorders: lax ligaments.
- Some joints have different positions in which they can be easily dislocated. (i.e. ball-throwing position →→ risk for shoulder dislocation)

- **At risk group:**
  - Major trauma victims
  - Athletes and sport enthusiasts
  - Connective tissue disorder patients
- When a joint is subjected to sufficient force in certain directions it might sustain a fracture, a dislocation or a fracture dislocation
- Different joints have different force victors that may lead to a dislocation
- A joint might dislocate in different directions
- A joint dislocation is described by stating the **location of the distal segment**:
  - ***Anterior shoulder dislocation*:** anterior displacement of the humeral head relative to the glenoid
  - ***Posterior hip dislocation*:** posterior displacement of the femoral head relative to the acetabulum

- ***Dislocation:***
  - Total loss of contact between the articular surfaces of the joint
- ***Sublaxation:***
  - Partial loss of contact between the articular surfaces of the joint
- ***Acute joint dislocation***
- ***Chronic joint dislocation:***

  Example of chronic joint dislocation is DDH. Obviously, a recurrent joint dislocation is NOT a chronic joint dislocation.

- ***Diagnosis:***

History of a traumatic event (major trauma or any trauma with the limb in high risk position)

- Pain and inability to use the limb
- Deformity
- Shortening
- Malalignment
- Malrotation
- Should check for other injuries (distracting injury)
- **Should always check the distal neurovascular status.**
- **Should check for compartment syndrome**
- Shortening is a hint in diagnosing DDH.

- ***X-rays:***

1. Should be done urgently without delay if dislocation is suspected.
2. Two perpendicular views of the involved joint .
3. Occasionally, special views are required such as the axillary view for shoulder dislocation .
4. X-rays to the joint above and below.

- ***Management principles:*** ***(Very IMP)***
  - Must rule out other injuries
  - Pain relief
  - Urgent reduction
  - Check stability and safety zone
  - Check neurovascular status after reduction
  - **X-rays after reduction**
  - Protect the joint
  - Rehabilitation
  - Follow for late complications

✓✓ **Notes** :

▪▪ Safety zone: The range of motion with stability (no danger of dislocation) For example, 10 degrees flexion and 20 degrees extension. If the patient goes beyond that, the joint will get unstable and might be dislocated.

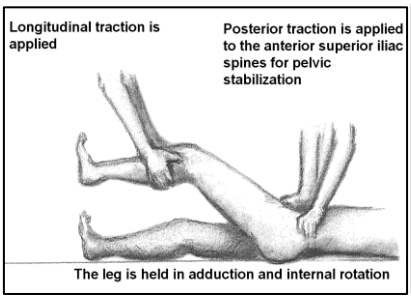
▪▪ Neurovascular status should be checked before and after the reduction. This goes for the x-rays as well.

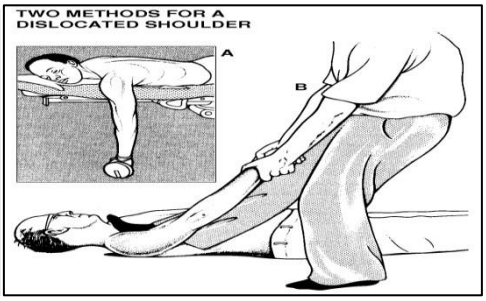
- ***Reduction:***

- Monitor vitals
- IV analgesia (opiod)
- IV sedation (to relax the muscles)
- Gradual traction to distract the joint
- Realignment and rotation to reduce the joint based on direction of dislocation
- A palpable clunk well be felt
- Check ROM and stability of the joint
- Muscle relaxant to allow the traction and distracion.
- Once joint is felt to be reduced, check distal NV status .
- If it was intact before but not after, farther urgent management is needed
- If it was not present before but intact after, check again later to confirm.
- Observe patients vitals until medications wear out.
- Stabilize joint and get X-rays.

- ***If irreducible or partial reduction only:***

- Urgent closed reduction under general anesthesia and possible open reduction if closed reduction fails
- Usually due to
  - Insufficient muscle relaxation
  - Entrapment of soft tissue
- Fracture dislocation →→ Open reduction (obviously!)





- ***Special considerations:***

- A fracture dislocation is usually reduced in an open fashion in the operating room
- Must confirm concentric reduction on the x-rays, otherwise an open reduction should be performed.

- ***Early Complications:*** ***(IMP)***
  - Heterotopic ossification
  - Neurological injury (reversible or irreversible)
  - Vascular injury
  - Compartment syndrome
  - Osteochondral fracture/injury
- **Note**: Heterotopic Ossification=Myositis Ossificans
- ***Late complications:*** ***(IMP)***
  - Stiffness
  - Heterotopic ossification
  - Chronic instability
  - Avascular necrosis
  - Osteoarthritis
- **Note**: Avascular Necrosis in hip dislocation mostly.

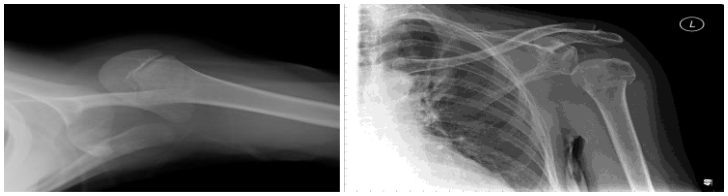
- ***Special considerations:***
- ***Hip joint:*** ***IMP***

- Posterior dislocation is commonest
- Major trauma with hip flexed (dashboard injury)
- Sciatic nerve injury common
- High incidence of late avascular necrosis
- An orthopedic emergency!!

Note: Bilateral in-situ pinning to cause fusion (the growth plate is already damaged by SCFE).

- ***Shoulder dislocation:***

- Common
- Anterior dislocation is more common
- **Patients with seizures prone to posterior dislocation**
- May cause chronic instability
- Can result in axillary nerve injury



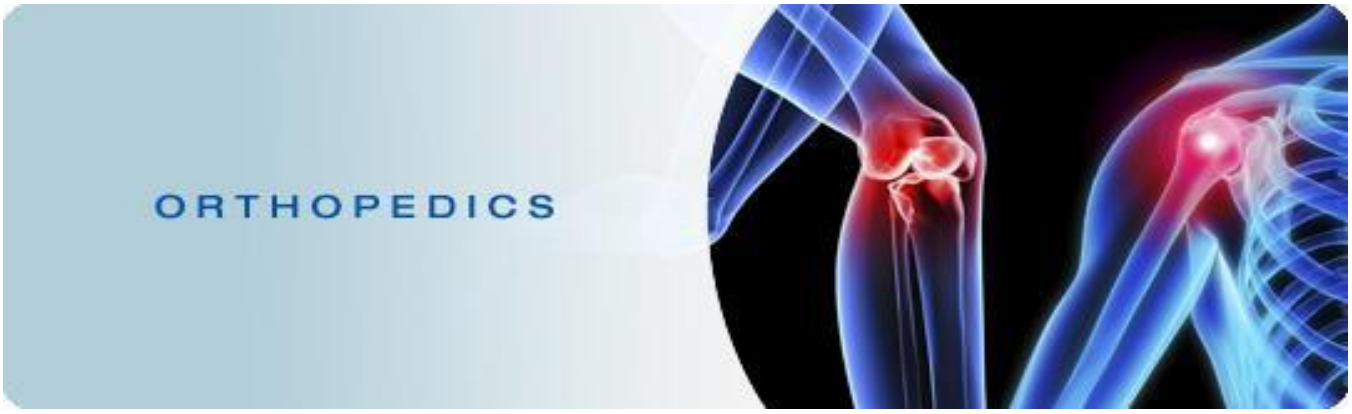
- ***Knee dislocation:*** (IMP)
    - Three or more ligaments
    - Severe (high energy) trauma
    - May be associated with popletial artery injury---- Limb threatening
    - Very serious emergency
    - Needs accurate vascular assessment
    - May be associate with peroneal nerve injury
    - May be associated with fracture/ compartment syndrome
    - Most require surgery either early or late or both

- **Note:**

1. Popliteal artery is attached to the posterior of the tibia →→ anterior dislocation of the tibia will stretch the artery →→ Intimal injury or rupture.
2. when there is a dislocation of knee we do ABI to role out the injury of Popliteal artery>> when the ABI is abnormal (less than 9) we do angiogam to confirm the diagnosis.(IMP)

Isn't it funny how someone can say, "I believe in Allah " but still follow the Satan who by the way also, " believes " in Allah…

430 ORTHOPEDICS TEAM



Lecture: Common spinal disorders.

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Team Leader:

Ayedah Al-Ruhaimi.

- The slides were provided by the doctor**.**
- Important notes in **Red**
- Copied slides in **Black**.

-Doctor's notes in **green**.

Degenerative Spinal Disorders

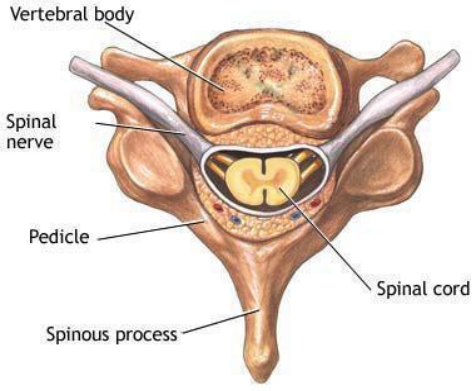
1. **Degeneration**:
   - "deterioration of a tissue or an organ in which its function is diminished or its structure is impaired"
2. **Other terms:**
   - "Spondylosis"
   - "Degenerative disc disease"
   - "Facet osteoarthrosis" → arthritis

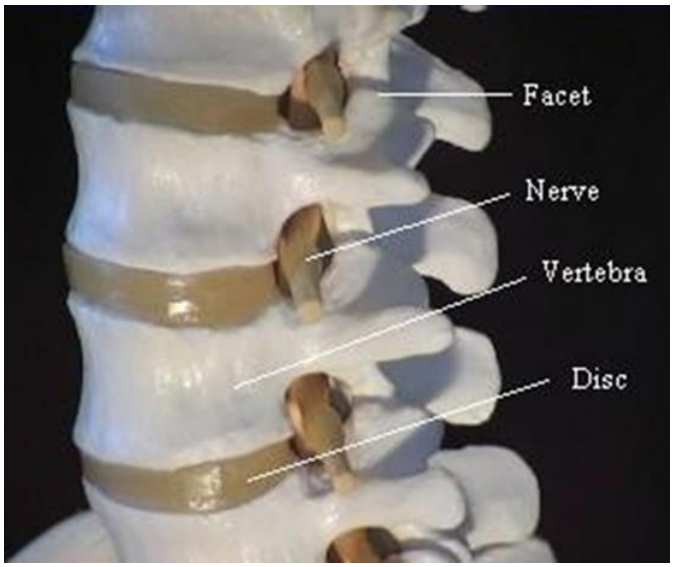
Etiology:

- **Multi-factorial**
  - **a.** Genetic predisposition (non-modifiable)
  - **b.** Age-related (non-modifiable)
  - **c.** Some environmental factors: (**modifiable**)→ you can't reverse or stop the disease, you can only lessen its progression.
    - Smoking
    - Obesity
    - Previous injury, fracture or subluxation
    - Deformity
    - Operating heavy machinery, such as a tractor

Anatomy:

- **Anterior elements:**
  - **a.** Vertebral body
  - **b.** ***Inter-vertebral disc***
    - Degeneration occurs at the disc
- **Posterior elements:**
  - **a.** Pedicles, laminae, spinous process, transverse process, ***facet joints*** (2 in each level)
    - Osteoarthrosis occurs at the facet joints
- **Neurologic elements:**
  - **a.** Spinal cord
  - **b.** Nerve roots (peripheral nerves)
  - **c.** Caudaequina





Pathology: The inter-vertebral disc:

- The first component of the 3 joint complex (disc anteriorly, canal centrally and 2 facet joints posteriorly)
- It is primarily loaded in **FLEXION**

- Composed of "annulus fibrosus" and "nucleus pulposus"
- Degeneration of the nucleus causes loss of cellular material and loss of hydration
    - ***Movement is impaired-painful- and could become unstable***
- Disc degeneration will also cause:
    - As you loss of disc height
        - Abnormal loading of facet joints
        - Stenosis in the inter-vertebral foramen
    - Bulging of the disc into the spinal canal
        - Contributing to spinal stenosis
    - Herniation of the nucleus into spinal canal
        - Causing radiculopathy (e.g. sciatica in the lumbar spine)

Pathology: The facet joints:

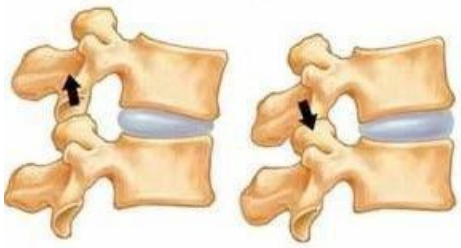
- Scientific name: "zygapophysial joints"
    - Similar to any synovial joint, unlike the disc (fibrous)
    - 2 in each segment
        - Together with the disc, form the 3 joint complex
        - Are primarily loaded in **EXTENSION**
    - Pattern of degeneration similar to other synovial joints
        - *Loss of hyaline cartilage, formation of osteophytes, laxity in the joint capsule*
- Facet degeneration will cause:
    - Hypertrophy, osteophyte formation
        - Contributing to spinal stenosis or foraminal stenosis
    - Laxity in the joint capsule
        - Leading to instability (degenerative spondylolisthesis)

Presentation:

- Falls into 2 catagories:
    - **Mechanical** pain: due to joint degeneration or instability
        - "Axial pain" in the neck or back
        - Activity related-not present at rest
    - Neurologic symptoms: due to neurologic impingement
        - Spinal cord
            - Presents as myelopathy, spinal cord injury
        - Caudaequina& Nerve roots
            - Presents as **radiculopathy** (e.g. sciatica) or neurogenic claudication

Mechanical pain

- Associated with movement
    - Sitting, bending forward (flexion):
        - Originating from the disc → "discogenic pain"
    - Standing, bending backward (extension) :
        - Originating from the facet joints→ "Facet syndrome"



Neurologic symptoms

- Spinal cord
    - **Myelopathy**:
        - Loss of motor power and balance

- Loss of dexterity → Objects slipping from hands
- UMN deficit (rigidity, hyper-reflexia, positive Babinski...)
- Slowly progressive "step-wise" deterioration.

– **Spinal cord injury**
- With Spinal stenosis, there is a higher risk of spinal cord injury
- Complete or incomplete

– **Caudaequina& Nerve roots**
- Radiculopathy→ unilateral arm or leg pain
  - LMN deficit
  - Commonest is sciatica, but cervical root impingement causes similar complaints in the upper limb (impingement causes pain along the dermatomes)
- Neurogenic claudication → bilateral leg pain, postural
  - Pain in both legs caused by walking
  - Must be differentiated from vascular claudication

Vascular vs. Neurogenic claudication:

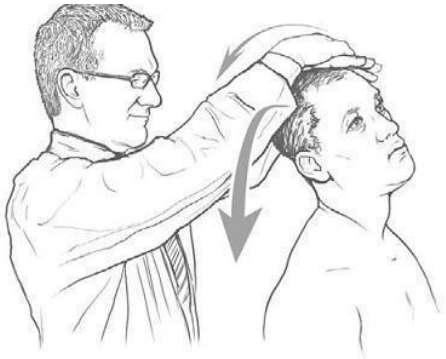
Table – Differentiating neurogenic and vascular claudication

Factors	Neurogenic	Vascular
Evaluation after walking	Increased weakness	Unchanged
Palliative factors	Bending over, sitting	Stopping
Provocative factors	Walking downhill Increased lordosis	Walking uphill Increased metabolic demand
Pulses	Present	Absent
"Shopping cart" sign	Present	Absent
van Gelderen bicycle test	No leg pain	Leg pain

The Cervical spine:

Introduction:

- Degenerative changes typically occur in **C3-C7**
- Presents with axial pain, myelopathy, radiculopathy
- Physical examination:
  – Stiffness (loss of ROM)
  – Neurologic exam:
    - Weakness
    - Loss of sensation
    - Hyper-reflexia, hypertonia
    - Special tests: **Spurling's sig n** →axial pressure + rotation+ bending (it's meant to provoke radiculopathy, similar to the straight leg raising test in the leg)



Management:

a. Conservative treatment

- First line of treatment for axial neck pain and mild neurologic symptoms (e.g. mild radiculopathy without any motor deficit)
  - **Physiotherapy**:
    - Focus on ROM and muscle strengthening
  - **Non-steroidal anti-inflammatory medications (NSAID): forjoint (axial) pain**
    - E.g. Diclofenac, ibuprofen, naproxen
  - **Neuropathic medication: for radiculopathy pain**
    - E.g. Gabapentin or pregabalin

b. Surgical management(motor weakness is an indication for surgery!**)**

- Indicated for:
  - Spinal stenosis causing myelopathy
  - Disc herniation causing severe radiculopathy and weakness
  - Failure of conservative treatment of axial neck pain or mild radiculopathy
- Procedures:
  - Anterior discectomy and fusion
  - Posterior laminectomy

Anterior Discectomy + fusion

The Lumbar spine:

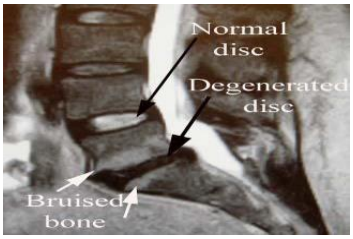
Introduction:

- Degenerative changes typically occur in **L3-S1**
- Presents with axial pain, Sciatica (radiculopathy) , neurogenic claudication
- Physical examination:
  - Stiffness (loss of ROM)
  - Neurologic exam:
    - Weakness
    - Loss of sensation
    - Hypo-reflexia, hypo-tonia
    - Special tests: SLRT (straight leg raising test)

Management:

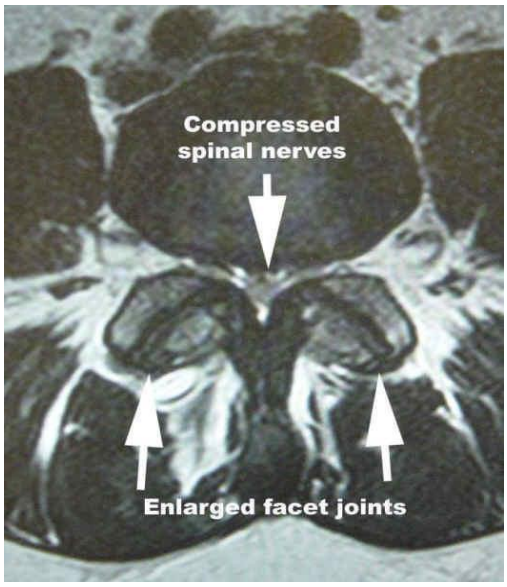
- **Axial low back pain:**
  - Conservative treatment if first-line and mainstay of treatment
    - Physiotherapy: core muscle strengthening, posture training
    - NSAID
  - Surgical treatment indicated for:
    - Instabilityor deformity(e.g. high-grade spondylolisthesis)
    - Failure of conservative treatment

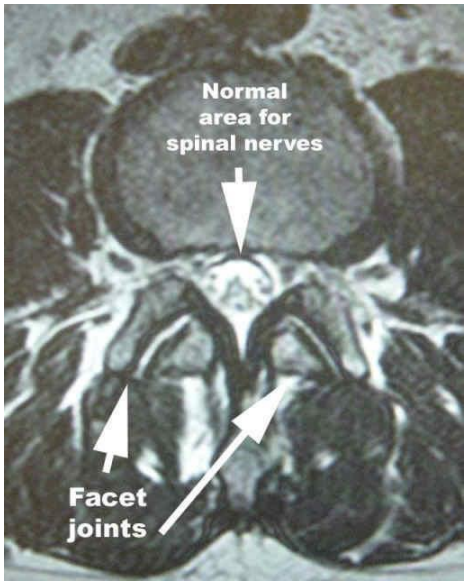
E.g. *Lumbar Spondylosis*:



- **Spinal stenosis**:(in the cervical spine it cause myelopathy)
  - Conservative treatment is first line of treatment
    - Activity modification, analgesics, epidural cortico-steroid injections
  - Surgical treatment
    - Indicated for:
      - Motor weaknesse.g. drop foot
        - failure of –minimum- 6 months of conservative treatment
    - Spinal posterior decompression (laminectomy) is the commonest procedure

E.g. Spinal Stenosis:

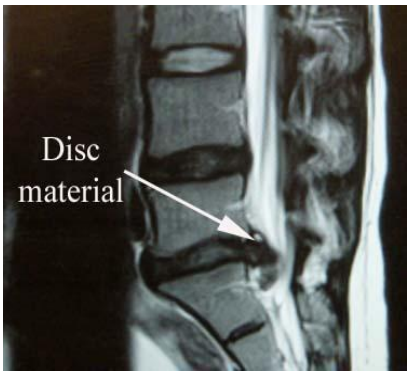


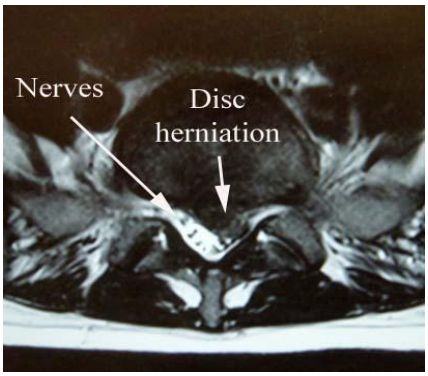


- **Disc herniation:**
  - Conservative treatment is first line of treatment for mild sciatica without motor deficit
    - Short (2-3 day) period of rest, NSAID, physiotherapy, epidural cortico-steroid injection
    - 95% of sciatica resolves within the first 3 months without surgery
  - Surgical treatment:
    - Indicated for cauda-equina syndrome, motor deficit, failure of 3 months of conservative treatment
    - Procedure: Discectomy (only the herniated part)+ spinal fusion

Spinal Fusion

E.g. Disc Herniation:





Osteoporotic Vertebral Fractures:

- Pathologic fractures
- Anterior column (±middle column) only compromised (Wedge/Burst Fracture)
- Often missed
- Repetitive fractures result in kyphoticdeformity (hunchback)
- Treatment of underlying cause!!

Spinal Deformities:

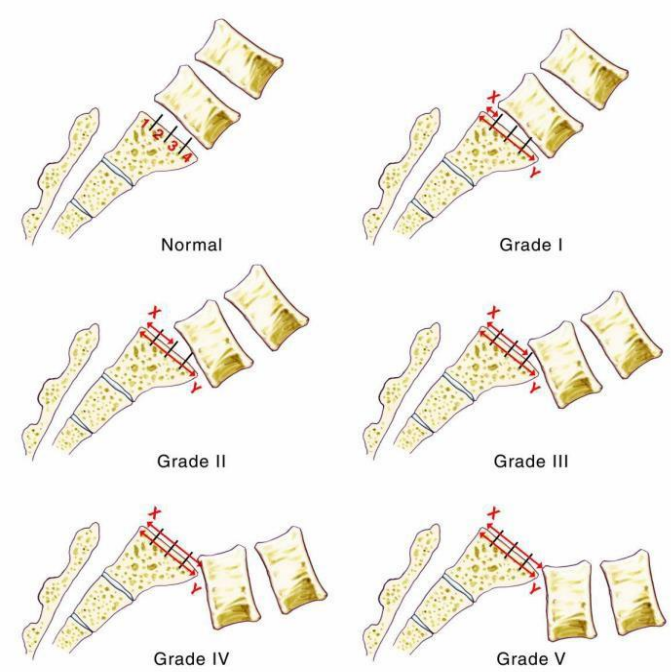
- **Scoliosis**
  - deformity of the spine in the **Coronal plane**
- **Kyphosis**
  - deformity of the spine in the **Sagittal plane**
- **Spondylolisthesis**
  - **Translation** of one vertebra over another

***Types of scoliosis**:*

- **Congenital**
  –Associated with anomalies of the bony vertebral column, e.ghemivertebra
- **Acquired** (=secondary)
  –Secondary to other pathology, e.gtumor, infection, spinal cord anomalies, degeneration
- **Idiopathic**
  –Most common is adolescent type
- **Adolescent idiopathic scoliosis:**
  - Three dimensional deformity of the spine
  - Vertebral Rotation is the hallmark
  - Presents with deformity *with little or no pain*
  - Usually noticed by parents/others, not the patient herself/himself
  - Examination: neurologically normal, positive **Adams** test
  - Management depends on degree of deformity
  - Imaging shows truncal shift

***Spondylolisthesis**: (*slippage of one vertebra over the other*)*

- Conservative treatment first
- Surgery if Grade 3 or more or failed conservative management.
- Types:
  - **Degenerative Spondylolisthesis**
    - Causes spinal stenosis
  - **Isthmic spondylolisthesis:**
    - Caused by inter-articularis defect (spondylolysis)



Destructive Spinal Lesions:

- Present with pain at rest or at night (the pain is biological in origin, NOT mechanical)
- Associated with constitutional symptoms
- Most common causes:
  - Infection
  - Tumors
- Vertebral body and pedicle are the commonest sites of pathology

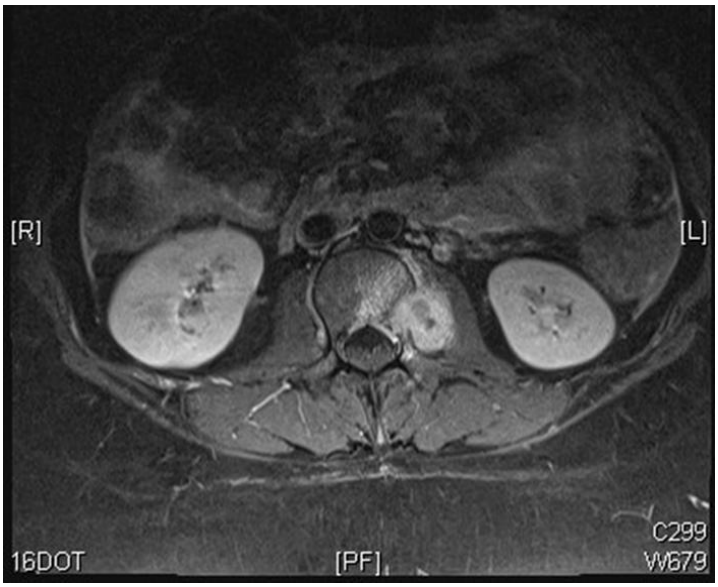
Spinal Tumors:

- **Primary Spinal tumors:**
  - Rare
  - Benign (e.g. osteoid osteoma) or malignant (e.g. chordoma)
  - Management depends on pathology
- **Spinal metastasis:**
  - Very common! The reason is that the venous supply of the spine is valveless(micrometastasis)
  - Biopsy required if primary unknown (can be done safely through CT guidance)

Spinal infections:

- Most common is **TB**and Brucellosis
- History of contact with TB patient, raw milk ingestion
- Potentially treatable diseases once diagnosis is established and antimicrobials administered

Spinal Tuberculosis (with psoas abscess)



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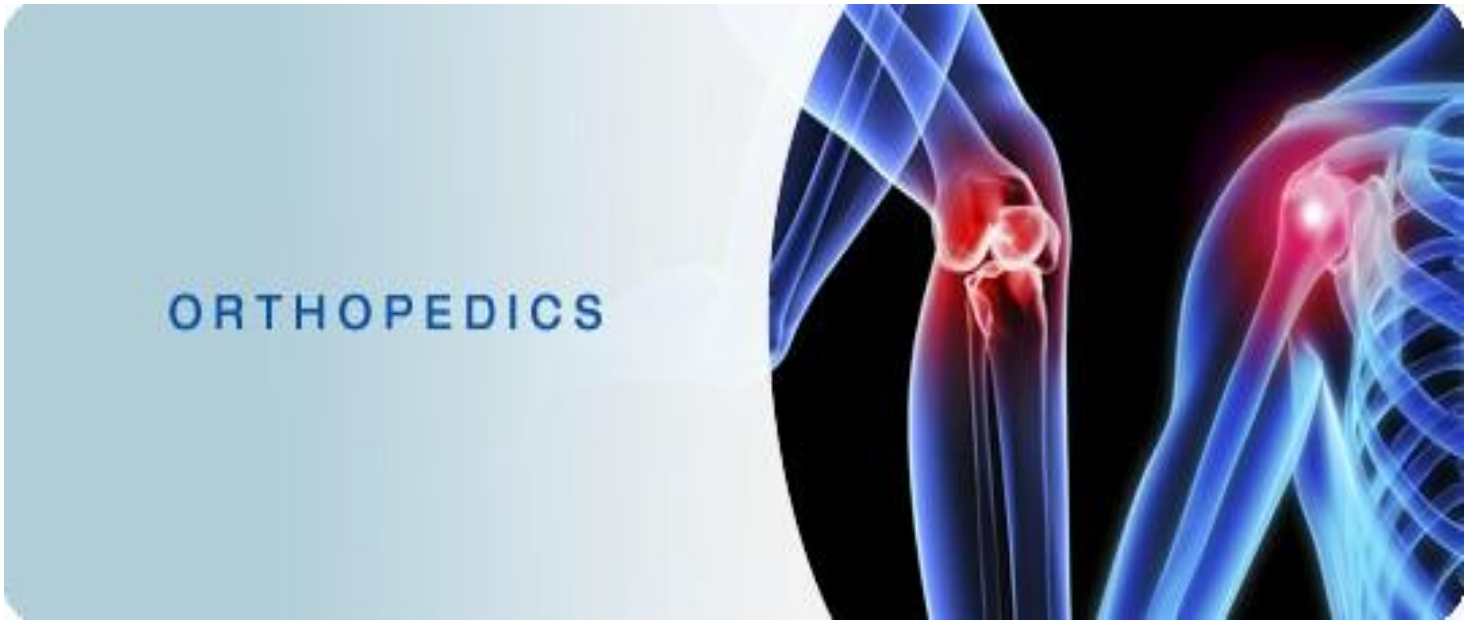

Lecture: Spinal Injuries.

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Team Leader:

Ayedah Al---Ruhaimi.

- The slides were provided by the doctor.
- Important notes in **Red**.
- 429 group A team in **Orange**.
- Doctor's notes in **Green.**
- Copied slides in **Black**.

❖❖ Epidemiology:

- 50000 cases per year.
- 11000 new spinal cord injuries.
- 15---20% multiple non---contiguous levels.
- 10% involving the cervical spine.
- 90% involving thoraco---lumbar spine.
- 25% have neurologic deficit.
- Age: mostly between 15---24 years.
- Gender: mostly males (4:1).

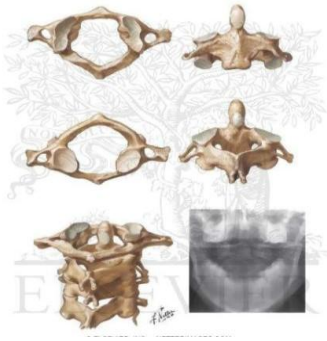
❖❖ Mechanism of Injury:

- High energy trauma such as an MVA or fall from a height or a horse.
  - MVA: 40---55% (most common).
  - Falls: 20---30%
  - Sports: 6---12%
  - Others: 12---21%.
- Low energy trauma in a high risk patient (e.g. a patient with known spinal canal compromise such as ankylosing spondylitis, Osteoporosis or metastatic vertebral lesions)
- Penetrating trauma from gunshot or knives

❖❖ Anatomy of the Spine: ((429))

- Bones: vertebrae for protection bear most of the weight put on your spine.
- Joints: 3 joints:
  - Interiorly :
    - inter---vertebral disc: helps absorb pressure and keeps the bones from rubbing against each other. 60---80 % injured.
  - Posterior :
    - 2 facet joints
  - Joint give the movement of spine :
    - Flexion.
    - Extension
    - Lateral bending
    - Rotation

- Ligament :
  - Supraspinatous.
  - Infraspinatous.
  - Legamentum Flavum. (the Most Important)
  - Ant. Longitudinal Ligament.
  - Post. Longitudinal Ligament.
  - Ligament is IMP. In maintain the flexibility of spine. If injured the x---ray will be normal.
- Muscles: all spinalis muscle



❖❖ Cervical Anatomy:

- **C1 & C2** (50% of rotation occurs BTW C1 & C2 and then 5% at each level). (50% of flexion and extension occurs BTW C1 and cranium)
  - C1:
    - No vertebra. Body
    - Composed of Ant. & Post .arch.
  - C2:
    - Have Ant. Projection is: Odentoid process significant in stability of C1 & C2.
    - Open mouth x---ray (MCQ), we see the C1 &C2 and their articulation.
- **C3---C7**
  - **C3-C7** is same.
  - Have body +2 Lat. masses (facet joints).
  - We differentiate it from the thoracic by Spinal process.

Cervical anatomy: C3-C7

❖❖ Thoracic Spine

- Articulate with ribs by body and spinal process (downward).

❖❖ Lumbar Spine

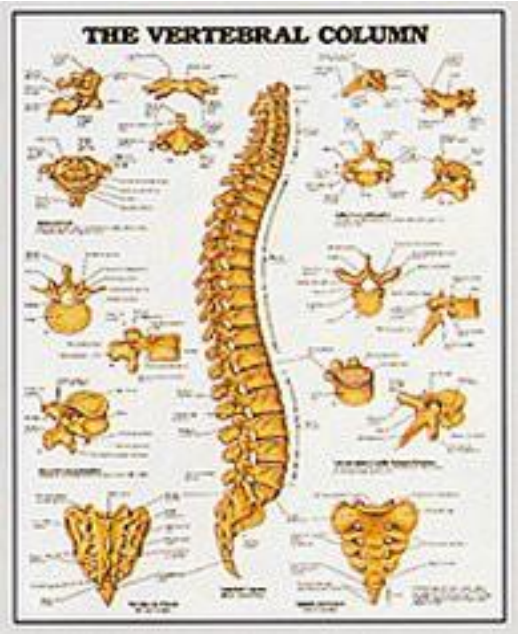
- More IMP.
- Lowest mobile segment.
- Most of ligament.
- More fracture.
- All joint here Ant +Post.
- Most of movement.

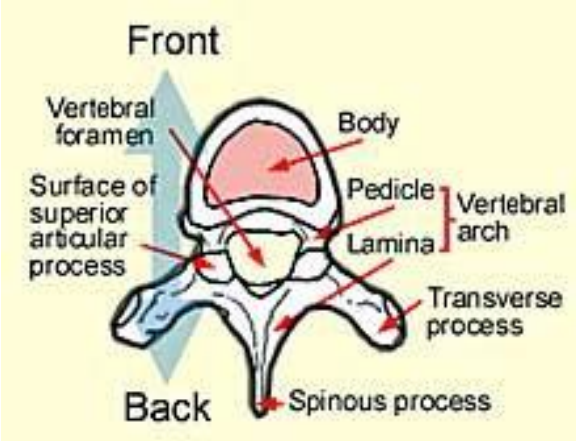
Thoracic Spine

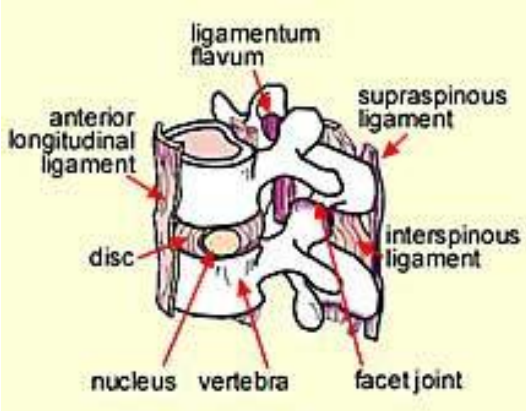
- **The Three columns (imp)**
  - Ant. Column >Ant. part of body
  - Middle column > Post. Part of body
  - Post. Column > Pedicle + Lamina+ Spinal process.
- **Stable injury :**
  - One column only
  - (e.g. Wedge #in Ant. Column)
  - Not required treatment or conservative only.
- **Unstable injury:**
  - 2 or more column.
  - Need intervention (surgery, etc.)

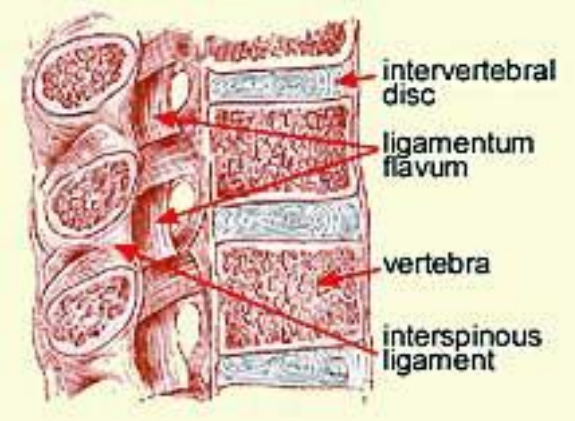
Lumbar Spine

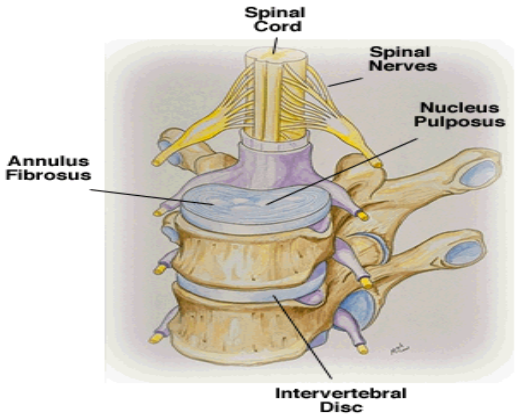
❖❖ Spinal Column:



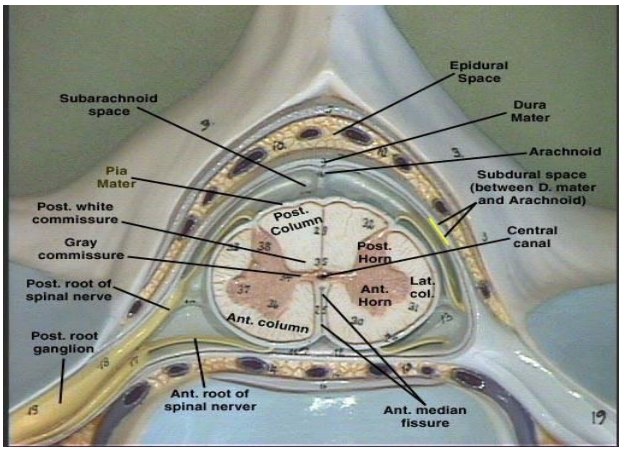


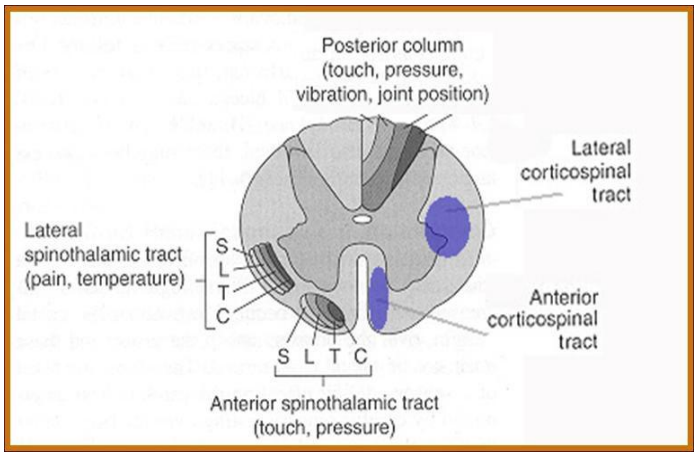




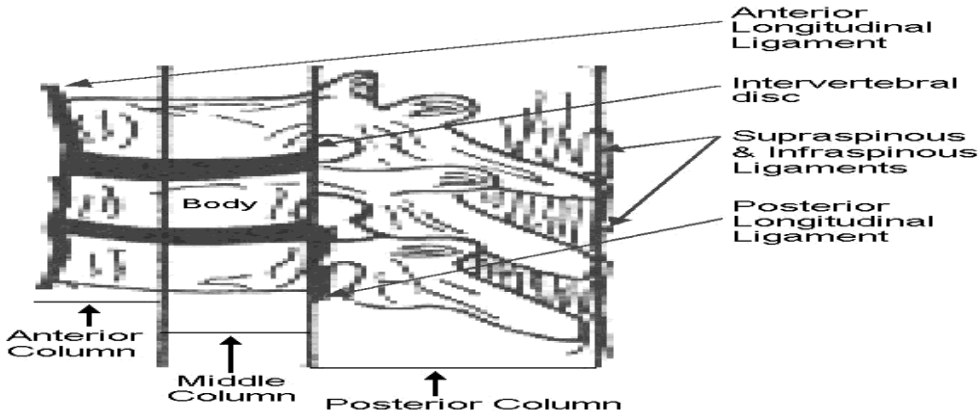


❖❖ Spinal Cord:





❖❖ The Three columns:



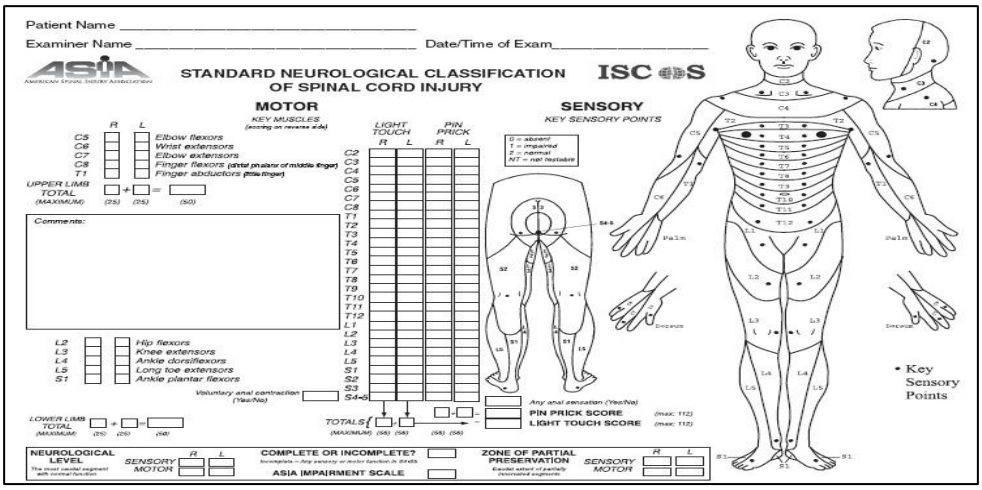
❖❖ Assessment:

- In cases of trauma, ABCDE's must be assessed first and treated appropriately (MCQ)
- Patients should be examined with spinal collar until spinal pathology is excluded.
- Careful log rolling keeping the head, neck and pelvis in line should be done to examine the spine properly.
    - Immobilization (by cervical collar only for 2 hrs for the sake of transportation only)
    - History:
        - Mechanism of injury (high or low energy)
        - compression, flexion, extension, distraction
        - Other injuries (head injuries with high incidence of cervical spine injury)
        - Seat belt
        - Other causalities. (presence of other passengers and their clinical situation)

- Physical examination:
  - Inspection, palpation.
- Neurologic examination →→ (Muscle Test, Sensory exam, light touch, Sharp dull discrimination, Vibration sense, Proprioception and two---point discrimination and Reflexes).



❖❖ Asia Score: Brief Trauma Neurologic Survey:



❖❖ Level of Cord Injury determines level of function: (imp)

ASIA IMPAIRMENT SCALE

- ☐ **A = Complete:** No motor or sensory function is preserved in the sacral segments S4-S5.
- ☐ **B = Incomplete:** Sensory but not motor function is preserved below the neurological level and includes the sacral segments S4-S5.
- ☐ **C = Incomplete:** Motor function is preserved below the neurological level, and more than half of key muscles below the neurological level have a muscle grade less than 3.
- ☐ **D = Incomplete:** Motor function is preserved below the neurological level, and at least half of key muscles below the neurological level have a muscle grade of 3 or more.
- ☐ **E = Normal:** motor and sensory function are normal

CLINICAL SYNDROMES

- ☐ Central Cord
- ☐ Brown-Sequard
- ☐ Anterior Cord
- ☐ Conus Medullaris
- ☐ Cauda Equina

Notes:

- You can palpate for Gaps and steps in the spine

C7 called: Cervical Prominence

- So, If there is a gap; you felt C1 then the other one below it deep (not at the same level) then it is →→ Steps →→spondylotheiasis
- Gaps: you will feel one spine then below it space then another Spine →→ could be due to a rupture if the ligaments .
- **ASIA Scale:** (American Spine injury association)
- **The Closer the patient to normal (E) the better prognosis.**

(E →→ excellent)

❖❖ Prognosis for Recovery of spinal Cord Injury:

- Poor prognosis for recovery if:
  - Pt arrives in shock.
  - Pt cannot breath.
  - Pt has a complete injury.

❖❖ Severity of neurologic deficit

- **Complete spinal cord injury:**
  - Flaccid paralysis below level of injury.
  - May involve diaphragm if injury above C5.
  - Sympathetic tone lost if fracture above T6.
- **Incomplete**
  - Any sensation?
  - Sacral sparing?
  - **Central cord syndrome:**
    - Characterized by disproportionally (UL>LL).
    - Mechanism: hyper---extension.
    - Occur with or without fractures.
    - Recovery: 50% regaining function.
    - Prognosis is fair.
  - **Anterior cord syndrome:**
    - Characterized by loss of corticospinal and spinothalamic tract with preserved posterior column.
    - Mechanism: ischemia or infarction to spinal cord.
    - Common injury.
    - Recovery: 10%.

- Prognosis is good if progressive recovery within 24hrs, absent SS (sacral sensation) after 24hrs portends a poor outcome

- **Brown---Sequard syndrome:**
  - Characterized by hemi---cord injury with ipsilateral paralysis, loss of Proprioception and fine touch, and contra lateral temperature and pain loss.
  - Prognosis is good, with over 90% regaining of bowel and bladder function and ambulatory capacity.
- **Conus Medullaris syndrome:**
  - Seen in T12---L1 injuries.
  - Loss of voluntary bowel and bladder control with preserved lumbar root function.
  - Uncommon as pure lesion (mixed conus---cauda).
- **Cauda Equine syndrome: (imp)**
  - Saddle anesthesia, urinary retention and stool incontinence (perform PR and sensation to that area)
  - Usually due to large central disc hernia ion rather than fracture.
- **Nerve root deficit: LMN**

❖❖ **Spinal Shock:**

- Transient loss of spinal reflexes.
- Lasts 24---72 hours (recovery may begin immediately)
  (Perform bulb---cavernous reflex (squeezing the glens of pens in male or clitoris in female) →→ contraction of anus)

❖❖ **Neurogenic shock:**

- Reduced tissue perfusion due to loss of sympathetic outflow and un---apposed vagal tone.
- Peripheral vasodilatation (hypotension and bradycardia).
- Rx: fluid resuscitation and vasopressors. (vasopressors are much more impotent than fluid resuscitation)

❖❖ **Imaging:**

- X---rays:
  - Cervical: 3 views.
    - AP, lateral and open mouth.
  - Thoraco---lumbar: 2 views.
    - AP & lateral.
  - Flexion---Extension views.
- CT: best for bony anatomy.
- MRI: best to evaluate soft tissue

❖❖ Management of Spinal Injuries:

- Depends on: (MCQ)
  - Level of injury.
  - Degree and morphology of injury: STABILITY
  - Presence of neurologic deficit.
  - Other factors.

❖❖ Some general rules:

- ***Stable*** injuries are usually treated conservatively.
- ***Unstable*** injuries usually require surgery.
- **Neurologic compression** requires decompression

❑❑ Specific Injuries:

❖❖ Cervical spine fractures

- Descriptive: depends on mechanism of injury.
  - Flexion/extension.
  - Compression/distraction.
  - Shear.
- Presence of Sublaxation/dislocation
- SCI:
  - High fracture results in quadriplegia.
  - Low fracture results in paraplegia. (C6 , C7 or C7, T1)

❖❖ **Thoraco---Lumbar fractures:**

- Spinal cord terminates at L1/2 disc in adult (L2/3 in a child).
- 50% of injuries occur at Thoraco---lumbar junction.
- Common fractures:
  - Wedge fracture (flexion/compression).
  - Burst (compression).
  - Chance (flexion/distraction).

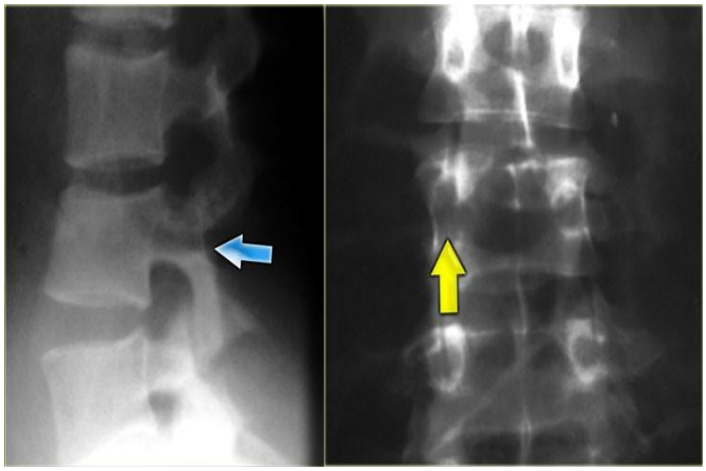
❖❖ **Wedge fracture:**

--- The distance BTW spinal process is equal ∄∄ meaning it is stable injury ∄∄ managed conservative.

❖❖ **Burst fracture:**

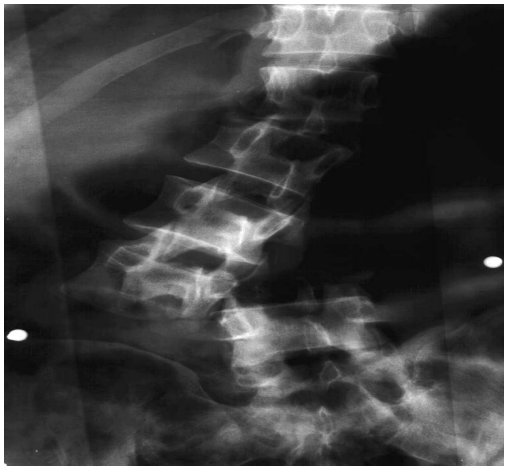
--- Retro---avulsion traction disturbed vertebral body, wide distance BTW pedicles. In the CT there is fragments in the canal
--- There is significant kyphosis.
--- Unstable fracture ∄∄ managed by compression or fixation according to neurological deficit.

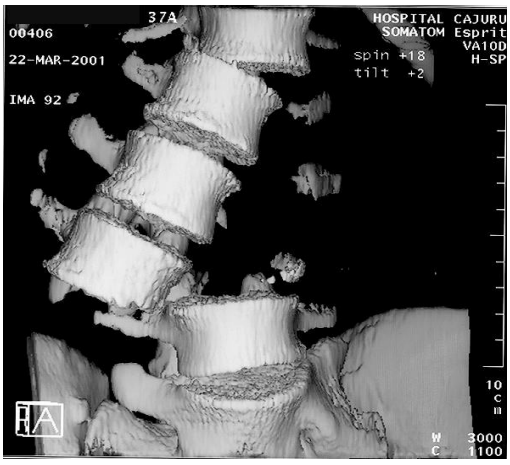
❖❖ **Chance fracture:**



- Chance fracture could be bony chance (in the upper part) or ligaments chance.
- The spinal processes are not aligned.
- There is a space BTW pedicles.
- Unstable →→ managed surgically

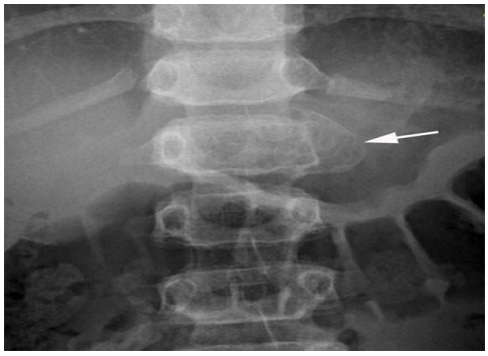
❖❖ **Fracture dislocation:**

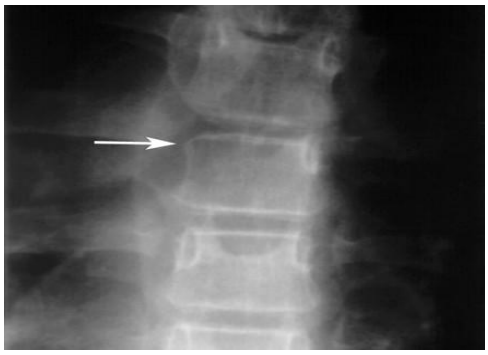




❖❖ **Pathologic fractures:**

- Low---energy fractures.
- Osteoporotic is common.
- Usually due to infection or tumor.
- X---rays: "winking owl" sign. (there is a missed pedicle as if it is winking (closed))





❖❖ Cauda Equine Syndrome:

- A surgical emergency.
- Common cause is herniated disc and spinal stenosis
- Requires full neurologic examination *including rectal examination for anal tone.*
- **Clinical features ➔➔**

1 --- Motor (UMN signs):

--- Weakness, Reduced deep tendon reflexes (knee or ankle).

2 --- Autonomic:

--- Urinary retention, fecal incontinence due to loss of anal sphincter Tone.

3 --- Sensory**:**

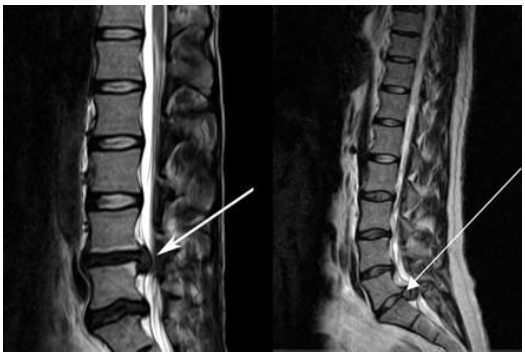
➔➔ Sciatica (low back pain radiating to legs aggravated by vlasava maneuver and setting, relived by lying down).

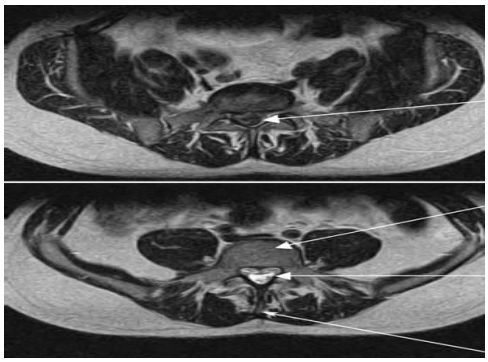
➔➔ Bilateral sensory loss or pain depends on the level affected

➔➔ Saddle area (S2---S5) anesthesia.

➔➔ Sexual dysfunction (late presentation)

- Investigations: X---rays initially (just a routine investigation but it will be negative), but *MRI is mandatory (it is the gold standard) as X---rays are usually unremarkable.*
- Treatment: Emergency decompression---usually discectomy and wide laminectomy within 24 hours. (it is not elective procedure)
- Prognosis is markedly improves with surgical decompression.





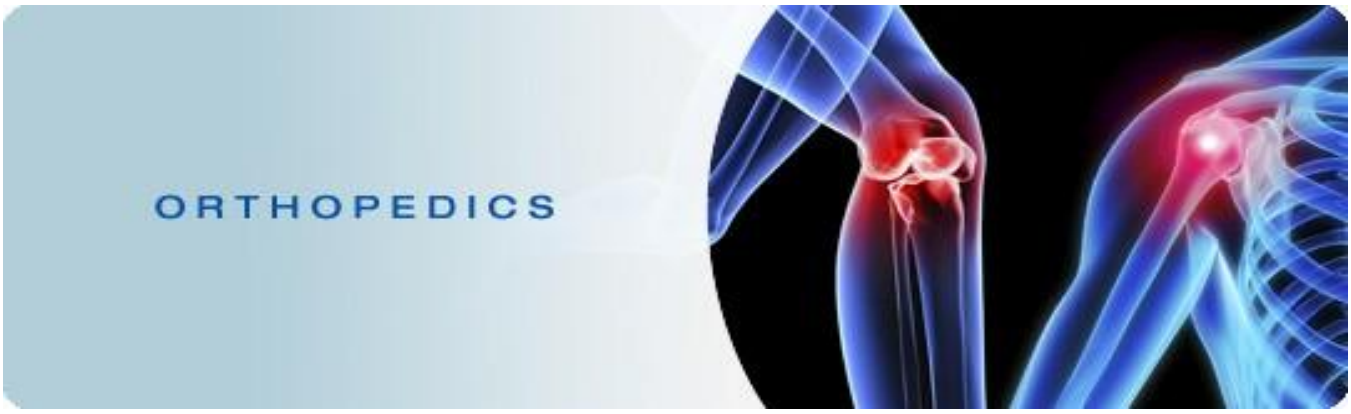
--- The only single exam that you would like to do is PR. (MCQs)

Notes //

- Spinal red flags are Cauda Equine, spinal tumors, and Fractures with instability.
- Pediatric pt with cervical injury, the most important complication is scoliosis.
- 90% of injuries occur in thoraco---lumbar spine and 50% of these fractures occur at the thoraco---lumbar junction.

Isn't it funny how someone can say "I believe in Allah " but still follow the Satan who by the way also, " believes " in Allah…

430 ORTHOPEDICS TEAM



Lecture:((Common Pediatric Fractures))

Team Members:

Faten Al---Mohideb.	Hanan Al---Salman.	Aliya Al---Awaji.
Hadeel Al---Ghamdi.	Ghadeer Al---Wuhayd.	Hissa Al---Balla.
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Hiba Al---Rahiem.	Nour Al---Enezi.	Wejdan Al---Swayyid.
Arwa Abudawood.	Leena Al---Shaman.	Areej Al---Qunaitir.

Team Leader:

Ayedah Al---Ruhaimi.

Special thanks to Norah Al---Turki

---The slides were provided by the doctor **.**

---Important notes in **Red**.

---Doctor's notes in **green/blue.**

---Copied slides in **Black**.

---MCQ in highlight.

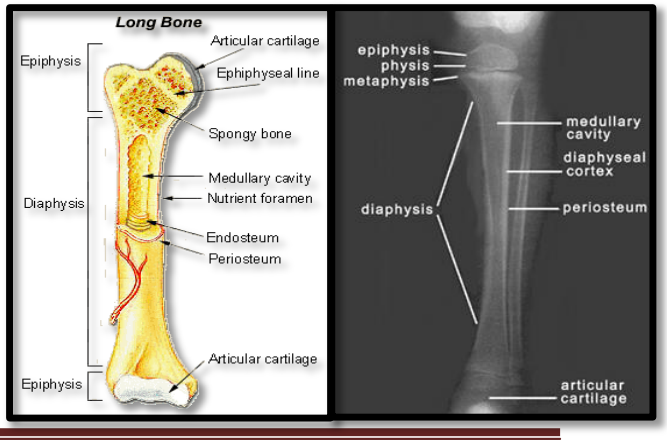
Objectives:

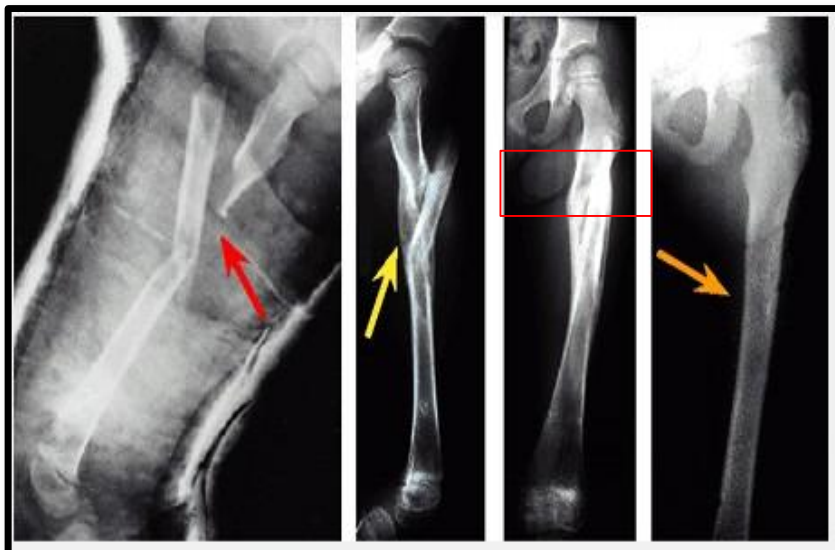
- ✓✓ know most of the mechanism of injury
- ✓✓ make the diagnosis of common pediatric fractures
- ✓✓ request and interpret the appropriate x-rays
- ✓✓ initiate the proper management of fractures
- ✓✓ Know which fractures can be treated by conservative or operative methods and the ways of fixation.
- ✓✓ Know the possible complications of different fractures and how to avoid them.

The different between adult and pediatric bones

- Pediatric bone has a higher water content and lower mineral content per unit volume than adult bone so less brittle than adult bone. **(weak bones)**
- The physis (growth plate) is a unique cartilaginous structure is frequently **weaker than bone** in torsion, shear, and bending, predisposing the child to injury through it. (That's why the most common pediatrics fractures occur in growth plate).
- The physis is traditionally divided into four zones that the injury through it can cause shortening, angular deformities. (In the Future).
- The periosteum in a child is a thick fibrous structure and Rich in blood supply than adult bone so there is high remodeling rate. **(Thick periosteeum→→ fast remodeling)**
- **Ligaments in children are functionally stronger than bone.** Therefore, a higher proportion of injuries that produce sprains in adults result in fractures in children.
- The Growth Plate Diffuses at the age of 16-18 years old, it depends mainly at the location of the growth plate.
- Twisted injury in adults will give you spiral Fracture but in Pediatric will give you injury to the growth plate.

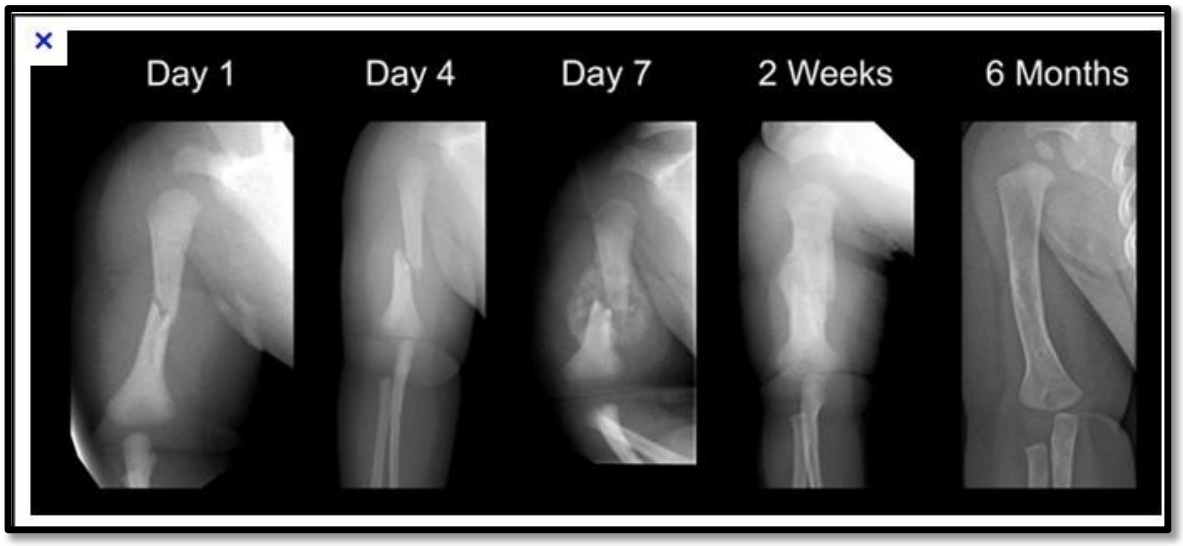
Immature bone (Pediatric bone)





E Remodeling of femoral shaft fracture This segmental fracture in an 8-year-old girl was managed in traction and in a cast (red arrow). Note the filling in of the periosteal sheath at 6 months (yellow arrow) and restoration of normal femoral shape at age 13 years (orange arrow).

F Remodeling of the humerus This 8-year-old boy shows a complete loss of apposition (red arrow). Note the remodeling over the next 2 years (yellow arrow).



This complete, displaced fracture of the femur occurred in a 9-year-old boy.

The child received a cast without surgical reduction. The remodeling process in the bone has begun.

This radiograph shows that the cast was successful and the femur healed very well by month 15.

Because of Periosteum, the Bone will remodel very well!

Common Pediatric Fractures:

- **Upper limb:**

Clavicle, **supracondylar Fracture (the most common upper limb fracture)**and distal Radius.

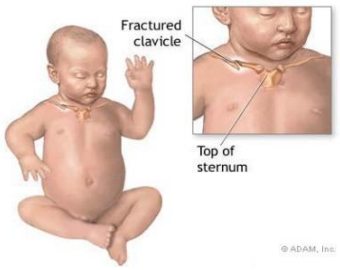
- **Lower Limbs:**

Femur fractures.

A. CLAVICLE FRACTURES

- 8% to 15% of all pediatric fractures.
- 0.5% of normal deliveries and in 1.6% of breech deliveries. (Birth Fracture).
- 90% of obstetric fractures. (During Delivery the baby will get shoulder fracture)
- **80% of clavicle fractures occur in the shaft.(the MIDDLE)**NOT the Proximal or the Distal!
- The periosteal sleeve always remains in the anatomic position. Therefore, remodeling is ensured.

▪▪ **Mechanism of Injury:**

Indirect	Direct	Birth injury
Fall onto an outstretched hand. 	**This is the most common mechanism;** it carries the highest incidence of injury to the underlying neurovascular and pulmonary structures.	 Patient will present with pseudo-paralysis of the limbs

▪▪ **Clinical Evaluation:**

- In Birth fractures: an asymmetric in the Shoulder, palpable mass overlying the fractured clavicle.
- typically present with a **painful (ACUTE) , palpable mass along the clavicle, Tenderness, Decrease Range of Motion (ROM), there may be tenting of the skin, crepitus, and ecchymosis.**
- **Ecchymosis ➔➔ Subcutaneous Purpura > 1 cm or a Hematoma, commonly called a bruise.**
- Neurovascular status, the brachial plexus and upper extremity vasculature may result.
- Pulmonary status must be assessed. Why? May Penetrate the Lung and Cause Pneumothorax.

- **Radiographic Evaluation:**

1. AP view (The most COMMON and important view, it will show the location of the fracture). **No lateral view**!
2. Cephalic tilt view (cephalic tilt of 35 to 40 degrees).
3. Apical oblique view (injured side rotated 45 degrees toward tube with a cephalic tilt of 20 degrees).

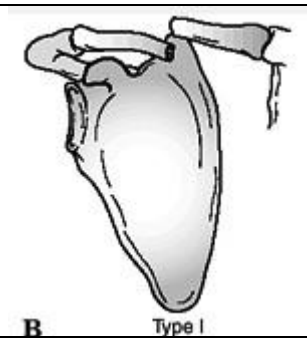
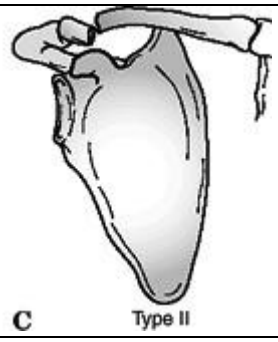
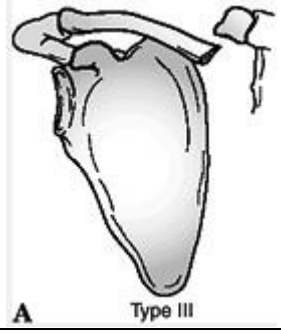
AP view

- **Classification (Descriptive):**

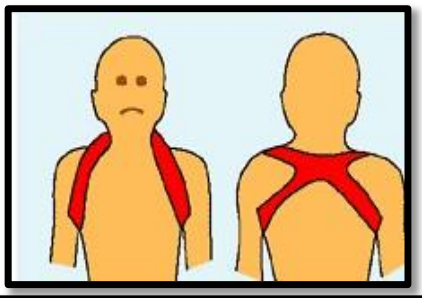
Location, open vs. closed, displacement, and angulation.

Fracture type: segmental, comminuted, greenstick.

▪ **Allman classification: (Another way to Classify):**

Type I	Type II	Type III
• **Middle third (most common).**	• Distal to the coracoclavicular ligaments (lateral third).	• Proximal (medial) third.
		

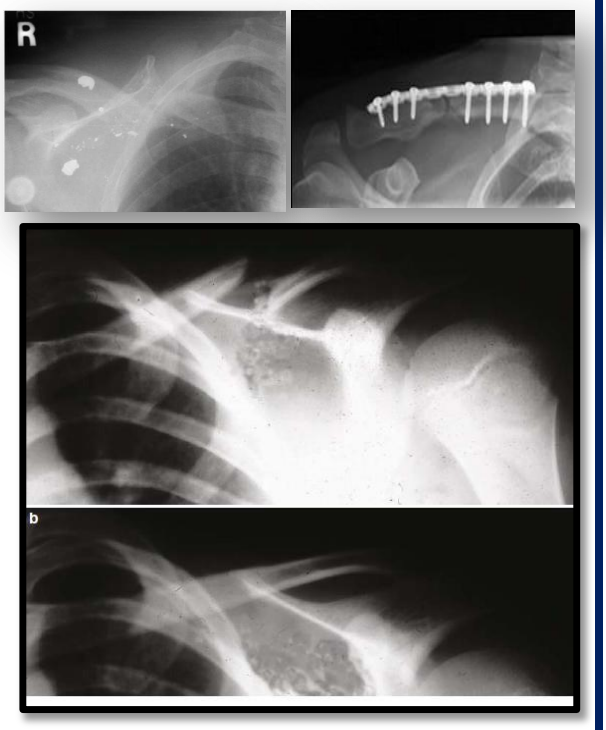
▪ **Treatment of clavicle fractures:**

Newborn to Age 2 Years	Age 2 to 12 Years
-Clavicle fracture in a newborn will unite in approximately 1 week. -Infants may be treated symptomatically with a simple sling or (figure-of-eight bandage) applied for 2 to 3 weeks. No Need For Reduction Due to presence of periosteum and the same teqnuiqe may apply to adults.   **The cullas Formation will be removed from the body After Healing!** **So we don't worry about them not like adults.**	A figure-of-eight bandage or sling is indicated for 2 to 4 weeks.  

Indication of operative treatment:

1- Open fractures
2- Neurovascular compromise
   - **99% of The Close Fractures Treated by the closed Method or sling!**

Example of **X-ray Mid clavicle fracture:** ⟶



- Post conservative treatment
- Healed completely
- With no complications (No Cellus Formation or Angulation)

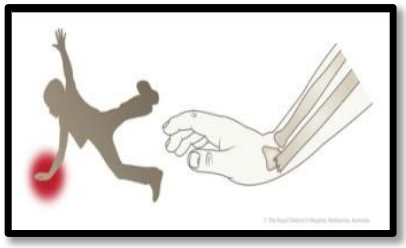
▪ **Complications (Rare):**
- Neurovascular compromise.
- Malunion.
- Nonunion.
- Pulmonary injury.

B. SUPRACONDYLAR FRACTURE

(The Commonest Fracture in Pediatric Age group)

- Comprise 55% to 75% of all elbow fractures.
- The male-to-female ratio is 3:2.
- The peak incidence is from 5 to 8 years, after which dislocations become more frequent.
- The left, or nondominant side, is most frequently injured.
- Supracondylar fracture is a fracture in the metaphysis.

▪ **Mechanism of injury:**

Indirect	Direct
The most common mechanism. Most commonly a result of a fall onto an outstretched (FOOSH) upper extremity. **(Extension type >95%).** 	A fall onto a flexed elbow or from an object striking the elbow (e.g., baseball bat, automobile). (Flexion type < 3%). 

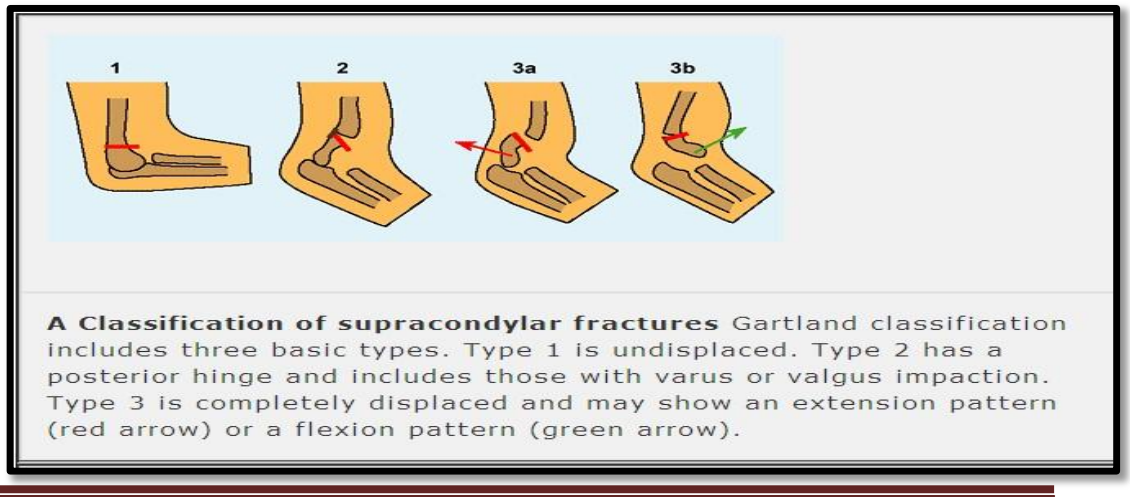
▪ **Clinical Evaluation:**

- A swollen, tender elbow with painful range of motion.
- S-shaped angulation at the elbow.
- Pucker sign (dimpling of the skin anteriorly) ⟶
- **Neurovascular examination:** The median, radial, and ulnar nerves as well as their terminal branches. Capillary refill and distal pulses should be documented and the Radial Artery.

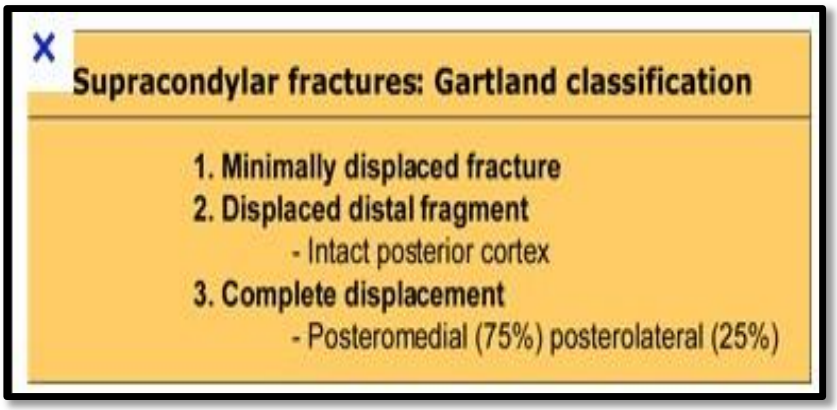
- **<u>The commonest Nerve to be injured is: Anterior Interosseous Nerve which is branch from the Median nerve and is associated more with Extension (indirect)Type. The Way to assess: Ask the Patient TO Do (OK) sign(medial nerve)!</u>**
- **Muscles involvled with median nerve injury→→ Flexor Polices Longs, Flexor digitorm longs!**
- **E.g. if there is radial nerve injury, there will be wrist drop and loss of sensation in the lateral side.**
- **Ok sign →→ Median nerve and loss of sensation**
- **Abduction of the thumb →→ ulnar**
- **You can examine 3 nerves by the thumb!**

Complete Fracture of Supracondylar. ⟶

▪ **Gartland Classification:**



A Classification of supracondylar fractures Gartland classification includes three basic types. Type 1 is undisplaced. Type 2 has a posterior hinge and includes those with varus or valgus impaction. Type 3 is completely displaced and may show an extension pattern (red arrow) or a flexion pattern (green arrow).



Type 1: Undisplaced --- Anterior humral line pass to Cubetelum, minimally displaced.

Type 1 Diagnosis

Type 2: Anterior Cortex Disrupted, Posterior cortex intact

Lateral elbow x---ray

AP view

Type 3A: Extension type--- posterior medial.

Type 3B: Flexion type ---posterior lateral (rare)

AP view elbow

Lateral view
(To differentiate between extension and flexion type)

▪▪ **Treatment of SUPRACONDYLAR fractures:**

1- Initial approach→→ in the ER →→ABCDE

"Close fracture"→→apply splint with flexion of 20-30◦ →→ X-rays →→Dx →→ Tx according to the type.(Apply back-slab if there is swelling, if not →→ complete cast)

"Open fracture"→→

control hemorrhage and correct coagulopathy

- e.g. direct pressure, tourniquets if in extremis
- fluid resuscitation, transfusion of packed cells and other blood products as required

give **analgesia and antibiotics early**

- e.g. morphine or fentanyl +/- ketamine for analgesia
- see Q10 for antibiotics

Assess the limb and **seek/treat complications**

- e.g. neurovascular compromise, compartment syndrome, crush injury and rhabomyolysis

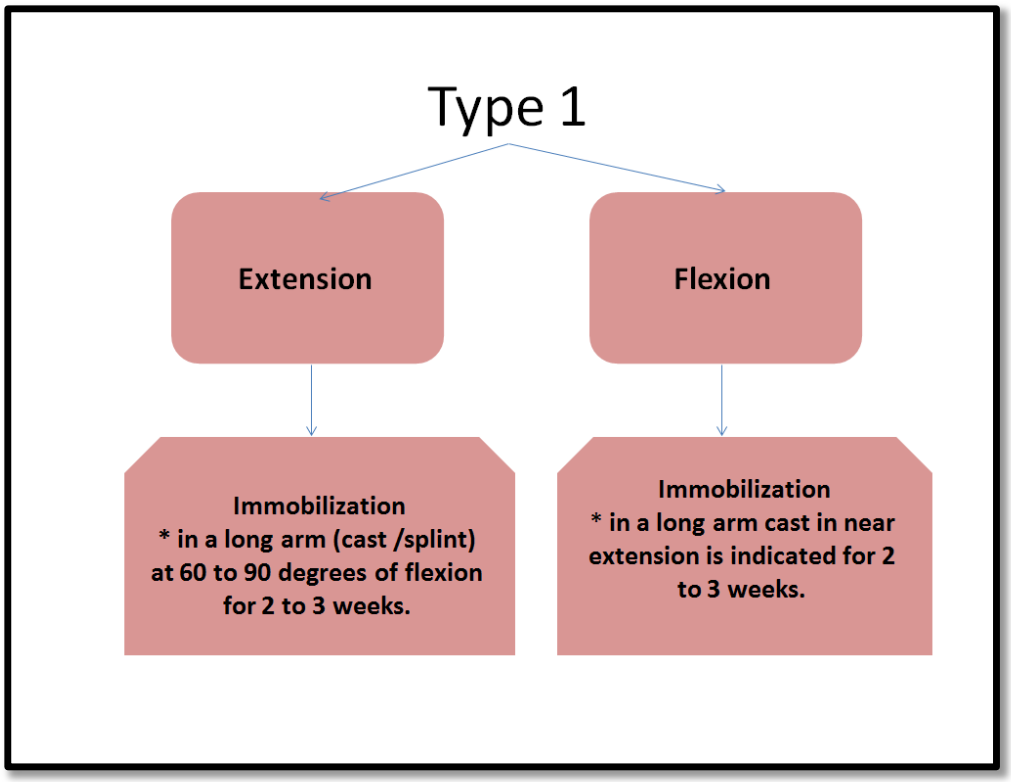
Following the provision of adequate analgesia:

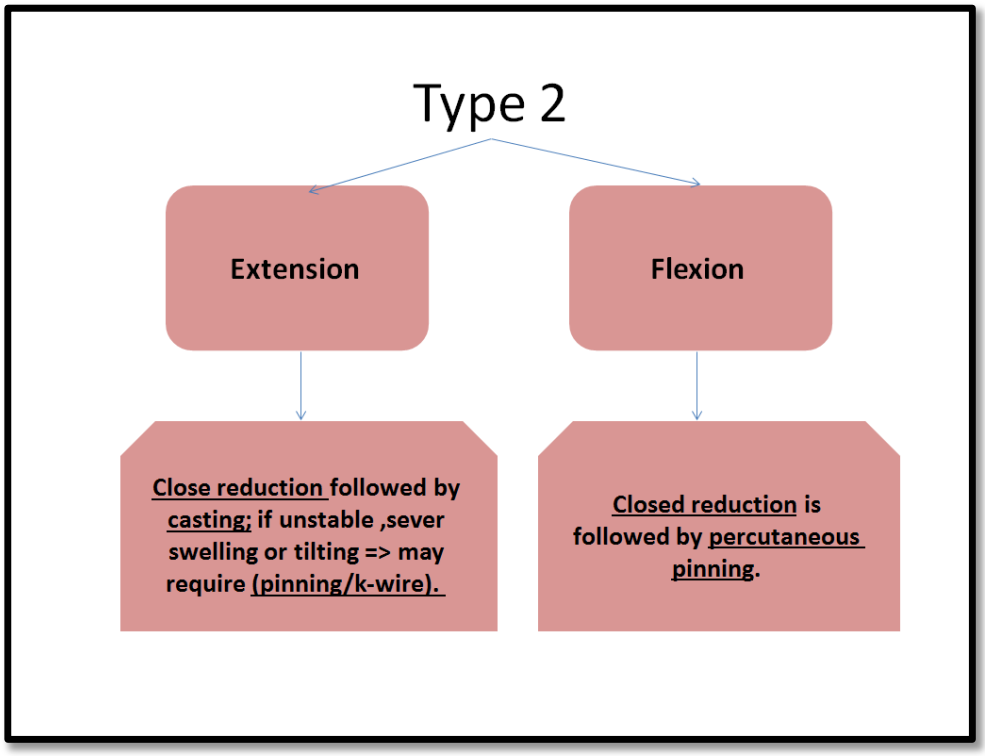
- **remove gross contaminants** from the wound
- if there will be more than a 1 to 2 hour delay in going to the operating theatre for washout and debridement then **clean** by profusely irrigating with saline and **cover** the wound with a sterile dressing (e.g. saline soaked pads).
- **reduce** gross deformities using gentle traction **and splint** the injured limb — this is a top priority if there is neurovascular compromise
- **immobilise** the limb with a POP back-slab **and elevate** the limb
- give t**etanus toxoid**/ tetanus immunoglobulin if indicated

Remember to look at the x-ray and consult orthopedics.

This protocol is applied for any open fracture (pediatric & adults)

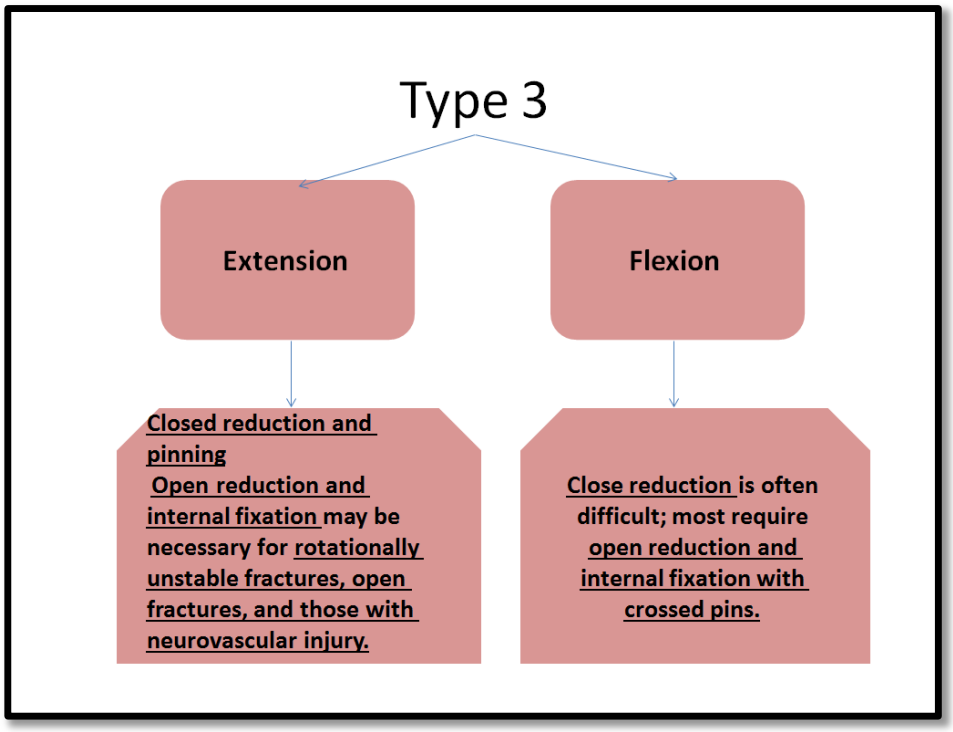
2- According to the type (definitive Tx)





Long arm cast (to mid---shaft od humerus)should be applied after all types of treatment.

If there is swelling, do back---slab.



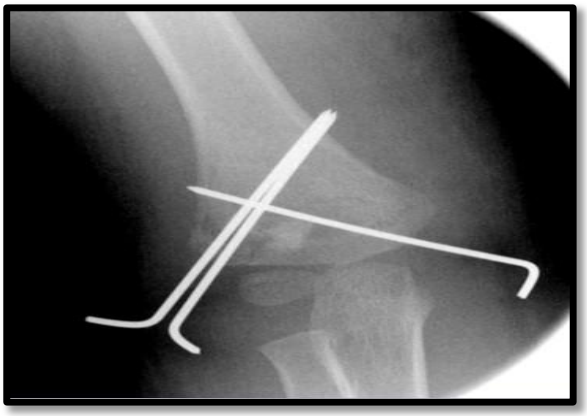
X-rays of extension type:

Intra Op fluoroscope

AP view

Lateral view

AP & Lateral views Post close reduction + pinning (k---wire)



▪▪ **Complications of Supracondylar fracture:**

A. *Neurologic injury (7% to 10%)*
   - Most are neurapraxias requiring no treatment
   - **Median nerve/anterior interosseous nerve (most common), ulnar and radial nerves.**
   - **Extension type is the most common.**

B. *Vascular injury (0.5%)*
   - Direct injury to the brachial artery, or secondary to swelling.

C. *Loss of motion*.

D. *Myositis ossificans:* soft Bone Formation in the Muscle, during manipulation, which will cause decrease ROM.

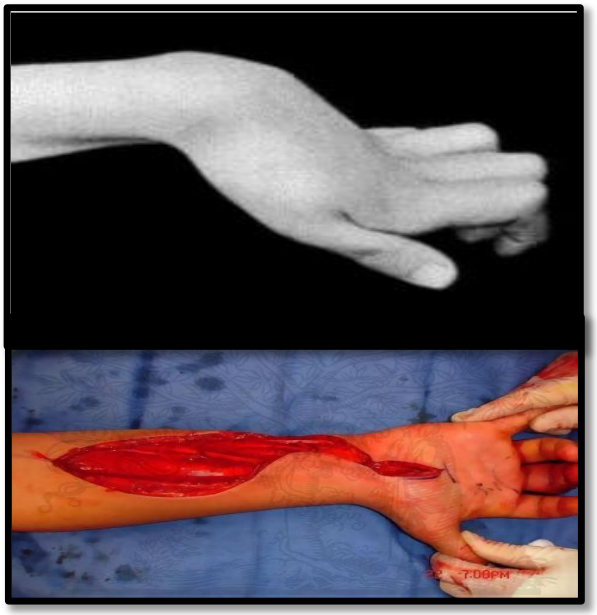
E. *Angular deformity* (Cubitus varus more frequently than Cubitus valgus) (10 to 20 %).(the most common complication in supracondylar fracture)

F. *Compartment syndrome* (<1%) Associated with Vascular Injury leads to Volkmann's Ischemic Contracture.
   - **Type of Fracture Depends on The Force and The Mechanism! Extension > Flexion.**

Cubitus varus deformity

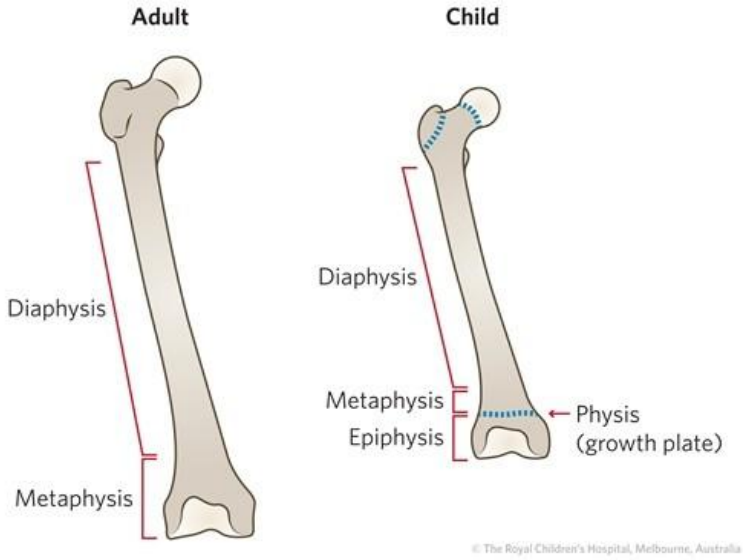
☒☒ **Compartment syndrome:**

Volkmann's ischemic contracture



C. DISTAL RADIUS FRACTURES

It is important to know the site of fracture, is itin thephysis (growth plate) or metaphysis. It differs in prognosis and management.



1. *Physeal Injuries.*

- Salter-Harris Types I and II

Salter-Harris (SH) Physeal Injury Classification	
Type	**Characteristics**
I	Separation through the physis, usually through areas of hypertrophic and degenerating cartilage cell columns.
II	Fracture through a portion of the physis that extends through the metaphyses.
III	Fracture through a portion of the physis that extends through the epiphysis and into the joint.
IV	Fracture across the metaphysis, physis and epiphysis.
V	Crush injury to the physis.

SH Classification from I - V

Type 1 (S= separated)

Type 2 (A=above)

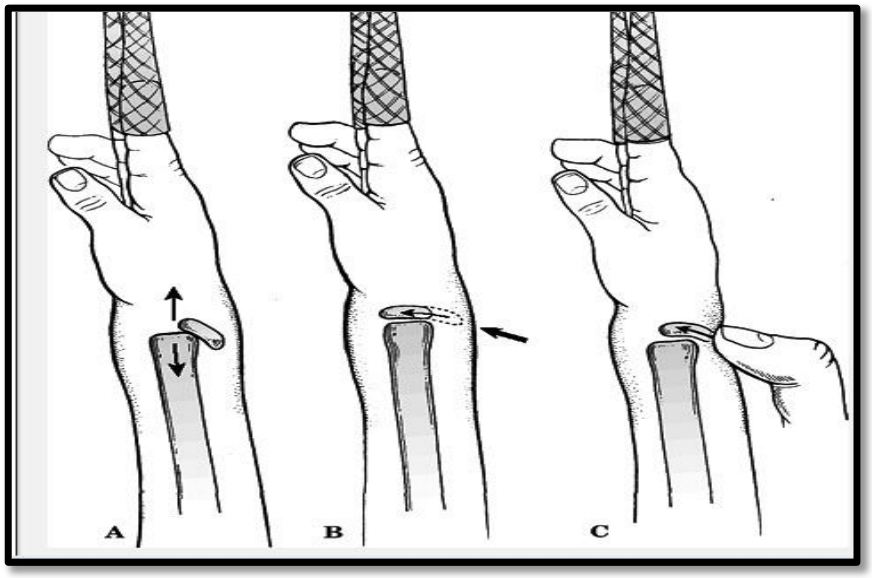
Type 3 (L=lower)

- **Treatment of PHYSEAL DISTAL RADIUS fractures:**

Salter harris Types I and II:

- Closed reduction is followed by application of a long arm cast or sugar tong splint with the forearm pronated.
- 50% apposition with no angular or rotational deformity is acceptable. Growth arrest can occur in 25% of patients if two or more manipulations are attempted.

- Open reduction is indicated if the fracture is irreducible or open fracture.



Pre---op Salter harris 2 **AP & lateral X---ray Post---op**

FIGURE 9-17 *A.* Clinical photograph of patient with a displaced Salter-Harris type II fracture of the distal radius. The patient has marked swelling volarly with hematoma and fracture displacement. The patient had a median neuropathy upon presentation. *B.* Lateral x-ray of the displaced fracture. *C.* Lateral x-ray in postoperative splint after percutaneous pinning to lessen the risk of neurovascular compromise in a cast.

Salter-Harris Type III:

- Anatomic reduction is necessary
- Open reduction and internal fixation with smooth pins or screws parallel to the physis is recommended if the fracture is inadequately reduced.

Salter-Harris Types IV and V:

- (Rare) need ORIF.

▪▪ **Complications of Physealinjuries:**

- Physeal arrest →→ lead to shortening, an angular deformity.
- Ulnar styloid nonunion.
- Carpal tunnel syndrome.

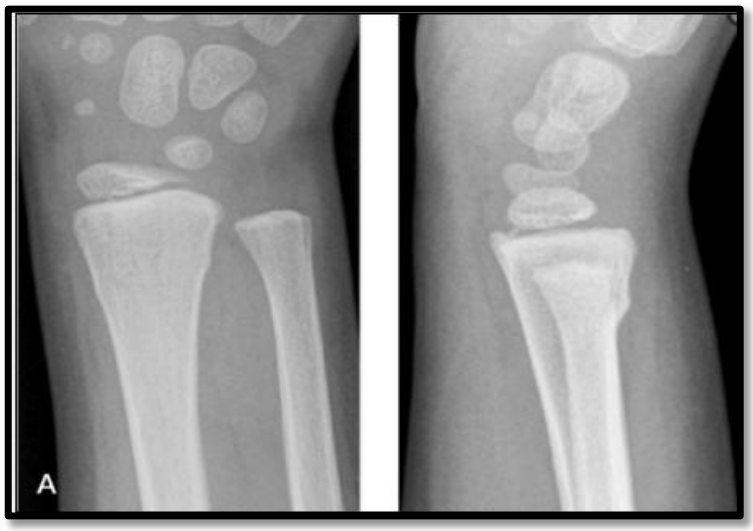
2. ***Metaphyseal Injuries:***

Classification :

- The direction of displacement.(Medial or lateral)
- Involvement of the ulna.
- Biomechanical pattern.

A. Torus (only one cortex is involved):

- The injury is stable.
- Protected immobilization for pain relief.
- Bicortical injuries should be treated in a long arm cast. (To prevent supination and pronation movements)



B. Incomplete (greenstick):

- These have a greater ability to remodel in the sagittal plane than in the frontal plane
- Closed reduction and above elbow cast with supination foream to relax the brachioradialis muscle.

Table 45.1. Acceptable angular corrections in degrees

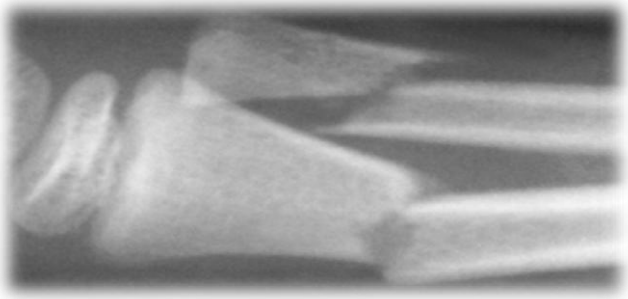
	Sagittal Plane		
Age (yr)	Boys	Girls	Frontal Plane
4â€"9	20	15	15
9â€"11	15	10	5
11â€"13	10	10	0
>13	5	0	0

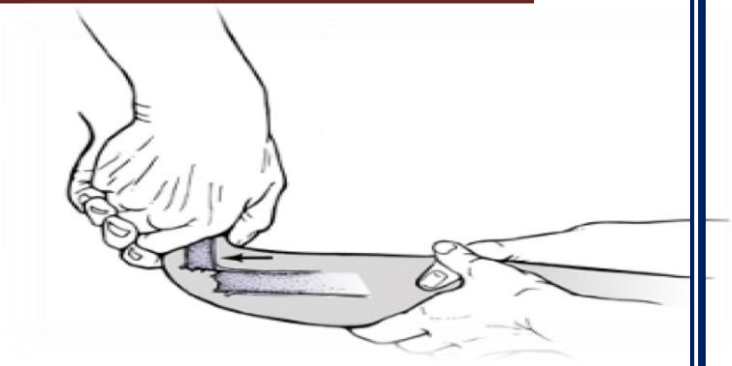
Acceptable residual angulation is that which will result in total radiographic

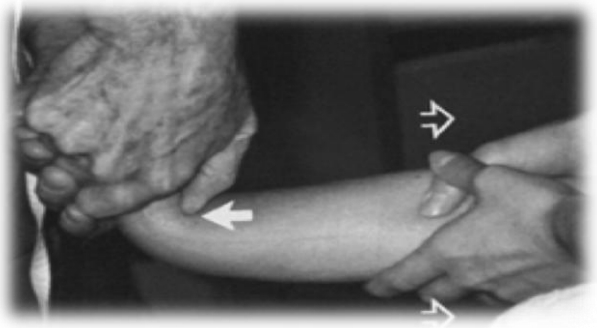
The younger the patient the more amount of angulation you can accept!
The Younger the Patient The more Remodeling.

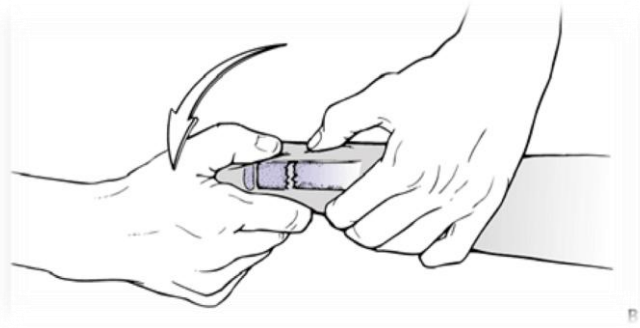
C. Complete :

- Closed reduction (by increase the deformity first, then after Reduction use the cast).
- A well molded long arm cast for 3 to 4 weeks.



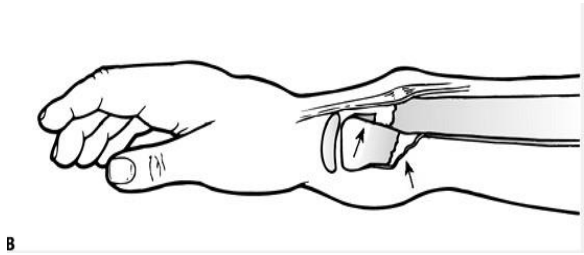


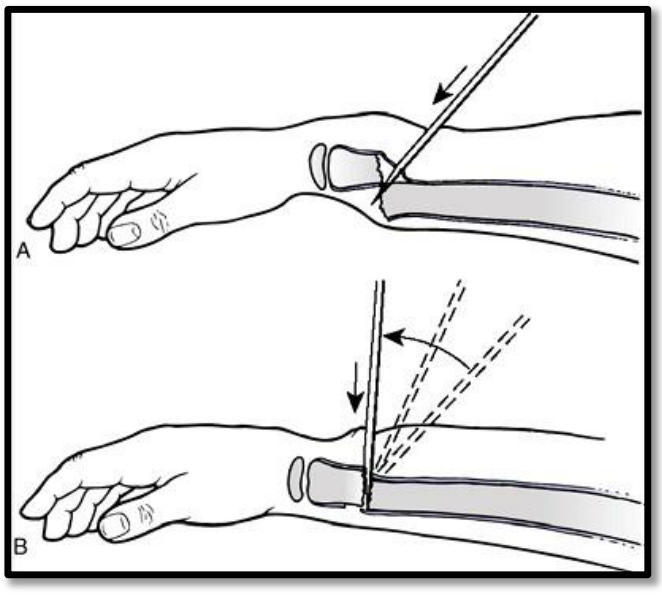




❖❖ **Indications for percutaneous pinning without open reduction**

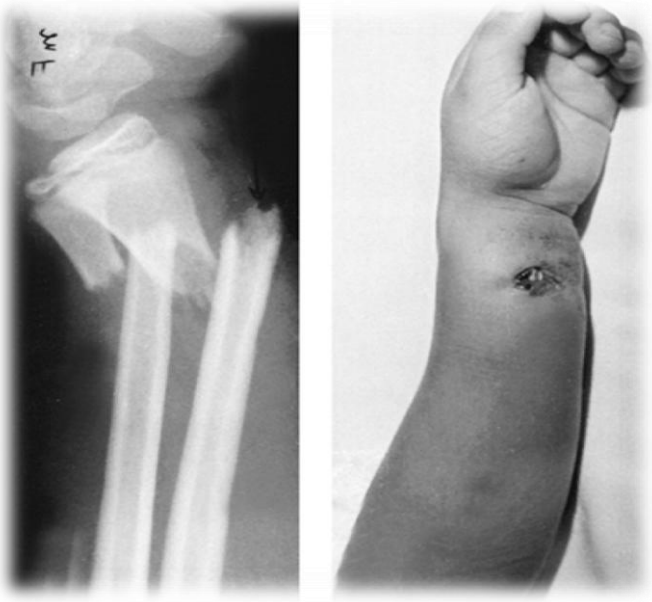
- Loss of reduction, excessive local swelling, floating elbow and multiple manipulations.





❖❖ **Indication for ORIF**

- Irreducible, open fracture and fracture with compartment syndrome.



▪▪ **Complications :**

- **Malunion →→ Residual malangulation of more than 20% may result in loss of forearm rotation.**
- **Nonunion – rare**
- **Refracture →→ An early return to activity (before 6 weeks).**
- **Growth disturbance →→ (overgrowth or undergrowth) 3mm/9-12Y**
- **Neurovascular injuries →→ avoid extreme positions of immobilization.**

D. FEMORAL SHAFT FRACTURES

- 1.6% of all pediatric fractures.
- Boys > girls
- Bimodal distribution of incidence 2 to 4 years of age, mid-adolescence.
- In children younger than walking age, 80% of these injuries are caused by child abuse; this decreases to 30% in toddlers.
- **In adolescence, >90% due to RTA (most common)**

▪ **Mechanism of injury:**
- **Direct trauma:** Motor vehicle accident, pedestrian injury, fall, and child abuse
- **Indirect trauma**: Rotational injury
- **Pathologic fractures**: osteogenesis imperfecta, nonossifying fibroma, bone cysts, and tumors.

▪ How to know if it's direct or indirect injury from the x-ray?
Transverse and comminuted fractures are direct
The spiral is indirect

▪ **Clinical evaluation:**
- A history of high-energy injury should undergo full trauma evaluation as indicated.
- An inability to ambulate, with extreme pain, variable swelling, and variable gross deformity.
- A careful neurovascular examination is essential.
- A careful examination of the overlying soft tissues to rule out the possibility of an open fracture.

▪ **Radiographic evaluation:**
- Anteroposterior and lateral views
- X-ray most includes hip, knee joints.

A mass is showing in the x---ray →→ consider OPEN fracture.

- **Classification**

a) **Descriptive:**

- Open versus closed
- Level of fracture: proximal, middle, distal third
- Fracture pattern: transverse, spiral, oblique, butterfly fragment
- Comminution
- Displacement
- Angulation

b) **Anatomical:**

- Subtrochanteric.
- Shaft.
- Supracondylar.

- **Treatment:**

❖❖ **Age <6 Months**

- Pavlic harness or a posterior splint.
- Traction and spica casting.

❖❖ **Ages 6 Months to 6 Years**

- Immediate spica casting is the treatment of choice **(>95%).**
- Skeletal traction followed by spica casting if there is difficulty to maintain length and acceptable alignment.

❖❖ **Ages 6 to 12 Years**

a) Flexible intramedullary nails

It is contraindicated to put nails in children less than 16 years old, use elastic

b) Bridge plating

c) External fixation: When?

✓✓ multiple injuries

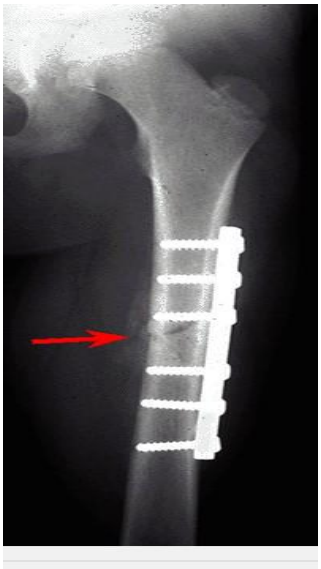
✓✓ open fracture

✓✓ comminuted

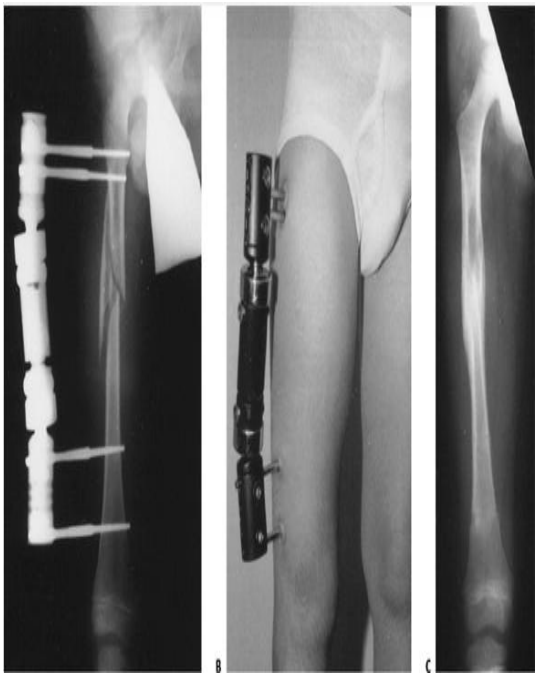
✓✓ Unstable patient

A

B

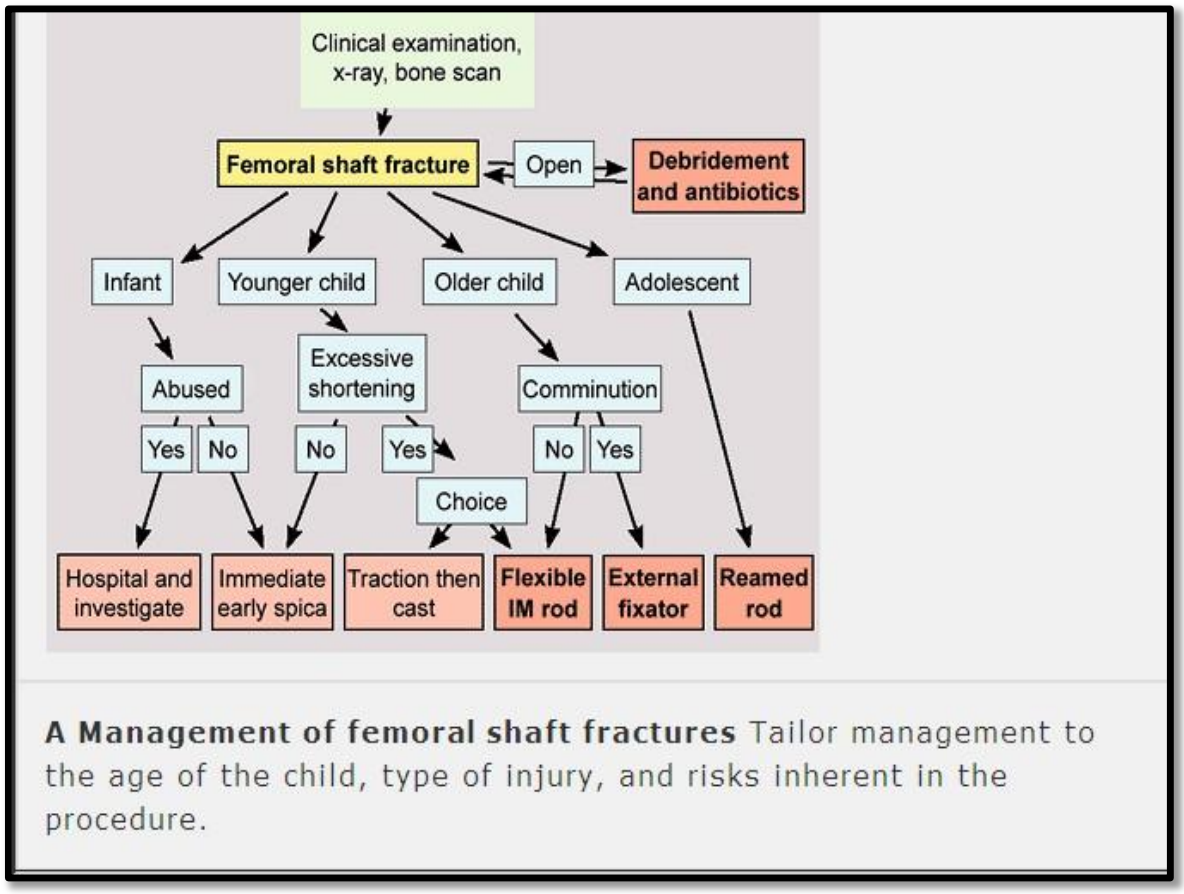


C



❖❖ **Ages 12 to Maturity**

- Intramedullary fixation with either flexible or interlocked nails(age>16y) is the treatment of choice.



A Management of femoral shaft fractures Tailor management to the age of the child, type of injury, and risks inherent in the procedure.

- **Operative Indications**
  - Multiple traumas, including head trauma.
  - Open fracture.
  - Vascular injury.
  - Pathologic fracture.
  - Uncooperative patient.

(Body habitus "OBESE **PATIENT**" not amenable to spica casting)

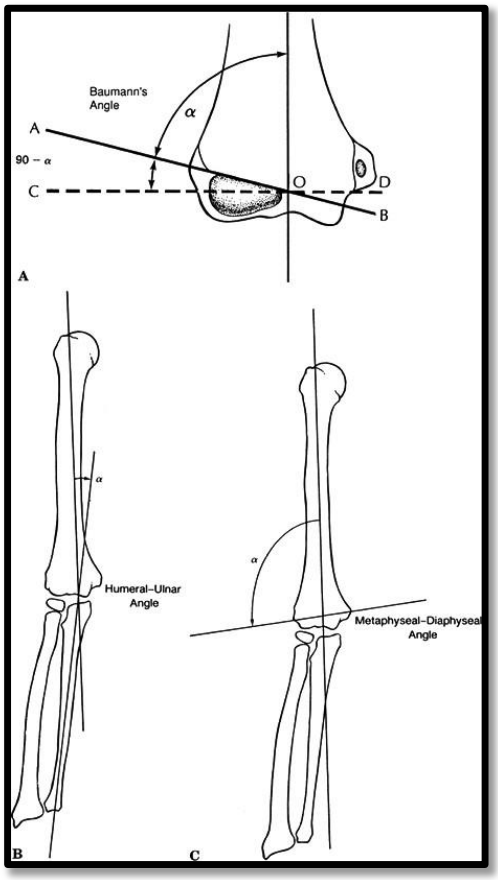
Table 48.1. Acceptable angulation

Age	Varus/Valgus (degrees)	Anterior/Posterior (degrees)	Shortening (mm)
Birth to 2 y	30	30	15
2â€"5 y	15	20	20
6â€"10 y	10	15	15
11 y to maturity	5	10	10

- **Complications:**

1. Malunion: Remodeling will not correct rotational deformities **(The Important Thing is to restore the ALIGNMENT)**
2. Nonunion –rare.
3. Muscle weakness.
4. Leg length discrepancy: Secondary to shortening or overgrowth, Overgrowth of 1.5 to 2.0 cm is common in the 2- to 10-year age.
5. Osteonecrosis with antegrade IM nail<16year. (So try to avoid Intramedullary Nail <16).

Some extra information regarding X-ray reading.



- ***Anteroposterior (AP) and lateral views:***

The following angular relationships may be determined:
a. **Baumann angle:** 15 to 20 degrees

b. **Humeral-ulnar angle:** reflects the true carrying angle (M=7.f=15)

c. **Metaphyseal-diaphyseal angle:** reverse of Baumann Angle!

- **True lateral radiograph of the elbow flexed to 90 degrees: (If any of them disrupted - Fracture!)**

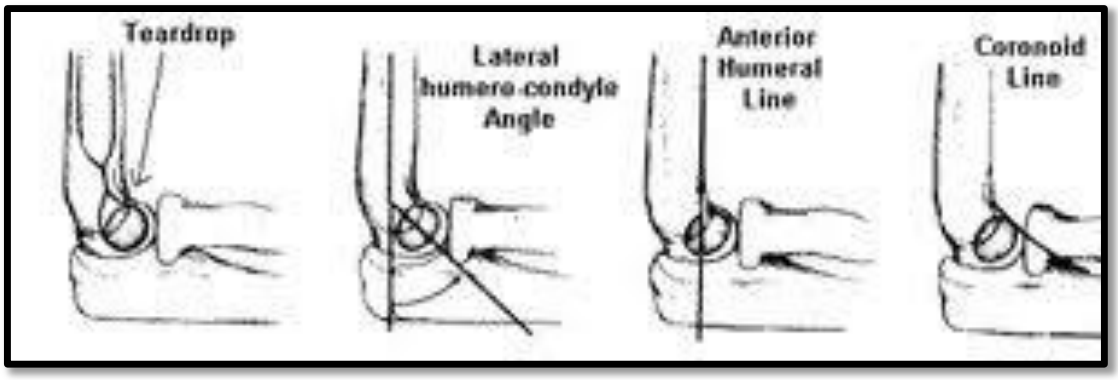
•Teardrop.

•Diaphyseal-condylar angle: (30 to 45 degrees anteriorly)

•Anterior humeral line.

•Coronoid line.

The contralateral elbow should be obtained for comparison as well as identification of ossification centers



- **Lateral X-ray:**

- Fat pad signs, black Presentation in front -- usually Fracture in X-ray!
- Anterior (coronoid) fat pad---joint effusion
- Posterior (The deep olecranon fossa) the deep olecranon fossa normally completely contains the posterior fat pad. large effusions cause posterior displacement fracture, it is present >70% .

The End ☺☺

Common Pediatric Hip Problem

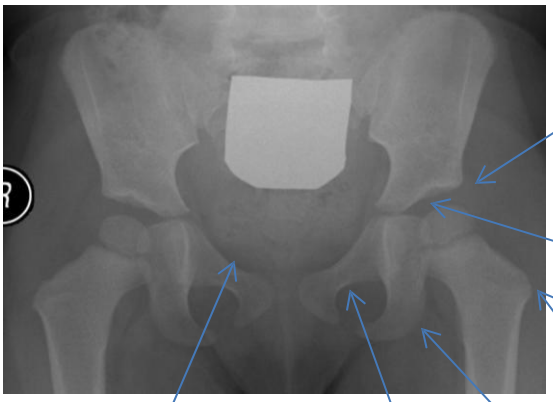
◈ Nomenclature:

- ***DDH*** : Developmental dislocation of the hip
- ***CDH*** : Congenital Dislocation of the Hip
- ***DDH*** : Developmental Dysplasia of the Hip
- ***SCFE*** : Slipped capital femoral epiphysis
- ***Perthes***

◈ Normal pelvis

ADULT

Lesser Trochanter



CHILD

✓ **Notes**:

- ***Triradiate cartilage*** (growth plate) connects three bones: acetabulum + ischium + pubic bone
- ***Head of femur***: in children it's not called head of femur (because not fully developed) only in adult
- ***2arterial***suply of the femur anterior and posterior circumflex artery that supply the head of femur
- ***Ligamentumteres*** is attached to the inside of the head of the femur, the ligament also contains artery. So arteries inside and outside the bone

"DDH"

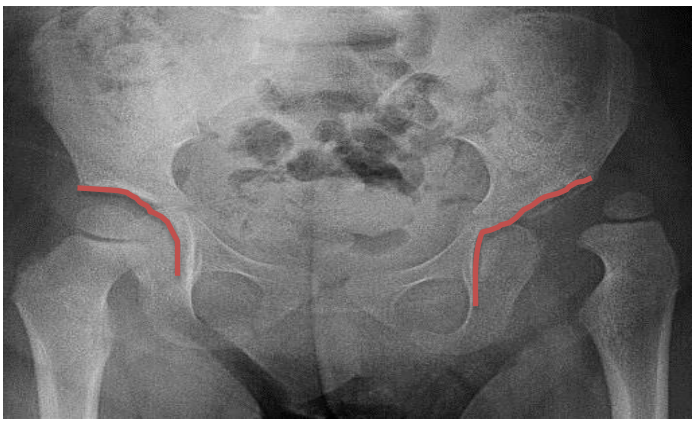
Normal Hip Dislocated Hip

✓ **Notes**:

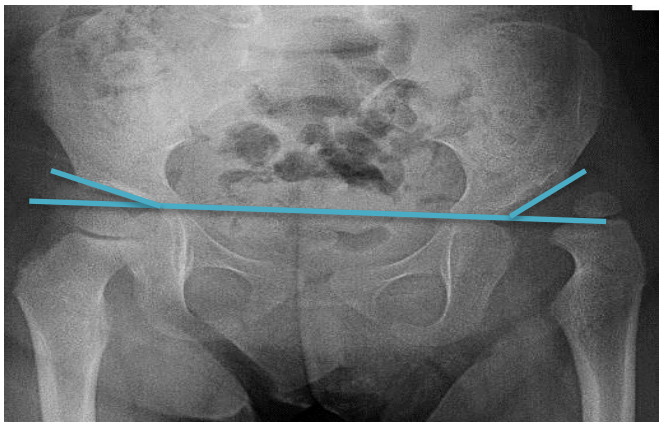
- The head of femur is not articulating/attached to the acetabulum. Notice the under developed epiphysis
- The acetabulum is shallow (dysplastic acetabulum) not curved (cannot hold the head)
- DDH is not due to injury during delivery (not congenital)

Patterns of disease

- Dislocated
- Dislocatable→ high risk of dislocation
- Sublaxated
- Acetabular dysplasia



Shallow acetabulum. Notice the curvature



Larger angle in the dislocated hip
A dislocated hip is reduced (not healed) by abduction not adduction (increases the risk of dislocation)

Causes (multi factorial)

- Hormonal
  - Relaxin, oxytocin
- Familial
  - Lig.laxity diseases
- Genetics
  - Female 4 X male --- twins 40%
- Mechanical
  - Pre natal
  - Post natal

Still Unknown the cause

Mechanical causes

- Pre natal
  - Breach , oligohydrominus , primigravida , twins
    - (torticollis , metatarsus adductus)
- Post natal
  - Swaddling , strapping

✓ **Notes**:

- ***Breach***: The fetus head should be caudal in position and the legs should be cephalic in position. Any other position is called breach (renders the place tight)
- ***Oligohydramnios***: little amniotic fluid
- ***Primagravida***: first pregnancy (inflexible uterus)
- All of the abovementioned factors decreases the space for the fetus in the uterus → increased risk for DDH
- ***Torticollis***: a twisted neck in which the head is tipped to one side
- ***Metatarsus adductus***: foot deformity
- ***Swadding and straping***: induces adduction of the hip (risk of dislocation, previously discussed)

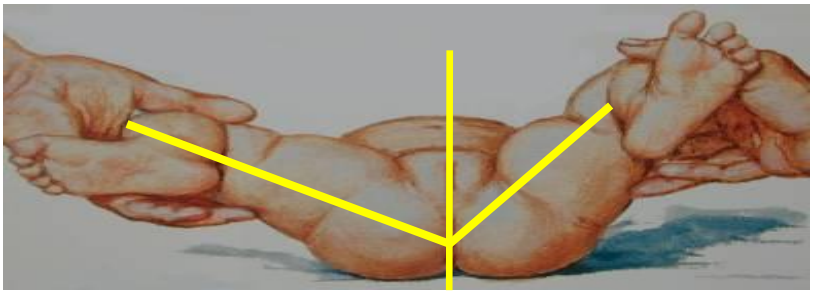
Infants at risk:

- Positive family history: 10X
- A baby girl: 4-6 X
- Breach presentation: 5-10 X
- Torticollis: CDH in 10-20% of cases
- Foot deformities:
  - Calcaneo-valgus and metatarsus adductus
- Knee deformities:
  - hyperextension and dislocation
- When risk factors are present, the infant should be reviewed
  - Clinically
  - radiologically
- During history taking, ask about all of the risk factors

Clinical examination

- The infant should be
  - quiet
  - comfortable
- Look:
  - External rotation
  - Lateralized contour
  - Shortening ***of the affected limb***
  - Asymmetrical skin folds
    - Anterior – posterior

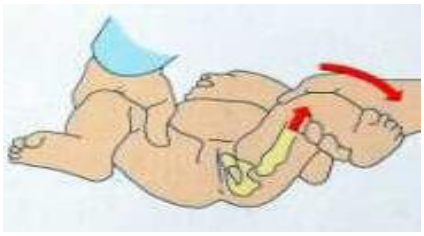
- Move
  - Limited abduction



- Special test
  - Galiazzi
  - Ortolani , Barlow test
  - Trendelenburgh sign
  - Limping (waddling gait if bilateral)
    - Only ortolani and Barlow tests are important

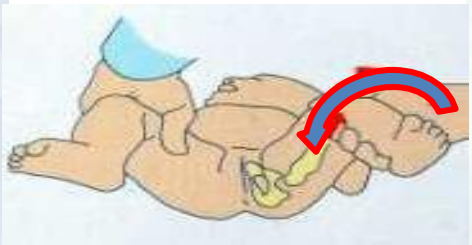
Galiazzi test

Ortolani test

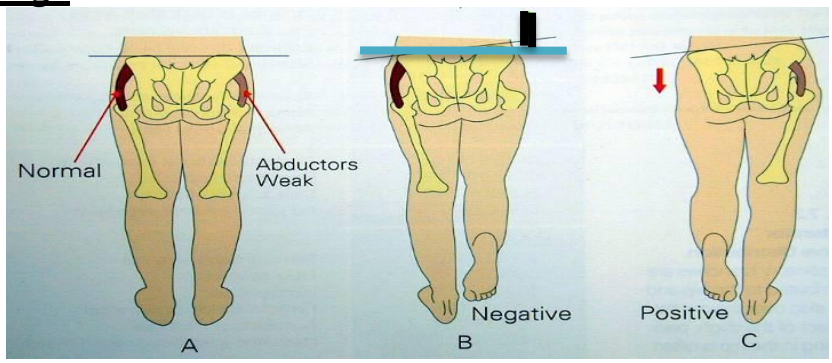

- Pull and **abduct**
- A clunk will be felt after reduction. The hip will soon be dislocated again (not a treatment, just to test for DDH)
- Cannot be done on dislocatable DDH → Do barlow test

Barlow test

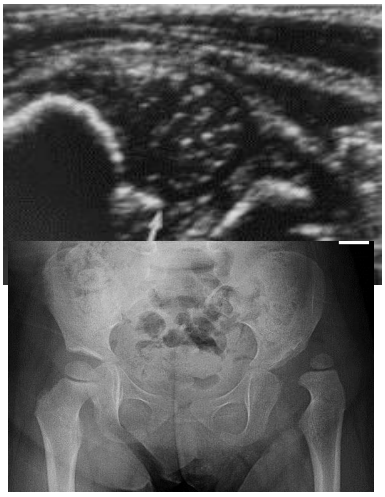




- Pull and **adduct**

Trendelenburgh sign



Investigations

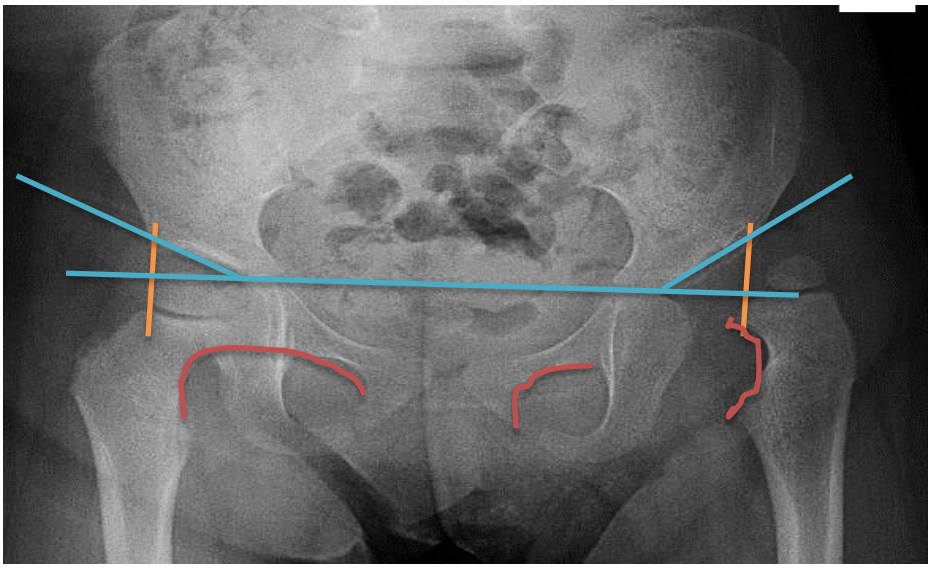


- -3 months U/S: most of the head and neck are cartilage (not clear on x-ray)

- > 3months X-ray pelvis AP + abduction

Radiology

- After 6 months: reliable



✓ **Notes**

- ***Red*: *Shenton line*** (disrupted in DDH)
- ***Blue: Hilgenreiner's line*** (through the triradiate cartilage). Notice the angle marking the acetabulum
- ***Orange***: ***Perkin's line***: it drowns vertically and perpendicular to ***Hilgeneiner's line*** starts at the lateral acetabulum
- ***Hilgenriner's line*** + ***Perkin's line*** form four quadrants. In the normal limb, the head of the femur is found in the bottom inner quadrant, unlike the affected limb, where the head is in the top outer quadrant.

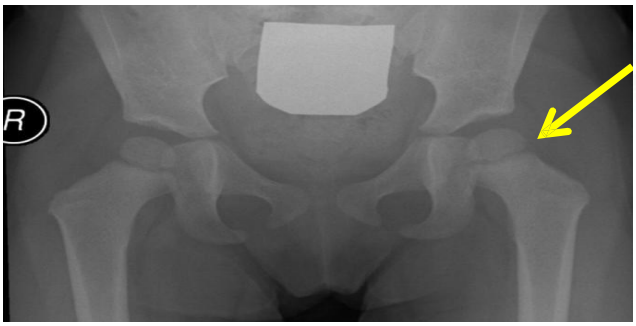
- Five signs of DDH on x-ray: **MCQ**
  1. Disrupted ***shenton'sline***
  2. Wide acetabulum angle on ***Hilgenriner's line***
  3. Head of femur located on the top outer quadrant when ***Perkin's line*** is drawn
  4. Shallow acetabulum
  5. Ossification center/head of femur is smaller than the one in the other limb

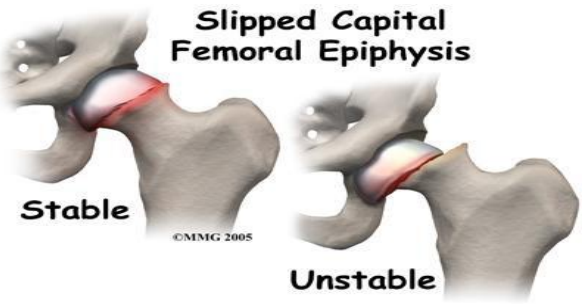
Treatment - Aims

- Obtain concentric reduction
- Maintain concentric reduction
- In a non-traumatic fashion
- Without disrupting the blood supply to femoral head
- Method depends on age
- The earlier started, the easier it is
- The earlier started, the better the results are
- Should be detected EARLY
- Either surgical or non-surgical
- **Way:** Refer to pediatric orthopedic clinic

After treatment

"SCFE"





- ***Slipped Capital Femoral Epiphysis***. In reality, it's not the capital of the femur that is slipped; it's the neck and shaft that are slipped.

- Where → at level of growth plate
- Why → ? Hormonal
  ? Metabolic (as in osteoporosis, Hyper Parathyroidism etc.)
  ? Mechanical, obesity
  ? Trauma
  ? Unknown
- ***Typical :***
  - 8-12
  - ↑ in males
  - ↑ in obese
  - ↑ in black
  - ↑ if other side affected
- ***History:***
  - Hip pain/knee pain *(radiating)*
  - Minor trauma
  - no trauma
  - Limping (painful)

- ***On Examination:***
  - Hip in ER (external rotation)
  - ↓ IR (internal rotation)
  - ↓ Abduction
  - Usually painful ROM (Range of motion)
  - Limping (painful)

- ***Investigation:***
  - X-ray
    - Pelvis – slippage positive or

↑↑ Growth plate space

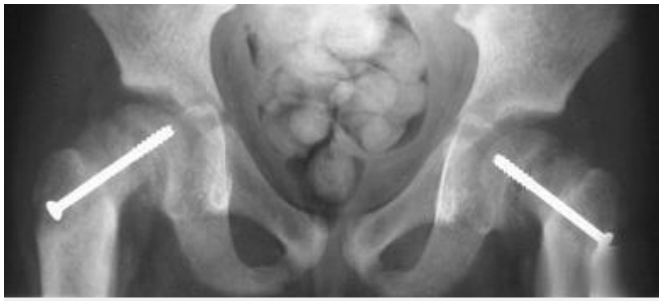
[Pre slip phase]

- Knee
  - If not clear but still doubtful MRI can help

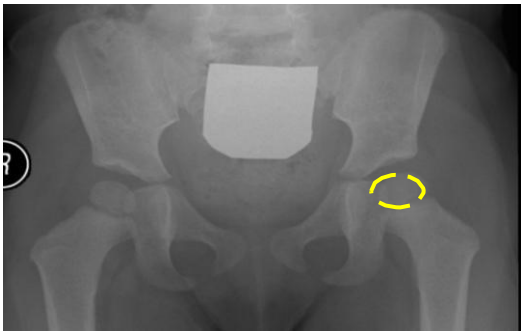

- ***Treatment:***
  - Refer to orthopedic as emergency case

What they will do?

- In situ pinning – to prevent further damage to the vascularity
- Protected weight bearing for 3-4 weeks then full weight bearing
- No sport for 6 months



"Perthe's Disease"



- ***Where***: at the level of head of femur
- ***Why***: ↓ vascularity of head of femur (avascular necrosis)
- ***Cause*→unknown**
- ***Typical*** :
  - 4-8 years (Younger age than SCFE)
  - ↑ in males
  - ↑ in obese

Severity of the disease depends on: the amount of femoral head involvement

History:

- Hip pain or knee pain
- Minor trauma or no trauma
- Painful limping

On Examination:

- ↓ Abduction
- ↓ IR (internal rotation)
- Usually painful range of motion ↓↓↓
- Limping (painful)

Investigation:

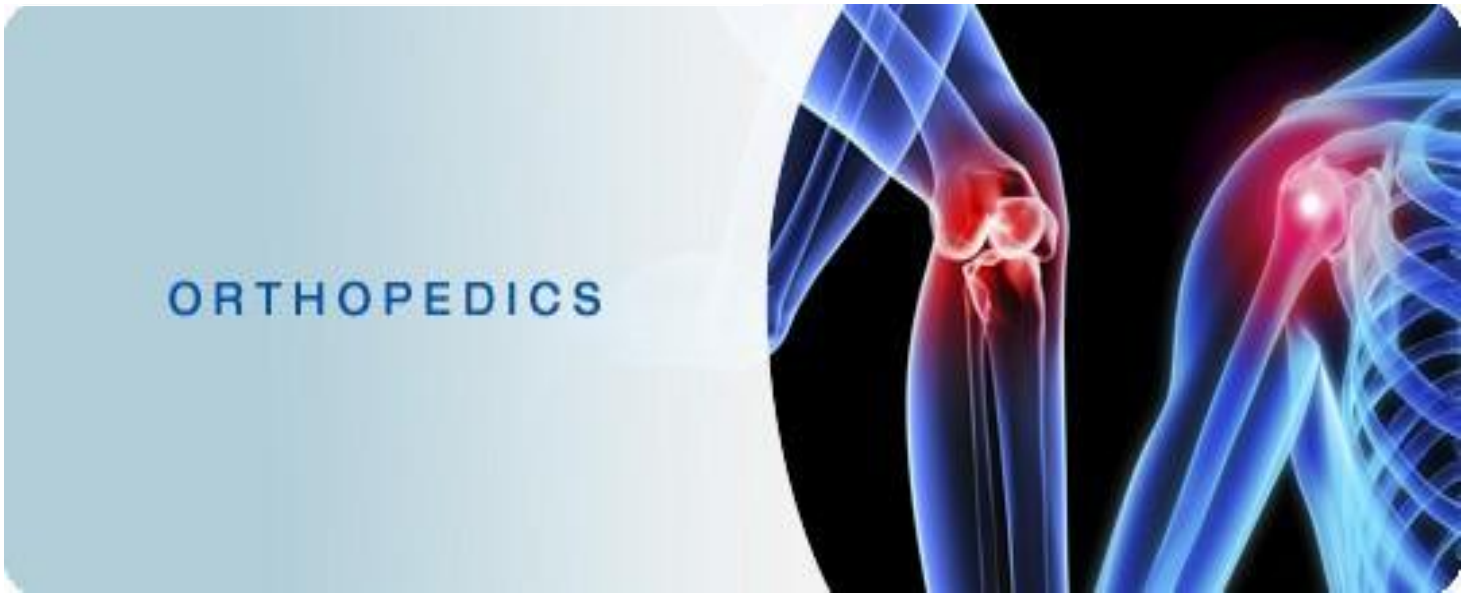
- X-ray: - knee
  - Pelvis →↓ head size (irregular shape)
- If early, MRI can help

Treatment:

- Very controversy
- Refer to pediatric orthopedics as an urgent case
- Guidelines of treatment:
  - Control pain
  - Maintain ROM
  - Hip containment

Treated DDH

430 ORTHOPEDICS



Lecture: Common Pediatrics Lower Limb Deformities.

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Team Leader:

Ayedah Al-Ruhaimi.

Black: Slides (by Dr. Zamzam)
Green: My notes (recording)
Red: Important
Blue: Extra notes (429 – webmd)
MC/MCC: Most common cause
ST: Soft tissue - IR: Internal Rotation – ER: External Rot.

1 COMMON PRESENTATIONS

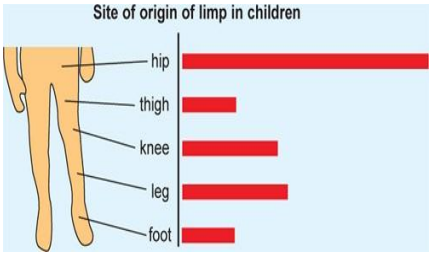
1.1 LEG ACHES

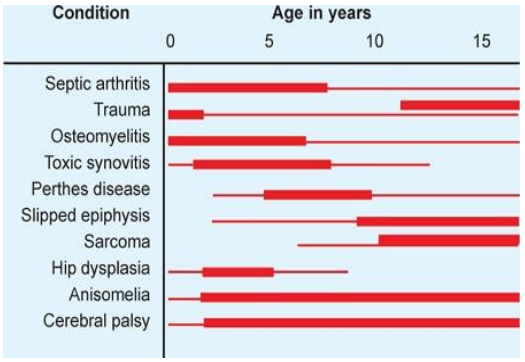
- History
  - It's a growing pain
  - With no functional disability
  - Benign
  - It resolves spontaneously
  - Unknown cause
- Screening Examination
- Tenderness Joint Motion
- Diagnosis by exclusion
- Differential Diagnosis from serious problems mainly tumor
  - Osteoid osteoma
  - Osteosarcoma
  - Ewing sarcoma
- Management
  - Symptomatic
  - Reassurance

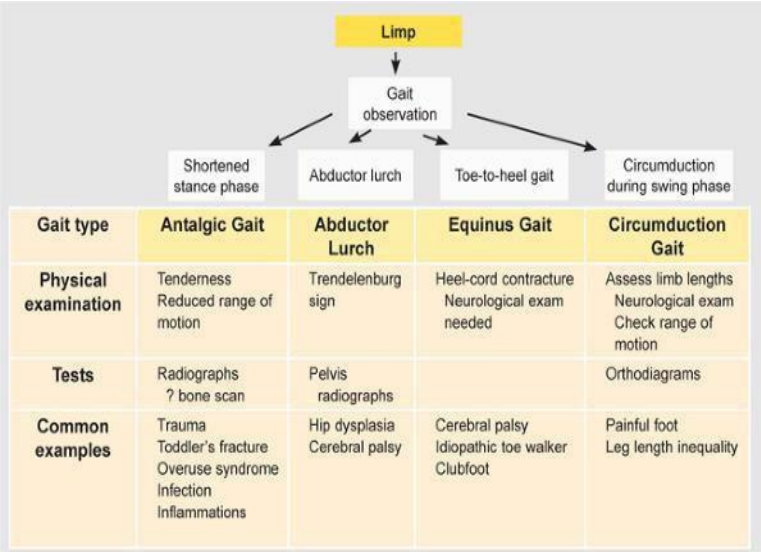
Feature	Growing Pain	Serious Problem
History		
Long duration	Often	Usually not
Pain localized	No	Often
Pain bilateral	Often	Unusual
Alters activity	No	Often
Causes limp	No	Sometimes
General health	Good	May be ill
Physical Examination		
Tenderness	No	May show
Guarding	No	May show
Reduced range of motion	No	May show
Laboratory		
CBC	Normal	± Abnormal
ESR	Normal	± Abnormal
CRP	Normal	± Abnormal

1.2 LIMPING

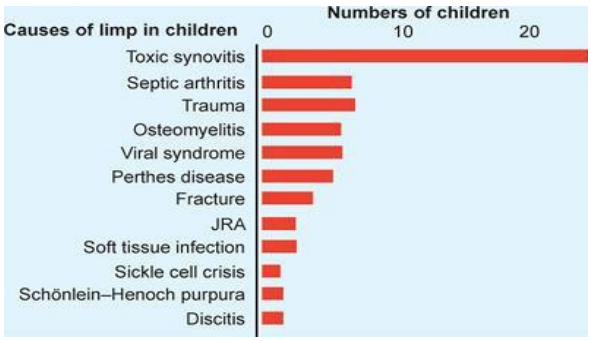
- Abnormal gait due to pain, weakness or deformity
- Evaluation
  - History (Mainly age of onset)
  - Observation
- Evaluate the limp by studying the child's gaitwhile the child walks in the clinic hallway
- Types of Limp
  - Painful gait: Antalgic gait
  - Waddling gait = abductors weak in both legs
  - Toe to heel gait (plantar flexion) = Equinus gait
- Management
  - Generalization regarding management cannot be made
  - Treatment of the cause







Gait type	Antalgic Gait	Abductor Lurch	Equinus Gait	Circumduction Gait
Physical examination	Tenderness Reduced range of motion	Trendelenburg sign	Heel-cord contracture Neurological exam needed	Assess limb lengths Neurological exam Check range of motion
Tests	Radiographs ? bone scan	Pelvis radiographs		Orthodiagrams
Common examples	Trauma Toddler's fracture Overuse syndrome Infection Inflammations	Hip dysplasia Cerebral palsy	Cerebral palsy Idiopathic toe walker Clubfoot	Painful foot Leg length inequality

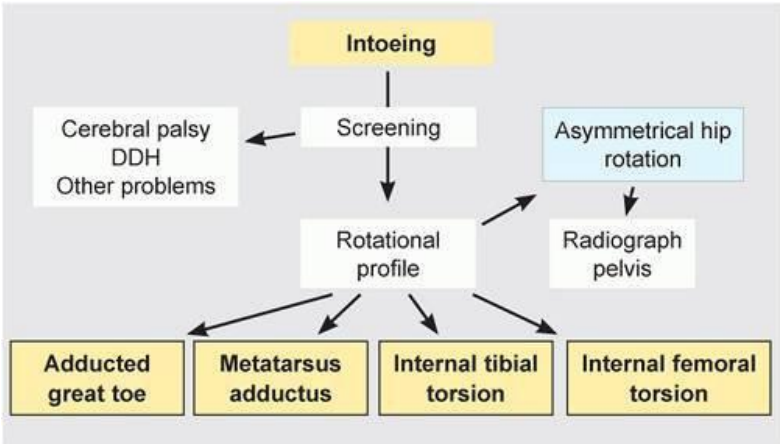


2 TORSIONAL DEFORMITIES

- Version
  - Describes normal variations of limb rotation – it may be exaggerated
- Torsion
  - Describes abnormal limb rotation
  - Internal or external
  - It may be complex, if there is compensatory torsion
- Normally: ext. rotation >50°, int. rotation >45°
- Differentiate between hip, tibia, foot causes
- Determine cause acc. to site

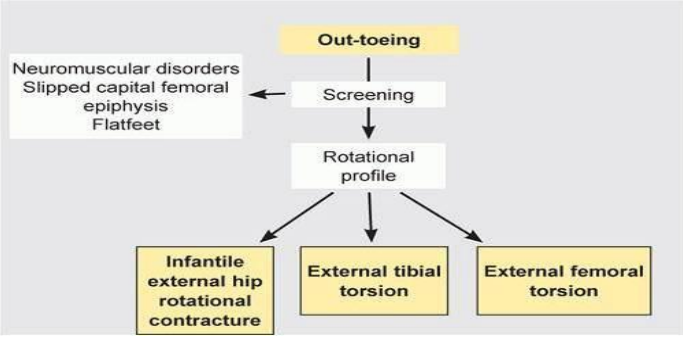
2.1IN-TOEING

- Walking with toe inwards
- MCC of in-toeing is cerebral palsy and DDH
- Increased internal rotation: -W position, cannot sit cross-legged (ext. rot.) >To assess angle (int. or ext.), look at hip



2.2 OUT-TOEING

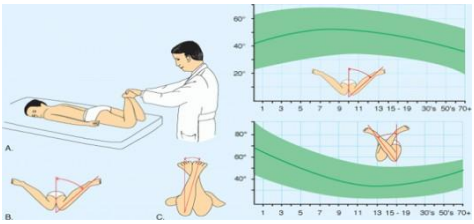
- Walking with toe everted
- MCC of out-toeing is SCFE and Neuromuscular disorders
- Rt. Foot is directed towards Lt. sacroiliac joint > means tibia is externally rotated (same goes to opp. Side)
- Increased External Rotation



2.3 SPECIAL TESTS

- Just understand the concept (Dr didn't emphasize much on them)

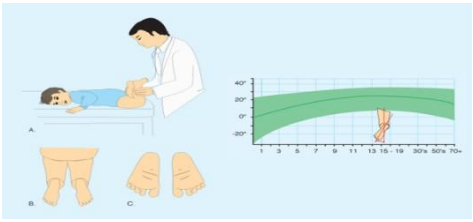
Assessing hip rotation



- ER in children is normally >50°, whereas IR is 45°
- In intoed child > IR could reach up to 90°

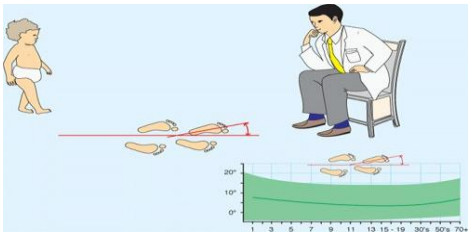
Assessing rotational status

- Flexion of the knee while the pt is prone
- Then determine bimanual angle of axis or simply look to which side is the foot directed to
- Rt. foot should face the Lt. sacroiliac joint; same goes to the Lt. foot



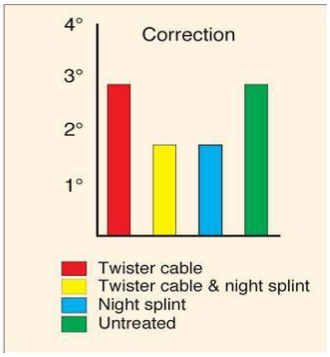
- If its facing anything else, you can determine if its Int. Tibital Torsion (ITT) or Ext. Tibial Torsion (ETT)
- Ex: If its facing the same SIJ > its ITT
- If the foot is going inwards that means the tibia is going outwards
- Forefoot adduction > determined by looking
- It's important to know the site of the problem in order to know the cause

Foot propagation angle

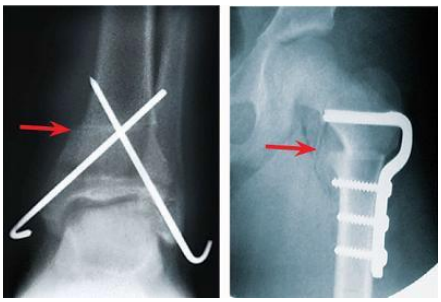


- Footprints while walking straight > check foot's direction
- Normally foot is 15°everted
- If direct > there's IR
- If more everted> ER

2.4 MANAGEMENT



- Determine site to determine the cause
- Define severity to determine Rx accordingly
- Allow for spontaneous correction (observational management) until 8 years of age
- Controlling a child's walking, sitting or sleeping is extremely difficult and frustrating
- Shoe wedges or inserts are ineffective
- Bracing with twister cables limits child's activities
- Night splints have no long term benefit
- If mild > wait for spont. correction
- If severe/past the age of spont. Corr. > surgical:
  - Rotate the bone after doing osteotomy and fix it in place with K-wires for 6-7 wks then remove them
- But if v. severe > can be done earlier than 8 years of age
- Operative correction
  - Indicated for children above the age of 8 years with significant cosmetic and functional deformity
  - Foot: correction of muscle imbalance that has caused the inward or outward deviation of foot
  - Break the bone & rotate it the other direction
  - Ex: 40°intoeing (in hip or femur) > osteotomy of the bone under trochanteric area & then rotate the femur 40°& fixate it using k-wires for 6-7 weeks



3 LIMB LENGTH INEQUALITY

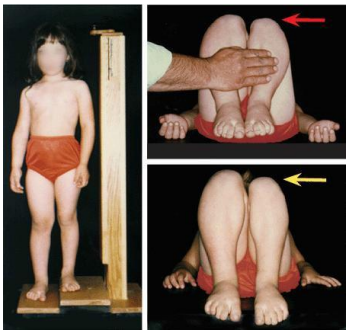
- True: Medial malleolus to superior anterior iliac spine
- Apparent: Medial malleolus to umbilicus
- Etiology
  - Congenital
    - Proximal focal femoral discrepancy
    - Congenital short femur
  - Developmental
    - DDH
    - SCFE
  - Traumatic
    - Trauma will cause overlap or fracture near epiphysis > initiation of bone growth > lengthening > discrepancy
  - Infection
    - By irritation/suppression of epiphysis or initiation to more bone growth

Category	Short	Long
Congenital	Aplasia Hypoplasia Hip dysplasia Clubfoot	Hyperplasia
Neurogenic	Paralysis Disuse	Sympathectomy
Vascular	Ischemia Perthes disease	AV fistular
Infection	Physeal injury	Stimulation
Tumors	Physeal involvement	Vascular lesions
Trauma	Physeal injury Malunion	Fracture stimulation Distraction

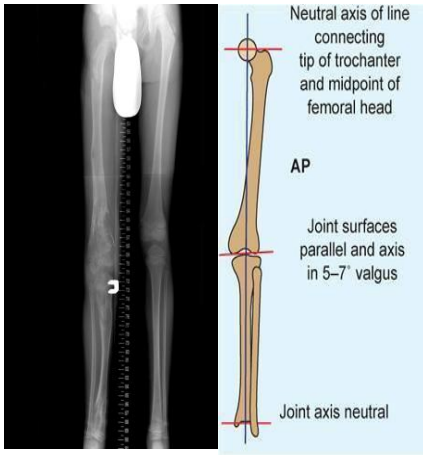
- Metabolic
- Tumor

- Adverse effects
  - Gait disturbance
  - Equinus deformity
    - Shortening in Rt. Side, child will involuntarily start to plantar flex the foot (walk on tiptoes) to compensate for the affected movement > with time, PF will become fixed > FPF = equinus deformity (needs surgical intervention)
  - Back pain
    - Due to stress of the inequality
  - Scoliosis
    - Longstanding inequality and stress on the spine will lead to fixation of the spine in that position > scoliosis

- Evaluation
  - Screening examination
  - Clinical measures of discrepancy
    - Pelvis is tilted towards the shortened limb
      - That may be the normal limb, if it was a lengthening case of the other limb
    - Fix the tilt by making the child stand on a wooden block until the pelvis is leveled. The difference b/w the 2 limbs will be equal to the length of the blocks that were put
    - Galliazi Test: Flexion of hip & knee > check if the knees are at the same level or not. If different, it's LLD.
      - If one knee is lower than the other knee & not deviated to the front > femoral problem
      - If lower than other knee (or at same level) and deviated to the front >tibial problem



  - Imaging methods
    - Centigram, a type ofxray, is one of the most imp. methods of determininig LLD.A long film of the 2 limbs from hip to toesis taken, while a ruler is put in the x-ray to measure the difference b/w the 2 limbs in length & to locate where the difference is (femur/tibia)
      - This confirms the clinical suspicions
      - It's v. imp to choose the appropriate choice of management



- Management principles
  - Severity
    - **LLD < 2 cm:**
      - Observe
      - Normal compensation that is found in most ppl

        - Not really apparent clinically
    - **LLD 2-5 cm:**
        - Shoe lift (for the whole foot NOT only heel)
    - **LLD > 5 cm:**
        - Consider surgery or active treatment

- Lifts(as we said, used in MILD cases)
- Shortening
    - Osteotomy then fixation (remove part of bone according to length required)
    - Ex: In neurofibromatosis, there is overgrowth of the whole limb >Debulking of soft tissue + shortening to equalize both limbs
- Epiphysiodesis
    - Temporary Epiphys. is done when you want to do shortening in young children that still have growth potential
    - Clips are inserted both medially and laterally of the bone for a certain period until desired equalization of the limb is achieved. Then have them removed so both limbs can continue to grow normally together at the same pace
    - Permanent method is done for children that are close to skeletal maturity (12-13 y/o). They'll have around 4-5 cms of growth potential left to reach, which equals the length desired to shorten the limb
        - Insertion of screw will destroy the epiphysis > bone stops growing

- Lengthening (just understand the concept)
    - More common
    - We use circular frames or do partial osteotomies& then insert a device that will start to lengthen bit by bit 1 mm per day (or so), by having the patient manipulate a screw of the external apparatus > callous formation b/w the 2 fragments of bone that are lengthening
    - Could reach up to 8 cm in tibia and 15 cm in femur
    - Takes up to 2-3 months. Success rate is high.
    - Can be performed in any age group, easier in children though

4 GENU VARUS & GENU VALGUS

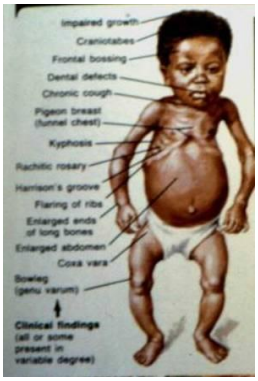
4.1 DEFINITION

- Valgus: Away from center (distal in relation to proximal) = knock knees
- Varus: Towards center = bow legs

-The normal 5-7°valgus is b/w the axis of the femur and that of the tibia. It's a result of the neck of the femur which doesn't descend straight like the tibia
-Its NOT the same as the mechanical axis which is measured starting from the center of the hip & is normally 0°

- Could be physiological (more common) or pathological
- Most children go through both varus and valgus:
  - < 2 y/o: physiological Genu Varus
  - >2 y/o: physiological Genu Valgus
  - ~4 y/o: straightening

Feature	Physiologic	Pathologic
Frequency	Common	Rare
Family history	Usually negative	May occur in family
Diet	Normal	May be abnormal
Health	Good	Other MS abnormalities
Onset	Second year for bowing Third year knock-knees	Out of normal sequence Often progressive
Effect of growth	Follows normal pattern	Variable
Height	Normal	Less than 5th percentile
Symmetry	Symmetrical	Symmetrical or asym
Severity	Mild to moderate	Often beyond ±2 SD



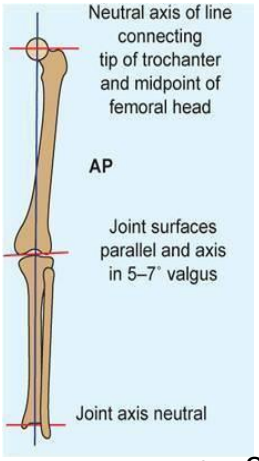
- Always exclude pathological causes first before reassuring parents& treat the underlying cause

4.2 EVALUATION

- History
- Examination (signs of Rickets)
  - ➢➢ Rickets is the MCC pathologically
  - ➢➢ If the pt still has active rickets, you don't touch the pt> Postpone the surgery
  - ➢➢ Residual deformity of Rickets > Osteotomy
- Investigations

Cause	Genu Valgum	Genu Varum
Congenital	Fibular hemimelia	Tibial hemimelia
Dysplasia	Osteochondrodysplasias	Osteochondro-dysplasias
Developmental	Knock-knee >2 SD	Bowing >2 SD Tibia vara
Trauma	Overgrowth Partial physeal arrest	Partial physeal arrest
Metabolic	Rickets	Rickets
Osteopenic	Osteogenesis imperfecta	
Infection	Growth plate injury	Growth plate injury
Arthritis	Rheumatoid arthritis knee	

- If physiological > reassure the parents
- Centigram without ruler
  - Take the whole limb under xray to determine the mechanical axis of the limb – the line that passes through the center of all 3 joints in a straight line (Normal = straight)
  - Any deviation is an abnormality: Valgus = knee inside line



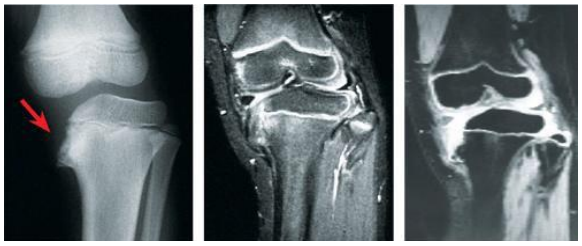
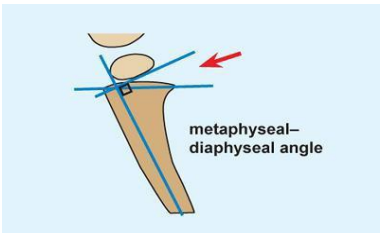
4.3 MANAGEMENT

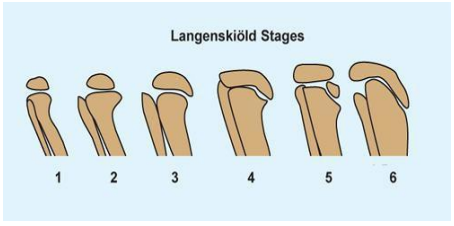
- It's important to determine severity and assess angulation
- If severe >Corrective osteotomy (tibia & femur together)
- If mild >Epiphysiodesis: Insert clip on medial side of bone to stop it from growing and allowing the lateral side to continue growing (very successful and minor)
    - If Epiphysiodesis is used for severe cases, it could lead to rotational deformities or complete destruction of epiphysis



4.4 TIBIA VARA (BLOUNT DISEASE)

- A special entity of Genu Varus
- The etiology is idiopathic
- The pathology is due to damage of proximal medial tibialgrowth plate
- Lateral grows more than medial > bowing of legs (varus)
- It's confined to the tibia (hence its name) and has many stages (1-5)
- MRI is mandatory: Bcz that's how we determine the extent of destruction that the epiphysis has underwent
- Most commonly occurs in blacks and obese
- Rx:
    - Mostly surgical (except type 1 & sometimes type 2)
    - Corrective osteotomy
    - Failure could still occur because of the epiphyseal destruction
    - Unfortunately, lots of times dropping of the tibial plateau occurs after surgery



5 FOOT DEFORMITIES

- Let's look at the characteristics of a normal foot first
  - **Stable:** for supporting the body weight in standing
  - **Resilient:**for walking and running
  - **Mobile:** to accommodate variations of surface
  - **Cosmetic**

5.1 CLUBFOOT(IMP)

5.1.1 ETIOLOGY

- Postural
  - Abnormal posture of uterus (IUGR) causing this deformity >assessed after delivery
- Idiopathic (CTEV)
  - Congenital TalipesEquinoVarus
- Secondary
  - (Spina bifida [MCC],myelodysplasia, arthrogryposis)

5.1.2 DIAGNOSIS

- Diagnosis by exclusion
  - If deformity is identified after delivery, try to do correction manually
    - If corrected successfully > Postural
    - If not > Idiopathic or secondary
      - If there's no syndrome or underlying pathology > Idiopathic
- Differentiate by exclusion (DDx):
  - Neurological lesion that can cause the deformity "Spina Bifida"(excluded by spine x-rays)
  - Other abnormalities that can explain the deformity: "Arthrogryposis, Myelodysplasia"
  - Presence of concomitant congenital anomalies: "Proximal femoral focal deficiency"
  - Syndromatic clubfoot: "Larsen's syndrome, Amniotic band Syndrome"

5.1.3 CLINICAL EXAMINATIONOF IDIOPATHIC

- Characteristic deformity (a MUST in every case)
  - Hind foot:
    - Equinus(fixed plantar flexion of ankle joint - FPF)
    - Varus(inversion of subtalar joint)
  - Fore foot
    - Forefoot Adduction(of talus)
    - Cavus(high-arched foot)
- Additional findings
  - Short Achilles tendon(due to FPF)
  - High and small heel (due to FPF)
  - No creases behind Heel(due to FPF)
  - Abnormal crease in middle of the foot(due to forefoot add.)
  - Affected foot is smaller (obvious if unilateral)
  - Callosities at abnormal pressure areas
  - Internal torsion of the leg: Varusforefoot add. > internal tibial torsion
  - Calf muscles wasting
  - Deformities don't prevent walking

5.1.4 MANAGEMENT

- Aim of treatment:
  - To reach an antigrade, mobile, normal, painless foot which looks cosmetically acceptable and fits normal shoes
- Ponseti technique:
  - Age limit is up to 12 months (controversial, won't be asked about it)
- Manipulation is maintained by a plaster cast
  - It's changed periodically, weekly at 1st, then every 2 wks> until full correction is obtained (4-6 casts)
- Then maintain correction by Dennis Brown splints until pt starts to walk
- Success rate is very high
- Indications for Surgery
  - If pt presents late after 12 months of age
  - Failure of conservativemanagement
  - Complementary to conservative treatment
  - Recurrence of deformity
    - For the 3 above, it could be soft tissue only or ST +/- bone surgery > To regain **function**
  - Complementary surgery (salvage) > To regain **appearance**
    - Longstanding varus>osteotomy: wedge removed ofcalcaneous

- Short Achilles tendon > Lengthening
- Before and after correction slide
- Triple osteotomy (talus – calcaneous – navicular)
  - Most common salvage procedure
  - Loss of inversion or eversion. Pt will feel pain walking on uneven ground, otherwise, they will walk normally

6 CEREBRAL PALSY

Cerebral palsy (CP) is a broad term used to describe a group of chronic "palsies" -- disorders that impair control of movement -- due to damage to the developing brain.

6.1 PHYSIOLOGICAL CLASSIFICATION

- Spastic
  - Spastic is the MC that goes to surgery
- Athetosis
- Ataxia
  - In ataxia and athetosis> surgery is contraindicated
- Rigidity
- Mixed

6.2 TOPOGRAPHIC CLASSIFICATION

- Monoplegia>one limb affected
- Paraplegia>both legs and trunk affected
- Hemiplegia>one side of the body (arm&leg) affected
- Triplegia>three limbs affected
- Quadriplegia or tetraplegia>all four limbs (+/- trunk, tongue and windpipe) affected
- Bilateral hemiplegia
- Diplegia>both legs affected

6.3 ASSESSMENT

- Hip:
  - Flexion
    - Do Thomas test to assess fixed flexed deformity of hip
  - Adduction: Scissoring gait
    - Hip ROM
  - IR: Intoeing
    - Hip ROM
- Knee:
  - Flexion

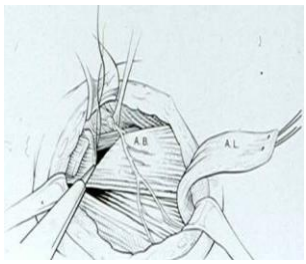
        - Popliteal angle: Flex hip then extend knee > normally angle of knee extension is 0°. If not, we subtract the measured angle on examination from 180°. That will give us the popliteal angle.

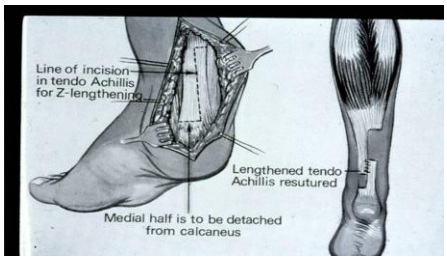
- Ankle
    - Equinus
        - Ankle ROM
    - Varus/Valgus
        - Podoscope

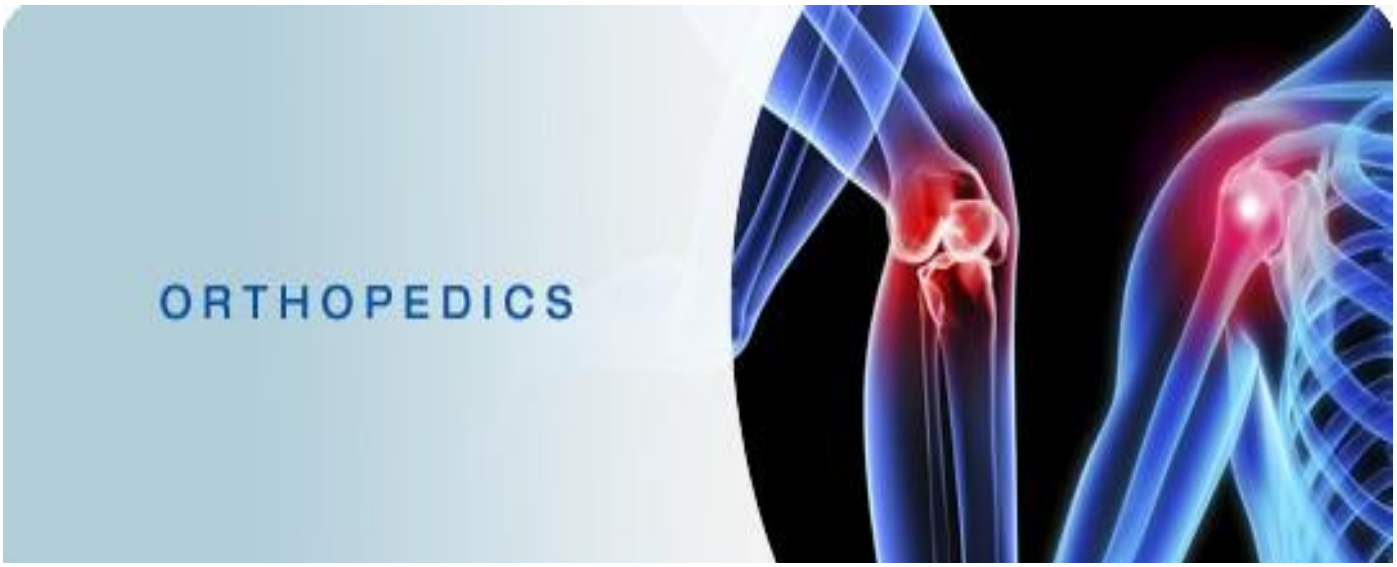
- Gait
    - Intoeing
    - Scissoring

6.4 MANAGEMENT

- Management is multidisciplinary
- Options of surgery
    - Neurectomy
    - Tenotomy
    - Tenoplasty
    - Muscle lengthening
    - Tendon Transfer>rarely done
    - Bony surgery Osteotomy/Fusion>for longstanding deformities






ORTHOPEDICS

Definition:

A non---inflammatory (DEGENERATIVE) disease affecting articular cartilage of joints.

TYPES:

- **Primary**

Intrinsic defect (mechanical, vascular, cartilage, hereditary-generalized O.A)

-usually familial , hereditary.

- Generalized and affects the upper limbs more than lower limbs.

- **Secondary**

Secondary to local or systemic disease

Etiology:

- Increased load: obesity (hips and knees take 3-4 body weight with each step) (the most common movements which can affect the knee is jogging & squatting).
- Trauma: osteochondral, malunion, sport injury
- Congenital/developmental: CDH, multiple epiphyseal dysplasia
- Infection
- Necrosis: Perth's disease, osteonecrosis, steroids
- Hematologic: SCD, hemophelia (**mostly by oseonecrosis**)

  Endocrine: DM (due to neuropathy, it can lead to unorganized remodeling of destroyed painless joint called "Charcot's Joint" which in turns lead to severe secondary OA), acromegaly
- Metabolic: crystaline deposition disease (gout mainly affect small peripheral joint "Feet", CPPD "crystalline pyrophosphate deposition which is psudo gout, mainly affect the knee "), Paget's disease
- Inflammatory: RA, SLE, Reiter's syndrome
- Neuropathic: DM, tabes dorsalis.
- Occupation (indirect cause of OA).

  -The first part affected by the normal aging degeneration process is the cervical spine.

Epidemiology:

- Common in our community (west region) esp. knees
- Much more in females ;esp. obese
- Presents earlier than in West
- About 90% of those over 40 have asymptomatic degeneration of weight bearing joints
- Commonest joints are knee, hip, C-Spine & L-Spine,1st CMJ,1st MTPJ (when it affected by osteoarthrosis, it called hallux stiffness) and IPJ

Pathophysiology:

- Increased water content: swelling and softening of cartilage (normally 80-85% of the cartilage matrix is water).
- Depletion of Proteoglycans (it's the polysaccharide which gives the cartilage its properties).
- Chondrocyte damage and synovitis › proteolytic enzymes› collagen disruption
- Fibrillation (The first sign to be seen by the scope) on weight bearing surfaces
- Loss of cartilage height and exposed bone› Decreased joint space
- Attempts of repair:

  SUBCHONDRALSCLEROSIS

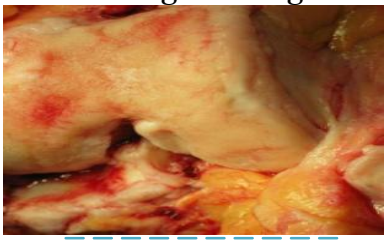
  eburnation (ivory-like bone)

The cartilage of the joint is type 2 cartilage.

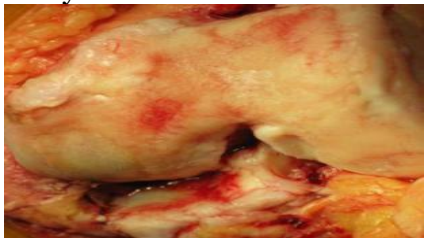
- Fissuring (cracks): synovial fluid pumped into subchondral bone ›SUBCHONDRAL CYST (late).
- Hypervascularity of synovium and subchondral bone

›proliferation of adjacent cartilage › enchondral ossification› OSTEOPHYTE

- Synovial (normally its quite viscous but here it becomes watery which make it easily to be compressed) and capsular thickening
- Progressive bone erosion› BONE COLLAPSE
- Fragmented osteophyte› LOOSE BODIES
- Loss of height and ligamentous laxity› MALALIGNM



Fissuring



Osteophytes & eburnation

Cysts & Sclerosis

Loss of bone & deformity

Clinical picture:

MCQ: indications of surgery are:

---pain (most common)

--- sub---laxation

--- severe bone erosion.

SYMPTOMS:

Pain, inability to bear weight, stiffness, limping, deformity.

Pain:

- It's the number one indication of management.
- It's also one of the indications of surgery.
- It's important to ask about the Activities Of daily Living "ADL"

whenever the patient is complaining of pain.

Deformities:

- Varus mal-alignment and fixed flexion are the most common in OA, while in Rhumatoid it's more common to have valgus and hyperextension.
- Deformity alone by itself is NOT an indication of surgical Rx.

-Acute presentation of OA can mimic Septic arthritis (red, swollen. Limited range of motion..etc)

SIGNS:

Effusion, Swelling, tenderness, crepitus, deformity-malalignment.

INVESTIGATIONS:

- **X-ray (STANDING in lower limb)**

"Presentations in order as severity increases" :

Loss of space

Sclerosis

Cysts

Osteophytes (at the peripheral lines of the joint).

Loose bodies

Malalignment.

Subluxation (in advanced cases)

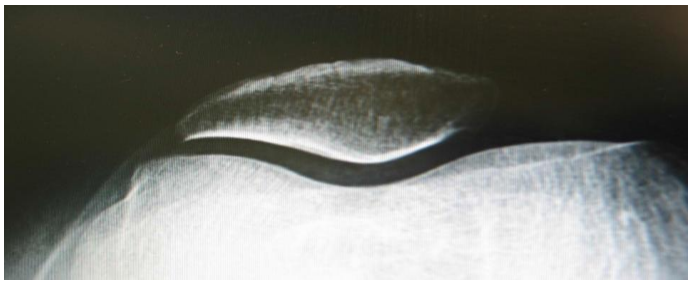
sulux.

Erosion.

synovial analysis (in differential diagnosis**)**

- Synovial fluid analysis should NOT be performed always, unless there is a massive effusion, otherwise don't do it all the time.

	Protein Level	Glucose Level
Septic Arthritis (>20,000-30,000 polymorph cell count).	High	Low
Inflammatory Arthritis	High	Normal
Osteoarthrosis	Normal	Normal



Diagnosis:

- OA is mainly diagnosed clinically, there is no much need to do many several investigations. X-ray is the best modality for investigation with AP & lateral standing views + Skyline "Axial" view in case of hip or knee OA to show the patella-femoral joint.
- Whenever a patient is complaining of knee joint, you should automatically examine the hip. Because hip disease can transfer to the knee and vise versa.

Management:

Case scenarios:

1---a 42 years old female complaining of right leg pain since 6 months . She has the pain after 1 hour of walking & praying. She doesn't have it when she use the stairs up & down. Her weight= 80, Height=165. On examination the patient has mild tenderness at the medial side of the joint, there is no redness. X---ray shows 3 degrees of valgus instead of 7 degrees. Her mother & father have osteoarthrosis. She is mildly diabetic on regulatory treatment. No Hx of trauma, previous surgeries or infection. She is on glucophage. How to manage this patient?

---Exercise, reduse weight & modification of the activities. – give her paracetamol.

2---a 47 years old female complaining of left knee pain since 2 years . The pain increase with praying , using of stairs & walking. She has a Hx of twisting injury over knee when she was 25 years old. She had meniscal tear & she has arthroscopy for meniscal tear. She has been seen by other doctors & she took NSAID. She did exercise & she is considered obese & she failed to lose weight. Height=165, weight= 95. X---ray shows subchondral sclerosis, decrease medial joint space osteophytes on the medial side of the joint. Also, she has varus deformity of 10 degrees. How to manage?

--- Hyaluronic acid. ---Arthroscopic lavage as a second choice if there is no hyluronic acid available.

3-a 55 years old male, porter complaining of knee pain since 5 years . Height =180, weight=100 بنقيي جسمم عضلمي. He loves exercise. X-ray shows 15 degrees of varus , sclerosis & redused medial joint line. He wants to complete his work & he tried everything. What modalities can be used?

-Arthroplasty (if patient accept to change his job & be carful about exercise).

-Osteotomy "closed wedge osteotomy" (reallignment of the joint).

Points to remember from the scenarios: IMP

- If the x-ray is only showing mild varus →→ exercise and weight reduction would be advisable.
- Paracetamole can be used in case of mild pain. NSAID are usually not beneficial in case of OA.
- Activity modification is advisable if the pain gets worse with specific movement or activity.
- Arthroscopic lavage "debridement" used as a temporary Rx and in case of moderate OA.
- Steroid injections has NO effect on OA as a main method of treatment, it's only beneficial in case of acute presentation of OA because its duration of effect = 3 weeks.
- Hyaluronic acid injection has almost similar results of arhtrosope, so it's preferred as it doesn't require anesthesia.
- If patient had arthroplasty, he should restrict his activity after this procedure especially sports & exercise.
- Osteotomy →→ used to over correct the valgus "overcorrection". Normal Anterior cruciate ligaments + knee stability & range of motion are one of conditions that should be considered before performing this type of surgery.
-

- **History**
- **Examination**
- **Investigations <u>Conservative</u>**

  <u>treatment:</u>
- Decrease load (stick, brace, reduce weight)
- Modify activity
- Physiotherapy:

  prevent contractures

  muscle strengthening

  range of motion
- Medications

  systemic

  Local

Surgical treatment:

- 1- Joint Debridement →→ if there are lose body (bone) in the joint and it block the movement
- 2- Corrective Osteotomy (there are 2 pictures in the slid no. 22 if you want to see them cus I couldn't copy them) :

What? varus/valgus, abd./add.

Why ? to realign axis and redistribute weight

Which joint? knee/hip

What joint? mobile, stable, minimally deformed

Which patient? young, thin, active

- 3- Arthrodesis: (fusion of the joint)

Why?	Transfer painful stiff into painless stiff joint.
Which joint?	-wrist, ankle, C-Spine, L-Spine, hand (Small joints "hand & foot"). - hips and knees (LESS COMMON)

When?	- failed TKR (Chronic infection & acute infection on post-hip replacement). - Neuropathic joint (the best treatment for it). - paralytic (flail). - Loss of quad. - Stiff in young.
When NOT to use it?	- Ipsilateral disease. - Contralateral hip disease. - bilateral joint disease.

TRANSFER LOAD TO DISTAL and CONTRALATERAL JOINTS

4-Arthroplasty:

- **Excision Arthroplasty (remove part of the joint to allow movement)**

Disadvantage:	-weakness. –shortening. -walking aid
Which joint?	-Hip; post infection (girdle stone) -1st MTPJ. -1st.MPJ

Excisional arthroplasty is indicated for small joints in hand & foot. It's not used for big joints **EXCEPT** in case of chronic infections "TB or Brucella" or acute infection in post---total hip replacement" because joint replacement is contraindicated in case of infection" so we use the excisional instead of it.

-patient with sever varus (25 degrees varus), sclerosis, osteophytes , lose of height , lose of bone = Arthroplasty.

- **Partial Replacement:** one side of the joint

Which joint?	- hip (fracture). - knee - shoulder(SCD, RA)
When?	- necrosis - degenerative - trauma - Inflammatory (ONLY SHOULDER)
When NOT?	- infection - young - inflammatory

-Partial or hemi-arthroplasty is indicated usually for trauma (e.g. femur neck fracture, hip fracture, knee fracture…). **It is CONTRAINDICATED in Rheumatoid Arthritis**

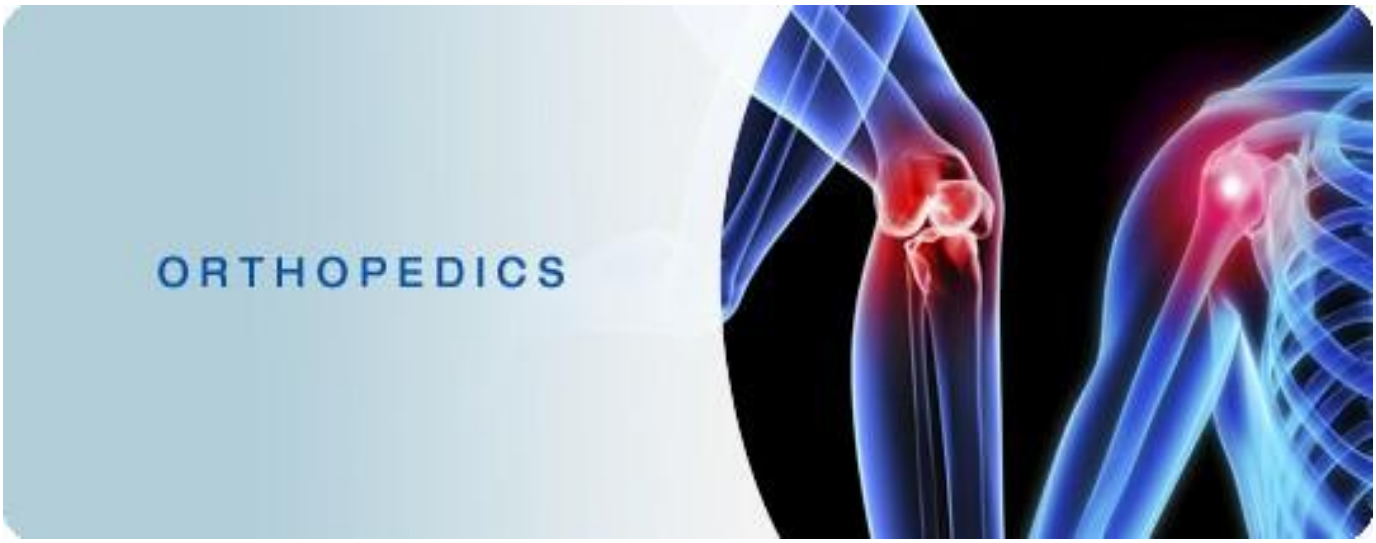
- **5- TOTAL REPLACEMENT (pictures in slide 33 & 34 which can't be copied also):**

Which?	- Knees (mainly). - Hips. - Shoulders. - Ankles. - elbow
When?	- painful, deformed stiff joint, old patient!!

When NOT?	- Neuropathic - Infection - Paralysis (e.g. polio) - young, active (RELATIVE) →→ Because young and active pt will consume the artificial joint very fast.

Isn't it funny how someone can say "I believe in Allah " but still follow the Satan who by the way also, " believes " in Allah…

430 ORTHOPEDICS TEAM



Lecture: Peripheral Nerve Injury.

Team Members:

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Hadeel Al---Ghamdi.	Ghadeer Al---Wuhayd.	Hissa Al---Balla.
Lujain Al---Yousef.	Nouf Al---Hammad.	Jawaher Al---Faraydi.
Hiba Al---Rahiem.	Nour Al---Enezi.	Wejdan Al---Swayyid.
Arwa Abudawood.	Leena Al---Shaman.	**Areej Al---Qunaitir.**

Team Leader:

Ayedah Al---Ruhaimi

---The slides were provided by the doctor.

---429 team group A---1.

---Important notes in **Red**.

---Copied slides in **Black**.

---Doctor's notes in **green**.

OUTLINE

- DEFINITION.
- TYPES OF NERVE INJURIES.
- FATE (pathophysiology) AND REHABILITATION.
- ETIOLOGY.
- PRESENTATION.
- DIAGNOSIS.
- CLINICAL EXAMPLES:
  - ✓✓ (ERB' S,CARPAL TUNNEL,RADIAL,ULNAR,SCIATIC AND PERONEAL)

What is peripheral nerve?

It is a nerve which connects between CNS & periphery, with EXCLUSION of cranial nerves. It is composed of: cell body, axon & nerve end.

If the Cell Body is Motor: it is located in anterior Horn cell in spinal cord (motor end plate).

If axon is sensory: it is located in posterior Horn cell.

Always mixed (contain both sensory & motor fibers) No pure sensory or motor.

It has the capability of regeneration unlike of CNS.

Rehabilitation is very important in peripheral nerve injury.

WHAT ARE THE FEATURES OF A PERIPHERAL NERVE?

- RELATES PERIPHERY AND SPINAL CORD.
- MIXED (SENSORY AND MOTOR).
- REGENERATES.

Definition of nerve injury:

It is Partial OR Complete interruption of normal physiology of the nerves (nerve conduction is affected).

Types:

1. **Neuropraxia:**

E.g.: when you set for long time you feel numbness.

- Commonest & easiest in recovery
- Reversible failure propagation of electrical impulses across the affected nerve segment.
- No anatomical change of the nerve structure (anatomy is intact).

- Duration: usually: seconds – minutes. Rare: hours - days.

e.g.:

- Saturday night palsy:alcoholics→radial nerve palsy
- Honeymooner's syndrome.
- Wheel chair bound persons.

2. Axontemesis:

- Complete absence of sensory & motor activity of that nerve
- Associated with accident & trauma:
  - ✓✓ Fracture of humeral shaft →radial nerve injury
  - ✓✓ Fracture of medial epicondyle → ulnar nerve injury.
  - ✓✓ Fracture of proximal fibula → peronealnerve injury.
  - ✓✓ Fracture of acetabulum &posteriordislocation of femoral head→sciatic nerve injury.
- No sensation or motion (loss of nerve function).
- Axon+myline sheath are damaged (histological changes).
- The cell body losses its continuity with nerve.
- Endo, epi, perineum are intact (fascia is intact).
- Anatomy is intact.
- There is wallerian degeneration.
- Good prognosis.

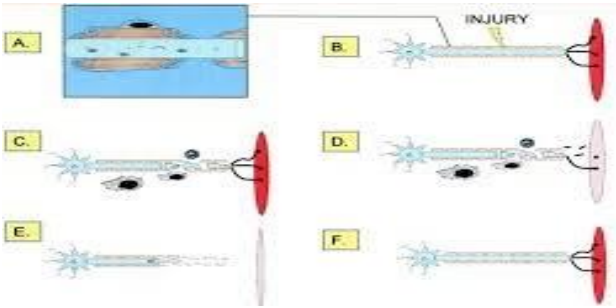
3. Neurotemesis:

- Anatomical damaged in the nerve (nerve ends are not in continuity) →complete disturbance of activity of that nerve + loss of supporting tissues.
- There is wallerian degeneration.
- Prognosis is poor& worst without surgical repair.

❖❖ Wallerian degeneration:

- It is a process of proximal part regeneration &distal part degeneration of the nerve regarding to the damage site.
- Length of regeneration: 1mm/day. e.g.: if the length of sciatic nerve injury is 50cm→it needs 500 days to recover.

- During the period of regeneration, if the distal part is not stimulated from outside→ lead to atrophy of motor end plate & loss its function. So, you have to stimulate motor end plate by rehab to prevent degeneration of it (it is not reversible).
- If the anatomy is intact (axontemesis) → no need to repair.
- If the anatomy is disturbed (neurotemesis) → you have to repair. Then wait for regeneration.
- N.B: if the tunnel is not in continuity that is mean there is no stimulus for regeneration which may cause neuroma (group of N. tissue which doesn't have any function).



Rehabilitation:

- Pain control by simple analgesia.
- Nerve& muscle stimulation.
- Dynamic splints to avoid stiffness. (We have to prevent pressure sores).*NECROSIS STARTS AFTER 20 MINS
- Nearby joints range of motion by doing passive movement to prevent muscle stiffness.
- It takes months-years (long time) to recover.

Remember:

- Pressure sores develops due to the pressure of splint in case of complete loss of sensation of the splinted limb.
- You can prevent pressure sores by padding the splint with cotton between splint & limb.

Etiology:

■ Acute:

- Fractures (the commonest) →axontmesis.
- Wrong position (Saturday night syndrome, handicap) {neuropraxia}.
- Surgery.{neurotmesis}

- Electrical burn (the worst) because it damages everything.USUALLY IRREVERSABLE

■ Chronic:

- Tight N. passage (e.g.: carpal tunnel syndrome, tarsal tunnel syndrome).
- Tumors which compress the nerve.

Presentation:

- Pain
- History of trauma.
- Loss of sensation.
- Loss of motion
- Loss of power.
- Loss of reflexes.
- Muscle wasting.
- Contractures (deformity).
- Tropic changes: loss of normal well-being of limb due to disuse (shiny skin, hair disturbance…..).

Diagnosis:

Confirmed by:

- X-ray: in trauma.
- EMG: study of muscle electrical activity.
- NCS (neural conduction study): study of activity of electricity in the N. itself.IT IS VERY IMPORTANT TO COMPARE THE PROGRESS FROM ONE VISIT TO ANOTHER AND TO DECIDE WHAT TO DO NEXT
- MRI. (Like in brachial plexus injury so, we use it in special cases).

✓✓ Erb's palsy:

- Birth injury (difficult labor e.g.: shoulder dystocia & breech presentation).
- Traction often on N. roots C5-C6 but may occur on C4-C7-C8.
- Stretch or rupture or avulsion ← the worst.
- Upper limb in extension + internal rotation ← waiter phenomena.

- Mother notices no motion in the affected limb.
- 90% good recovery.
- Remember: rehab. Is important.
- Role of surgery after 3 months of life: explore & repair.ASSESSING BY NCS
- Fracture of clavicle does not cause Erb,s palsy.

✓✓ Carpal Tunnel Syndrome:

Median N. entrapment due to thickening of flexor retinaculum.

Presentation:

- Pain, numbness, worse at night & wakes pt. from sleep.
- Weakness + burning sensation: ↑with bending the wrist forward.

It affects:

- lateral 3⅕ fingers
- Thenar area is wasting.
- Female > male: ↑ with pregnancy & hypothyroidism → no explanation.
- ↑in manual workers.

Diagnosis:

- Clinical.
- Needs NCS to confirm the diagnisis.

Rx:

- Conservative (not helpful).
- No role of medical Rx.
- Surgical (main procedure for this condition) just open the flexor retinaculum.
- Immediate recovery post-operatively.

✓✓ Radial nerve injury:

The common cause: humeral shaft fracture at the junction between middle & lower third.

Presentation:

- Wrist drop (cannot extend).
- Loss of sensation in snuff box area (numbness).
- Rarely disturbed anatomically.

Rx:

- Conservative (dynamic splint).
- Do NCS, if no improvement within 3 months → surgical intervention.
- N.B: dynamic splint= splint with joint movement but static splint= splint with no joint movement.

✓✓ **Ulnar N. injury:**

Associated with elbow injury + tight compartment.

Usually in children with supracondylar fracture.

Presentation:

- Numbness in medial 1⅘ fingers.
- Hypothener muscle wasting.
- In late stage: CLAW hand (extension of MCP +flexion of IPJ) due to loss of lumbrical&interosseous action.

Rx: as in radial nerve.

✓✓ **Sciatic nerve injury:**

(no loss of hip flexion + Knee Extension)

With trauma or posterior dislocation of the hip + distal injury to its branches (posterior Tibial + common peroneal).

Presentation:

- Loss of sensation & motion below the knee level.
- Loss of all activities (flexion, extension …) below the knee level.
- Extension of the knee is not lost.
- Long period of recovery.

✓✓ Peroneal nerve injury:

Presentation:

Foot drop → no heel strike= inability to extend the foot.

Loss of sensation. - Leg weakness.

Causes:

- Direct injury is rare.
- Tight splint without proper cotton padding.
- Skeletal traction.

Rx:

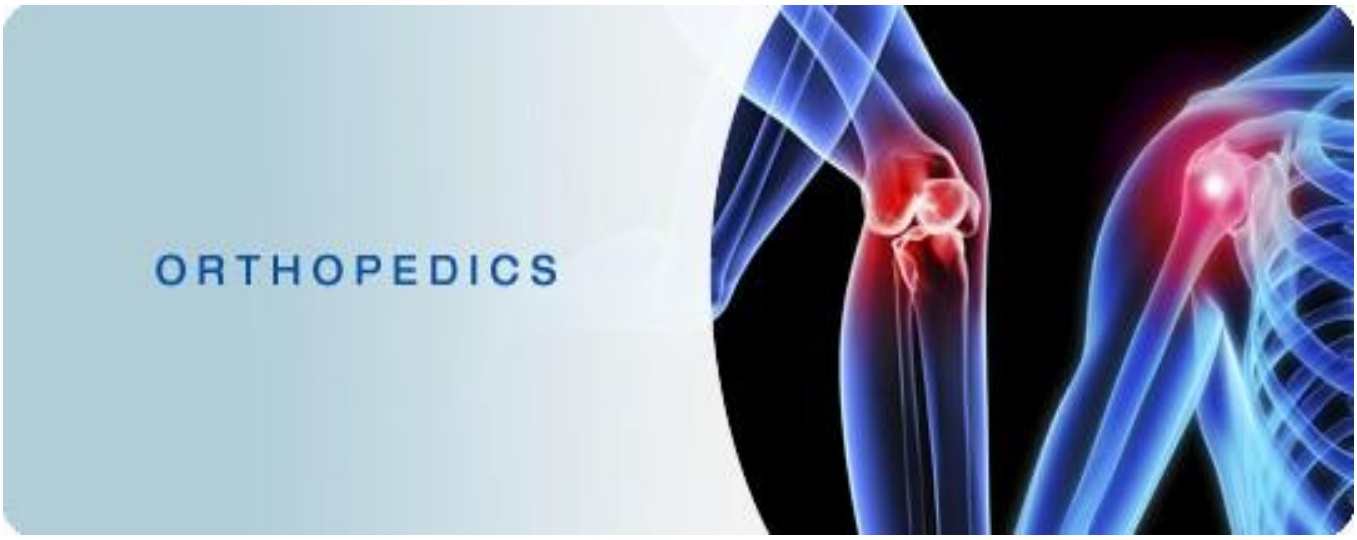
- Skeletal traction.
- Dynamic splint.

Quiz:

1) Axon degeneration occurs from mild compression injury. X
2) The prognosis for Neuropraxia is poor. X
3) Axonotmesis is generally caused from separation of the cell body from the neuron. XWallerian Degeneration typically does not occur in Neuropraxic injury. √
4) Surgical reconstruction is necessary in Neurotmesis. √
5) Wallerian Degeneration does not occur in Neurotmesis. X
6) A ligamentous structure can cause Neuropraxia. √

Isn't it funny how someone can say "I believe in Allah " but still follow the Satan who by the way also, " believes " in Allah…

430 ORTHOPEDICS TEAM



Lecture: Common Shoulder Disorders

Team Members:

Faten Al---Mohideb.	Hanan Al---Salman.	Aliya Al---Awaji.
Hadeel Al---Ghamdi.	Ghadeer Al---Wuhayd.	Hissa Al---Balla.
Lujain Al---Yousef.	Nouf Al---Hammad.	**Jawaher Al---Faraydi.**
Hiba Al---Rahiem.	Nour Al---Enezi.	Wejdan Al---Swayyid.
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Team Leader:

Ayedah Al---Ruhaimi.

--- The slides were provided by the doctor**.**

--- Important notes in **Red**

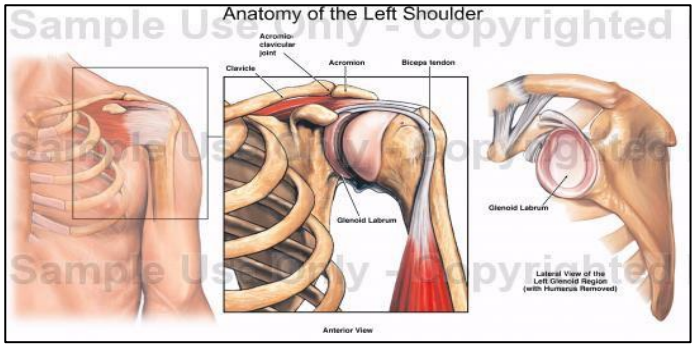
--- Copied slides in **Black**.

---Doctor's notes in **green**.

Special thanks to hend Al---Qhtani.

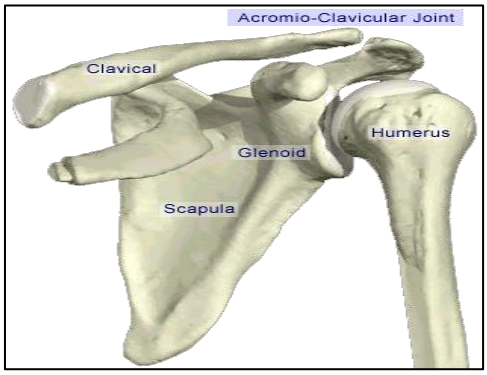
Shoulder Anatomy

The greatest range of motion body



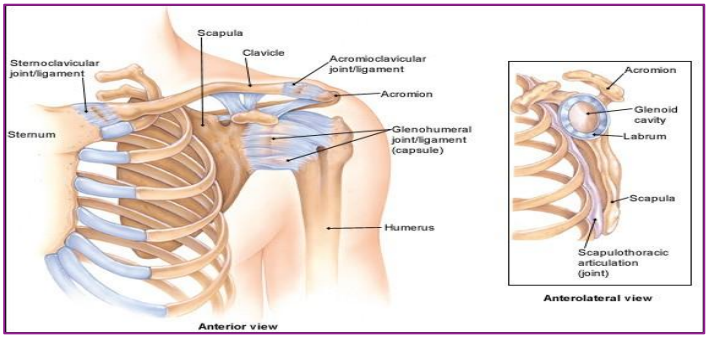
Bony Anatomy

- Humerus
- Scapula
    - Glenoid
    - Acromion
    - Coracoid
    - Scapular body
- Clavicle
- Sternum

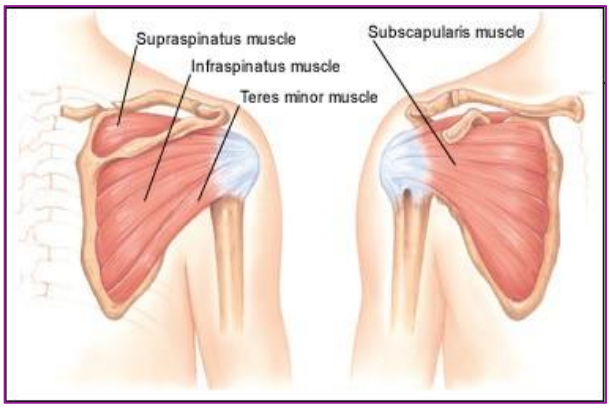


Joints

- *Glenohumeral joint: the main joint*
- *Acromioclavicular* (AC) joint
- *Sternoclavicular* (SC) joint
- *Scapulothoracic joint*



Rotator Cuff Muscles (SITS)

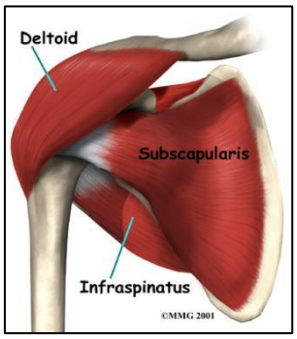


Depress humeral head against glenoid

- **S**upraspinatus:
  - Initiating of Abduction.(there can be cases of complete tears of the ms. And the Pt. can still abduct his shoulder)
- **I**nfraspinatus:
  - External rotation
- **T**eres Minor:
  - External rotation
- **S**ubscapularis:
  - Internal rotation

Teres minro is not important clinically –there is no specific test for Teres minor

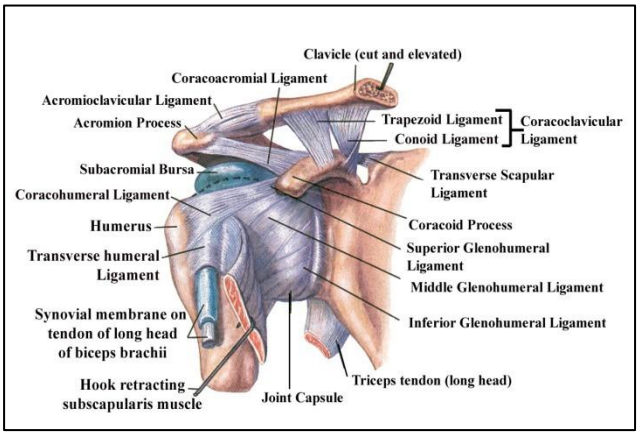
Muscles

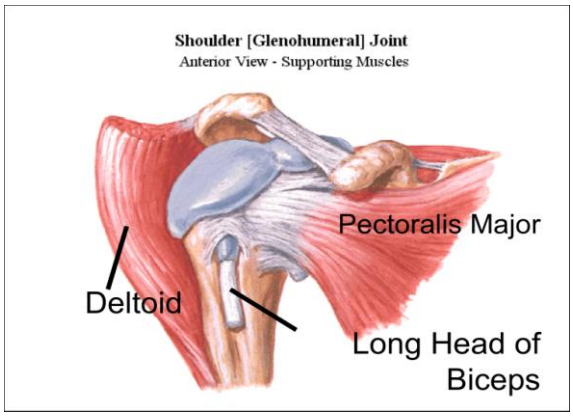


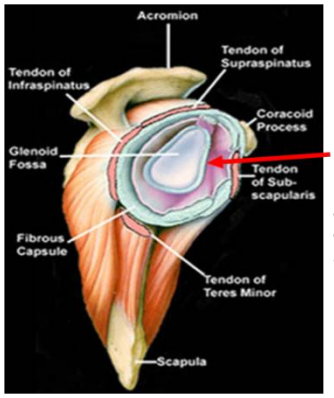
*Deltoid:

Largest, strongest muscle of the shoulder. Most important muscle is the deltoid: 3 origins(scapula spine –acromion---clavicle) and one attachment(proximal third of humerus) supplied by axillary nerve

***Biceps :** 2 heads . long head is deep – the only tendon in the body that goes into a joint . short head attach to cricoid process







LABRUM

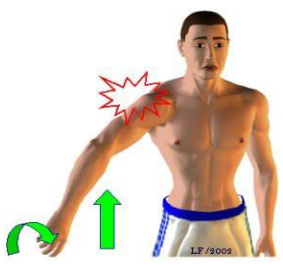
Cartilage ring around the glenoid. Deepens the socket of the G-H Joint

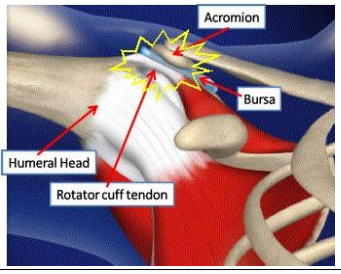
Labrum : makes the glnoid fossa deeper .help in stability of the joint .

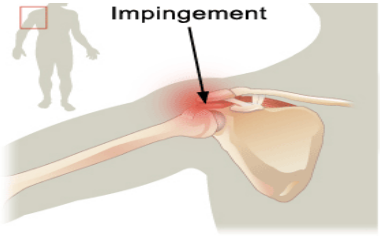
Subacromial bursa

- Between the acromion and the rotator cuff tendons.
- Protects the acromion and the rotator cuff from grinding against each other.

1.Impingement Syndrome







- Describes a condition in which the supraspinatus and bursa are pinched as they pass between the head of humerus (greater tuberosity) and the lateral aspect of the acromion

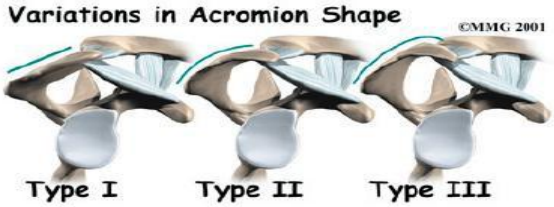
Impingement syndrome caused by :

1--- the contents gets bigger due to inflammation – bursitis and tendentits

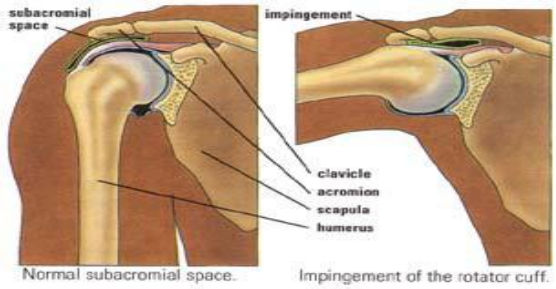
2--- the space get smaller due to osetophyts formation

Risk factors:

- Age: over 40 years
- Overhead activities (lifting ,swimming, tennis)
- Bursitis and supraspinatus tendinitis
- Acromial shape: type II & III acromion higer risk more than type 1
  AC arthritis or AC joint osteophytes



- 3 Types of acromion:
  - I : flat
  - II : curved
  - III: hooked



Symptoms

- Pain in the acromial area when the arm is flexed and internally rotated→→ Inability to use the overhead position.
- The pain may result from subacromial bursitis or rotator cuff tendinitis
- Pain when sleeping on the affected side..
- Pain will often become worse at night, as the subacromial bursa becomes hyperemic after a day of activity
- Decreased range of motion especially abduction
- Weakness
  sever impingement may lead to rotator cuff tear

Differential diagnosis

- Rotator cuff tears
- Calcific tendinitis
- Biceps tendinitis
- Cervical radiculopathy
- Acromioclavicular arthritis
- Glenohumeral instability
- Glenohumeral osteoarthritis.

Physical examination

- Atrophy of rotator cuff muscles.
- Decreased range of motion (esp. internal rotation & abduction)
- Weakness in flexion and external rotation.
- Pain on resisted abduction and external rotation.
- Pain on "**impingement tests**".

Impingement tests

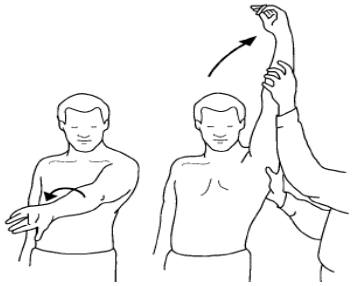
Neer's impingement test:

passive elevation of the internally rotated arm in the sagittal plane (shoulder passive forward flexion).

Hawkins' impingement test: more sensitive than Near's

with the elbow flexed to 90 degrees, the shoulder passively flexed to 90 degrees and internally rotated.

Neer's test

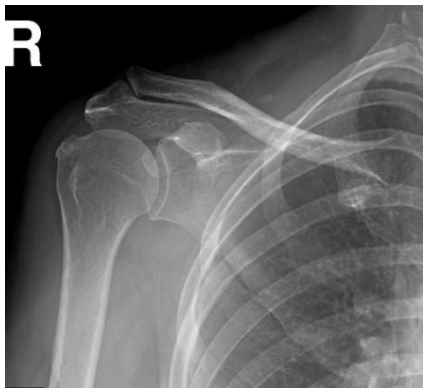


Hawkins test

Radiological findings :

Plain X---rays:

- Acromial spurs
- AC joint osteophytes
- Subacromial sclerosis
- Greater tuberosity cyst



X rays shows signs of impingement syndrome

(hypertrophy of greater tubersity)

MRI:

To confirm the diagnosis and rule out rotator cuff tear

Management

- **Conservative treatment**:
- Always start with it
- Operative:
- Indicated when conservative measures fail

Conservative treatment

Avoid painful and overhead activities

Physiotherapy:

1. Stretching and range of motion exercises
2. Strengthening exercises

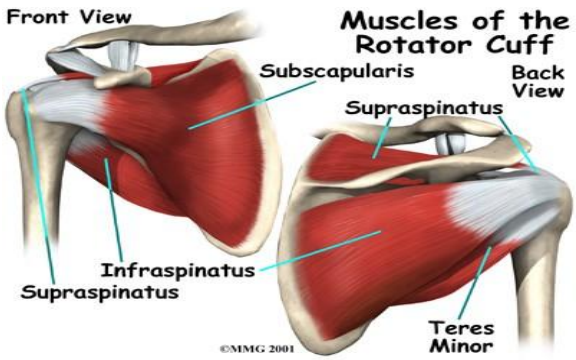
NSAIDs (after 2---3 months of physical activity---failed---)

Steroid injection into the subacromial space

Operative treatment

- The goal of surgery is to remove the impingement and create more subacromial space for the rotator cuff
- Indicated if there is no improvement after 6 months of conservative treatment
- The anterolateral edge of the acromion is removed
- Open (called: Acromioplasty – we open the deltoid ms , Pt need to be immobilize for long time), or arthroscopic(better than open) technique (called subacromial decompression)
- Success rate 70---90%

2.Rotator Cuff Tears



Supraspinatus:

Initiation of abduction + external rotation **Rotator cuff**

Infraspinatus:

External rotation

Subscapularis:

Internal rotation

Teres Minor:

External rotation

Function of rotator cuff muscles

- Keep the humeral head centered on the glenoid regardless of the arm's position in space.
- Generally work to depress the humeral head while powerful deltoid contracts to pull the humeral head up

Causes of rotator cuff tears

- **Intrinsic factors:**
- Vascular = in the greater tubresity is very poor>risk of avasacular necrosis due to any small injury , maluniuon
- Degenerative (age---related)
- **Extrinsic factors:**
- Impingement (in acromion, or sub acromioclavicular joint)
- Acromial spurs
- AC joint osteophytes
- Repetitive use
- **Traumatic (e.g. a fall or trying to catch or lift a heavy object)**

Diagnosis

- History
- Physical examination(empty can, lift off test)
- X---rays(not showing any abnormalities)
- MRI (best)

Symptoms

- Pain(can't lift his arm up) radiating to deltoid insertion or biceps(Pt. said I had pain in the upper part of my arm or in my neck)
- Insidious progression of pain
- Night pain
- Popping noises
- Weakness
- Could be asymptomatic

Signs

- Painful arc
- 60 degrees --- 120 degrees elevation
- Drop arm test
- Restricted internal rotation
- Subacromial crepitus
- Weak RC muscles
- Inability to lift the shoulder
- Palpation of cuff defect and (wasting of supraspinatus muscle in long history of rotator cuff tearing)

Imaging

- Plain radiographs
- AP + lateral view
    - Supraspinatus outlet view
    - AC --- joint view
- Ultrasonography= operator dependent
- Arthrogram = invasive not done usually
- MRI is the diagnostic tool in rotator cuff tear!
- MRI – arthrogram
- Diagnosis of the tear + impingement
- Size of tendon retraction
- Atrophy and fatty infeltration

Management

Goals of treatment:

- Elimination of pain(the main aim)
- Restoration of function
- Full range of motion
- Prevention of progression or recurrence

Modalities of management : Degenerative vs traumatic

Degenerative type: (always start with conservative except for traumatic case)

- (If no improvement after 6 months, surgical repair (open or arthroscopic) is indicated
- Rest
- Physio
- NSAIDs
- Steroid injection

Traumatic type: (acute surgical repair)

- Can't treat it with conservtive ! Muscle may retract .

- **Operative treatment**

Depends on:

Patient factors:

- Activity level
- Expectations
- Needs

Pain or weakness:

- Interferes with work, sports, activities of daily living.
- Unresponsive to appropriate non---operative treatment

Wide spectrum of tears:

- **Partial** (just shaving the partial tear)
- **Complete (** need repair the tendon **)**
- Small
- Large
- Massive (irreparable) : muscle atrophy and contracts– cant do repair – too late and need joint replacement

Surgical Modalities :

If conservative failed after 6 month of trials

1. Rotator cuff tendon debridement

2. Subacromial decompression

--- open

--- arthroscopic = much easier

3. Rotator cuff tendon repair = most immobilize the shoulder to help the tendon bone fixation

--- completely surgically open repair

--- arthroscopic assisted mini---open repair

--- completely arthroscopic repair

4. Reverse shoulder arthroplasty = in massive tear

Complications of RC tears

- Complete tears: if not treated →→ chronic pain and loss of motion and with time becomes irreparable →→deltoid take of the role leading to shoulder elevation and Glenohumeral –rotator cuff arthropathy---
- Complications of surgery: not improving, stiffness, infection, RSD
  4---6 wk of immobilization = risk of stiffness in longer duration

3.Adhesive Capsulitis

- Also called "frozen shoulder"
- It is characterized by pain and restriction of all movements of the shoulder (global stiffness)
- (in adhesive capsulitis all movements of shoulder are affected in contrast to impingement syndrome where limitation of abduction only) –
- Usually self limiting (typically begins gradually, worsens over time and then resolves but may take >2 years to resolve)
- Adhesive Capsulitis

Risk factors:

- DM (esp. insulin dependent) the most imp risk factor
- Following injury or surgery to the shoulder
- Hypo and Hyperthyroidism
- High cholesterol

Diagnosis:

- Mainly clinical = global movement limitation
- X---rays and MRI to rule out other pathologies

Stages: each stage takes 2 years

1---Pain (freezing stage)= pain

2---Stiffness (frozen stage)= pain with movement limitation

3---Resolution (thawing stage)= start healing

Treatment

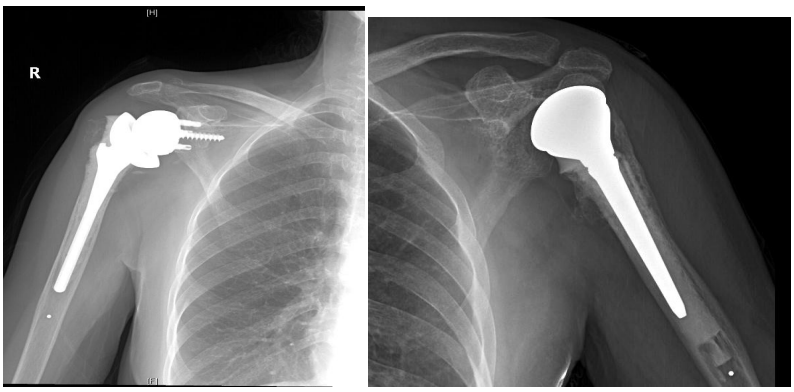
- Resolves if untreated over 2---4 years
- Start with conservative after 6 month if no improvement go for surgery
- Aggressive Physiotherapy
- Pain and anti---inflammatory medications } used all together
- Steroid injections
- Manipulation under anesthesia = risk of fracture due to disuse osteopenia

- Arthroscopic capsular release = best way of management and safer

4.Glenohumeral osteoarthritis

- Mainly wear and tear
- Could be a result of RA, AVN or malunited fractures
- Glenohumeral osteoarthritis
- The management starts with conservative measures.
- If it fails to relieve the pain, the best management for elderly patient is arthroplasty (hemi or total shoulder replacement)
- If associated with irreparable rotator cuff tear →→ for reverse shoulder replacement
- Note there is 2 types of glenohumeral osteoarthritis:

1) Primary osteoarthorosis like the knee > Rx with arthroplasty
2) 2ry to irreparable rotator cuff tear >Rx with reverse shoulder replacement

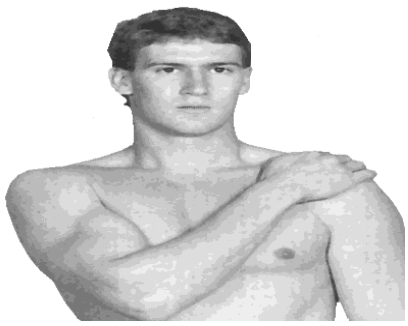


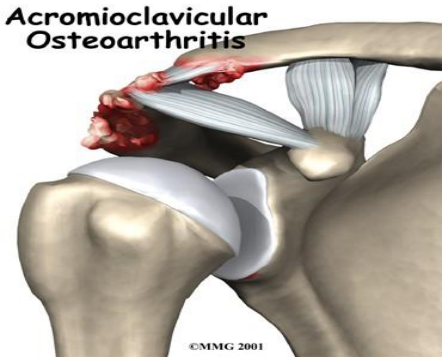
Reverse shoulder replacement

Hemi arthroplasty

4.AC arthritis

Across the chest adduction test(positive if there is pain)





Causes of AC Arthritis

- Degenerative osteoarthritis.(wear and tear in old aged people)
- Rheumatoid Arthritis .
- Gouty Arthritis.
- Septic Arthritis.
- Atraumatic distal claivcle osteolysis in weight lifters.

Signs and Symptoms

- Pain , which worsens with movement and progressively worsens.(the patient may suffer a night pain which is a sign of arthritis)
- It is commonly associated with impingement syndrome
- Positive across the chest adduction

Diagnosis: Clinical

and by x---rays

Treatment :

Non---surgical Treatment

- Rest , avoid weightlifting and push---ups(triggering activities)
- Pain medications and NSAID to reduce pain and inflammation

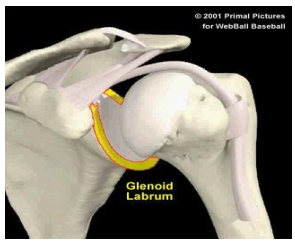
Surgical treatment

---it involves removing of the AC joint applying an artificial joint.

---the bone spurs must also be removed .

5. Dislocation of the Shoulder

Basic anatomy about Glenohumeral Joint :



- Most common dislocated joint
- Lacks bony stability
- Composed of:
    - Fibrous capsule
    - Ligaments
    - Surrounding muscles
    - Glenoid labrum

.Dislocation of the Shoulder:

- According to the direction:
- Mostly *Anterior* > 95 % of dislocations
- Posterior Dislocation occurs < 5 % in 3Es: epileptic , electrical shock , alcoholic. patient
- True Inferior dislocation (luxatio erecta) occurs < 1%
- According to the mechanism:
  - Traumatic
  - Non traumatic dislocation may present as Multi directional dislocation due to generalized ligamentous laxity. It may become painless →→ habitual

  ✓✓ With laxity minor truma lead to dislocation

  ✓✓ Avoid surgery – Rx with physiotherypy

  ✓✓ Trumatic Rx with surgery

Anterior Shoulder dislocation

Usually also inferior(anterioinferior)

Bankart's Lesion : detachment of the anterior inferior labrum – loss of stabalizing function of the labrum

Mechanism of anterior shoulder dislocation

Usually Indirect fall on Abducted and extended shoulder

May be direct when there is a blow on the shoulder from behind

Clinical picture of acute *anterior* shoulder dislocation

- Patient is in severe pain
- Holds the injured limb with other hand close to the trunk
- The shoulder is abducted and the elbow is kept flexed
- There is loss of the normal contour of the shoulder

Clinical picture

- Loss of the contour of the shoulder may appear as a step
- Anterior bulge of head of humerus may be visible or palpable
- A gap can be palpated above the dislocated head of the humerus

X---ray anterior shoulder dislocation

Tow views AP and axillary view

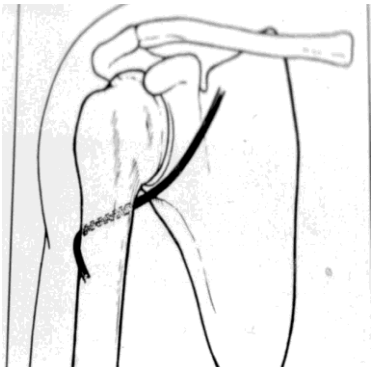
Trans---scapula view

Associated injuries of anterior Shoulder Dislocation

- Injury to the neuro vascular bundle in axilla
- Injury of the Axillary Nerve (Usually stretching leading to temporary neuropraxia) Deltoid function loss + loss of sensation over the deltoid
- Associated fracture
- 

Axillary Nerve Injury

- It is a branch from posterior cord of Brachial plexus
- It hooks close round neck of humerus from posterior to anterior
- It pierces the deep surface of deltoid and supply it and the part of skin over it



Axillary nerve injury

Management of Anterior Shoulder Dislocation

- Is an Emergency Why ? Risk of Avascular necrosis &Risk of nerve injury
- It should be reduced in less than 24 hours or there may be Avascular Necrosis of head of humerus(x ray after the reduction)
- Following reduction the shoulder should be immobilized strapped to the trunk for 3---4 weeks and rested in a collar and cuff

Methods of Reduction of anterior shoulder Dislocation

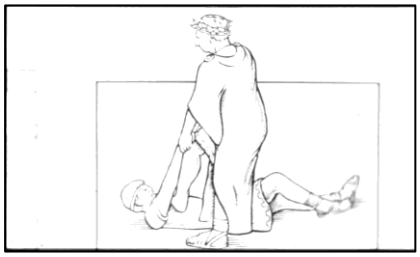
(traction and counter traction)

Hippocrates Method (A form of anesthesia or pain abolishing is required)

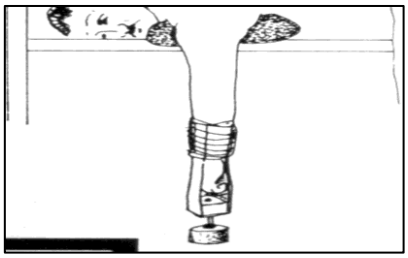
its done out the hospital if no other assistant is there .

Stimpson's technique (some sedation and analgesia are used but No anesthesia is required) not done any more

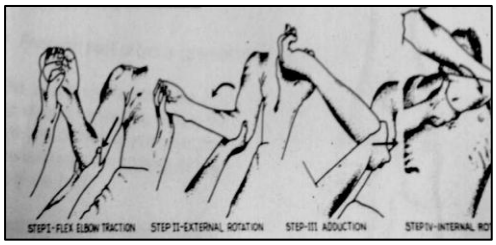
Kocher's technique is the method used in hospitals under general anesthesia and muscle relaxation



Hippocrates Method



Stimpson's technique



Kocher's Technique

Complications of anterior Shoulder Dislocation : Early

- Neurovascular injury (rare)
- Axillary nerve injury
- Associated Fracture of neck of humerus or greater or lesser tuberosities

Complications of anterior shoulder Dislocation : Late

- Avascular necrosis of the head of the Humerus (high risk with delayed reduction)
- Recurrent shoulder dislocations (the commonest complication) , treated by Bankart repair (either arthroscopic or open)re---attachemtn of the labrum

Bankart lesion

Arthroscopic Bankart

Bankart lesion

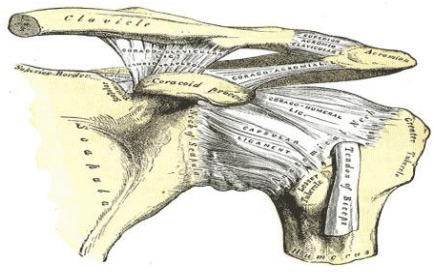
6. Acromioclavicular separation

Acromioclavicular Joint

The AC joint is different from joints like the knee or ankle, because it doesn't need to move very much. The AC joint only needs to be flexible enough for the shoulder to move freely. The AC joint just shifts a bit as the shoulder moves.

The AcromioClavicular joint is stabilized by three ligaments

- 2 Coracoclavicular ligaments
- Conoid
- trapezoid
- AC ligament



Acromioclavicular separation

Mechanisms of Injury:

- Fall on the tip of the unprotected shoulder.
- Fall on the outstretched hand.
- Downward force on the acromion from above.
-

Acromioclavicular separation--- Rockwood Classification:

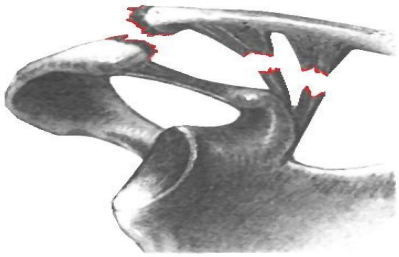
type I: sprain of joint with out a complete tear of either ligament

type II: tear of AC ligaments with intact coracoclavicular ligaments; will not show marked elevation of lateral end of clavicle

type III: both AC & CC ligaments are torn

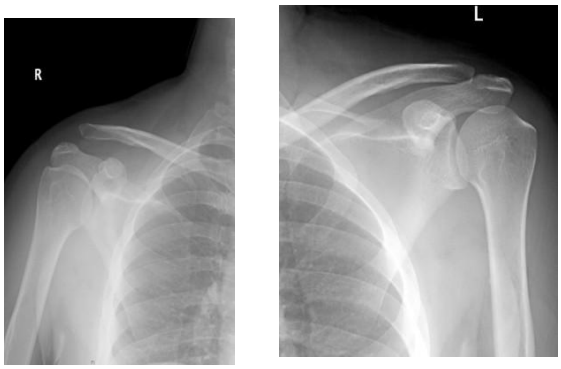
type IV: distal clavicle is dislocated posteriorly into trapezial fascia

type V: distal clavicle is dislocated inferiorly



GRADE III

type III: both AC & CC



Type 3 X---Ray

type 1 and 2 = no surgery

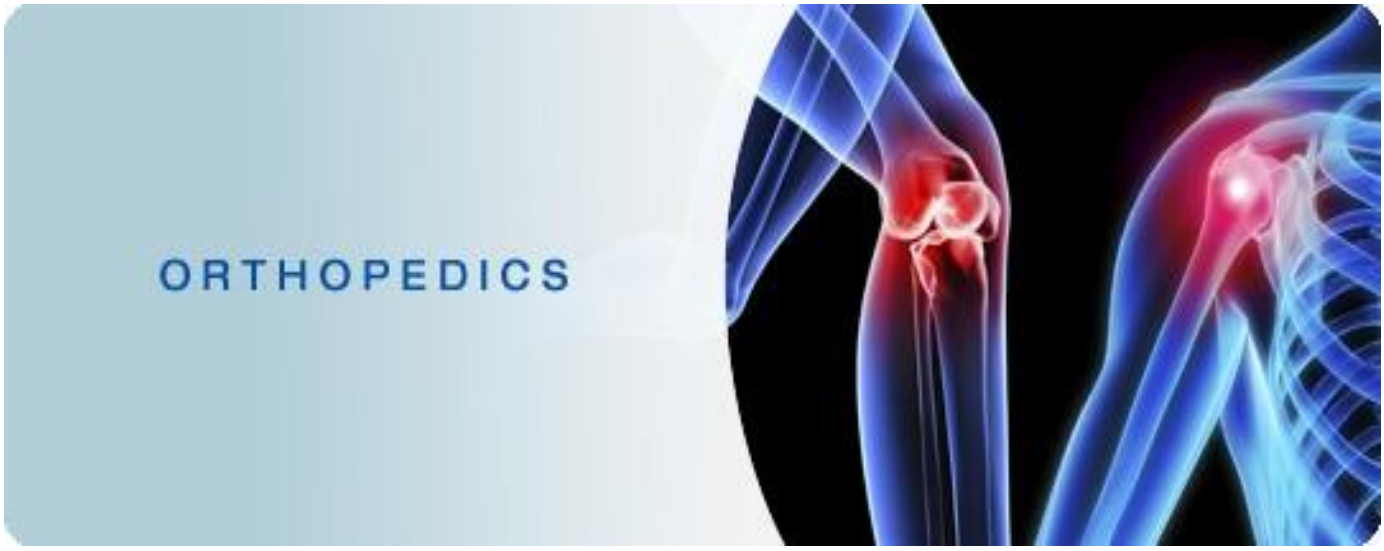
Type 4and 5 = sugery

Type 3= according to the patient state = young athletic patient = rx with re---attachment (surgery)

Elderly /non athletic rx conservtive

Isn't it funny how someone can say "I believe in Allah " but still follow the Satan who by the way also, " believes " in Allah…

430 ORTHOPEDICS TEAM



Lecture: Metabolic Bone Disorders

Team Members:

Faten Al---Mohideb.	Hanan Al---Salman.	Aliya Al---Awaji.
Hadeel Al---Ghamdi.	Ghadeer Al---Wuhayd.	Hissa Al---Balla.
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Team Leader:

Ayedah Al---Ruhaimi.

---The slides were provided by the doctor**.**

---Important notes in **Red**

---Copied slides in **Black**.

---Doctor's notes in **green**.

Orthopedic Surgeons and Bone:

- Orthopedic surgeons have to deal with all types of bone: healthy or diseased; and that's why they have to know about bone metabolism.
- Bones in the body protect vital organs eg: skull protects brain, ribs protect lungs and heart.
- Bones give support to muscles and tendons.
- Bone may become weak in certain conditions.

Bone is a living structure:

- There is a continuous activity in bone during all stages of life
- There is continuous bone resorption and bone formation as well as remodeling.
  While osteoblasts are forming a new bone, osteoclasts are removing the dead aged ones. This process accelerates with aging and when estrogen levels drop (menopause) with decreased rate of formation and increased rate of bone loss. Opposite to that is happening in childhood where bone is formed in higher rates than loss, the age period from 18---21 years is the period of equilibrium.
- That means bone is not only for protection and support but its contents play an important part in blood homeostasis
- Many factors are involved in this process

Bone Metabolism:

Bone metabolism is controlled by many factors:

- Calcium
- Phosphorus

regulated by:

- Parathyroid gland
- Thyroid gland

- Estrogen
- Glucocorticoid hormones
- Intestinal absorption
- Renal excretion

Patients with malabsorption condition like celiac disease or sprue or having a kidney disease like tubular necrosis or glomerular nephropathy will not

benefit from the dietary or supplemental calcium and vitamin D intake till this condition is corrected.

- Diet
- Vitamin D
- Sun exposure
- Exercise

Bone Structure:

Bone is formed by

- Bone matrix : which consists of
  - 40% organic : collagen type1 (responsible for tensile strength)
  - 60% Minerals: mainly Calcium hydroxyapatite, Phosphorus, and traces of other minerals like zinc
- Cells in bone : osteoblasts, osteoclasts, osteocytes

Plasma levels:

- Calcium : 2.2---2.6 mmol/l
- Phosphorus : 0.9---1.3 mmol/l

you should remember those values only if you are intern or resident
Both absorbed by intestine and secreted by kidney in urine

- Alkaline phosphatase : 30---180 units/l shows the activity of bone metabolism

Is elevated in bone increased activity like during growth or in metabolic bone disease or destruction
in adult it should not exceed 180 units/l, but in children it is considered normal up to 400 units/l because of growth

- Vitamin D level : 70---75 nmol/l

this value is controversial, because here in Saudi Arabia all women are less than 75, they still don't know if it is normal to have less than that in our population or that all Saudi females are truly vitamin D deficient. Most probably it shouldn't be less than 75 even in our population :/
Vitamin D is not only important for human skeleton, it also gives immunity against cancer and several diseases. Recently they discovered that all Alzheimer patients are vitamin D deficient.

Parathyroid Hormone (PTH):

Production levels are related to serum calcium levels:

- It increases calcium levels in the blood by increasing its release from bone, this is a fast action that increases ca levels in blood secondary to disease as a compensatory mechanism.
- increase absorption from the intestine

- and increase reabsorption from the kidney (also increase secretion of phosphorus)

Hyperparathyroidism:

This part and the last part of the lecture which also about hyperparathyroidism are not included in the syllabus and you are not going to ask about, it is only to help you in DDx.

- Primary: Adenoma of the gland very rarely carcinoma.
- Secondary: as a result of low calcium "Chronic" malabsorption, low calcium diet, kidney excrete more Ca .
- Tertiary: as a result of prolonged or sustained stimulation = hyperactive nodule or hyperplasia

Calcitonin:

- Is secreted by C cells of thyroid gland
- Its secretion is regulated by serum calcium
- Its action is to cause inhibition of bone resorption and increasing calcium excretion by this it causes lowering of serum calcium

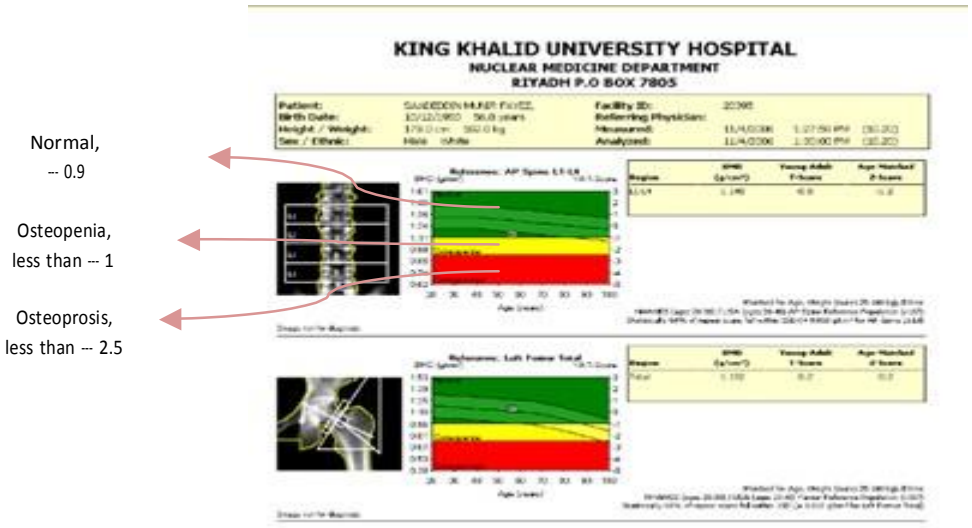
Bone Strength:

- Bone strength is affected by mechanical stress which means exercise and weight bearing, those who were exercising since childhood or farmers have very strength bone.
- Bone strength gets reduced with menopause and advancing age
- Reduced bone density on X rays is called Osteopenia
- Osteopenia is also a term used to describe a degree of reduced bone density, which if advanced becomes Osteoporosis

Bone Density:

- Bone density is diagnosed at current time by a test done at radiology department called : DEXA scan which tests 3 areas: vertebrae, hip and wrists.
- DEXA is (Dual Energy X ray Absorbtionometry)
- Increased bone density does not always mean increased bone strength, as sometimes what is called Brittle bone which is a dense bone is not a strong bone but fragile bone which may break easily

Dexa Scan: for example, if bone is dense and we send 100 rays, 20 will go back and thin means that 80 are absorebed. But if bone is osteopenic 50 will go back so only half is absorbed which means less density.



Disorders to be discussed:

- Rickets
- Osteomalacia
- Osteoporosis
- Hyperparathyroidism (not included)

Rickets & Osteomalacia:

Different expressions of the same disease

→→ Inadequate **mineralization**

- Rickets: Affects areas of endochondral growth in children (wrist, knee, shoulder, hip)
  We can diagnose rickets by looking at knees (inspection) or wrist x---ray
- Osteomalacia: Affects all skeleton is incompletely calcified in adults

Causes

- Calcium deficiency
- Hypophosphataemia
- Defect in Vitamin D metabolism
  - Nutritional (poor, war zoon, …)
  - underexposure to sunlight
  - intestinal malabsorption (ex. Celiac disease)
  - liver & kidney diseases, (renal tubular acidosis , Glomerular nephropathy) collect 24 hour urine Ca (normal : 500 mg of Ca)

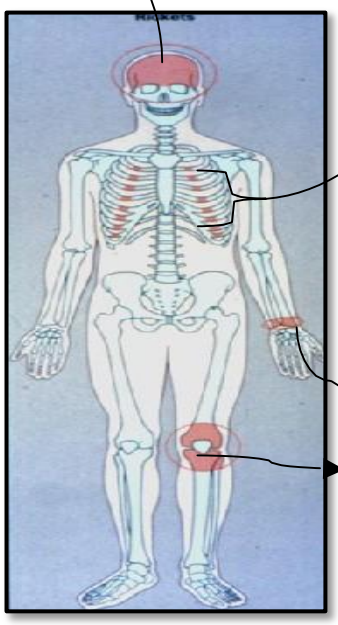
Rickets: Symptoms and Signs:

Knees are the first one to be affected then wrists then costochondral

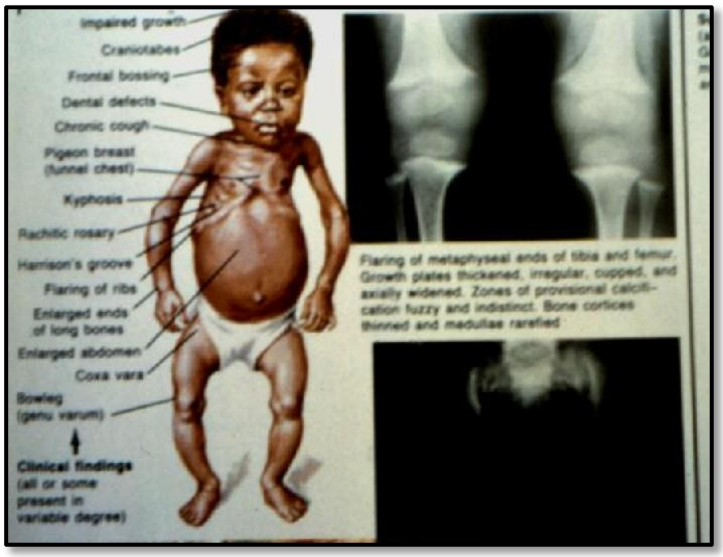
- Child is restless, babies cry without obvious reason
- Failure to thrive
- Muscle weakness
- In severe cases with very low calcium: tetany or convulsions
- Joint thickening (hypertrophy) especially around wrists and knees
- Deformity of limbs, mostly Genu varum (bowl legs) or Genu Valgum in late presentation
- Pigeon chest deformity, Rickety Rosary (beads like), craniotabes

Skull enlarge =Delayed sutures closure

Between costochondral junction in rib cage



Chondral hypertrophy especially in growing bone



X Ray Findings in Rickets:

Growth Plate& Metaphysial Changes:

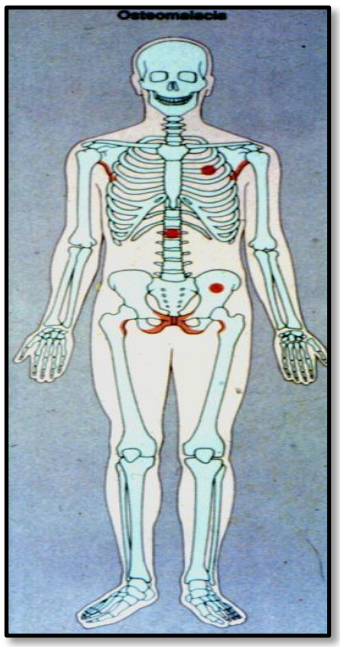
Long Bones Deformities:

Epihyseal Widening

Biochemistry:

Hypocalcaemia, Hypocalciuria, High alkaline phosphatase (try to form too much bone)

Osteomalacia Symptoms and Signs:



- Generalized bone pain, mainly backache
  why back? Because back bear body during walking
- Muscle weakness

Because muscles actions depend on Ca
→→ low Ca = pain and weakness

- Reduced bone density
- Vertebral changes : Bi---concave vertebra, vertebral collapse , kyphosis

When bone become soft the convex shape of intervertebral disc will be concave then any press on vertebra with this shape will cause fracture

- Stress fractures: (transverse fracture on x---ray) Loosers zones in scapula, ribs ,pelvis, proximal femur. It can happen from only walking up from chair not even a fall

Bi---concave vertebra

(from above and below) .
Any fall can cause compression fracture (looser zoon)

Reduced bone density
femoral head stress fracture

Kyphosis

Treatment:

easily treated unless the patient is having intestinal or kidney disease**.** (should be treated first. because there is no point of the treatment without treat the primary cause)**.**

Vitamin D deficiency

--- Rickets

- adequate Vitamin D replacement
- sun exposure
- correct residual deformities

--- Osteomalacia

- Vitamin D + Ca (milk, eggs, fish)
- fracture management
- correct deformity if needed

Osteoporosis:

loss of bone unit unlike osteomalacia which affects bone mineralization

- Decreased **bone mass**: decreased amount of bone per unit volume (and this causes reduced density) ➔➔ osteoclast activity
- Mineralization is not affected
- Mainly post---menopausal (drop Estrogen level) and age related

Normally we lose 0.3% of bone but in osteoporosis will be about 3% per year

Osteoporosis: Primary and Secondary

- Primary Osteoporosis:
  - Post menopausal
  - Senile process happen in every men and women

Post menopausal Osteoporosis:

- Due to rapid decline in estrogen level
- This results in increased osteoclastic activity
- Normal bone loss usually 0.3% per year
- Post menopausal bone loss 3% per year

---Osteoporosis is painless disease unless it cause fracture (neck of femur).

--- Hx. Of F# (high risk group)

Risk Factors in Post menopausal Osteoporosis:

- Race: Caucasian (fair skin)
- Hereditary
- Body build (thin people)
- Early menopause
- Smoking/ alcohol intake/ drug abuse
- ? Calcium intake (low Ca)

Senile Osteoporosis:

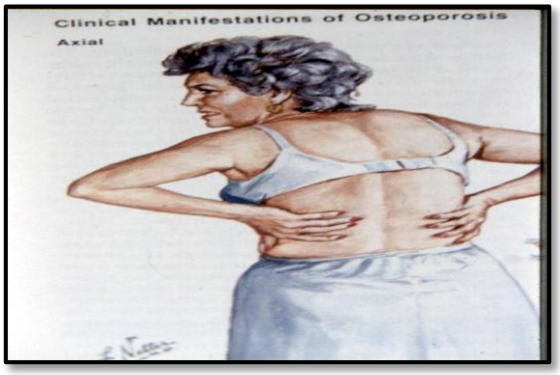
- Usually by 7th to 8th decades there is steady loss of at least 0.5% per year female after 50 years and male after 70 years
- It is part of physiological manifestation of aging

Risk factors in Senile Osteoporosis:

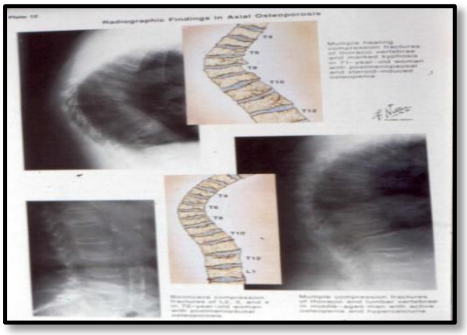
- Male menopause
- Dietary : less calcium and vitamin D and protein
- Muscle weakness
- reduced activity

Clinical Features of Osteoporosis:

- Osteoporosis is a Silent disease
- Osteoporosis is Serious due to possible complications :mainly fractures
- Osteoporosis does not cause pain usually
  pain comes with fracture especially femoral neck which can cause death, or vertebral fracture which starts with gradual back pain as a result of micro---fracture due to vertebral changes.
  Osteoporotic patients are 50% more prone to recurrent fractures.
- Osteoporosis causes gradual increase in dorsal kyphosis
- Osteoporosis leads to loss of height
- Osteoporosis is not osteoarthritis; but the two conditions may co---exist



How does kyphosis and loss of height occurs:



With osteoporosis the anterior part of vertebra narrows which leads to kyphosis and loss of height.

Can't be prevented

Osteoporotic Fractures:

- They are Pathological fractures (malignancies, cyst)
- Most common is osteoporotic compression fracture (OVC #s)
- Vertebral micro fractures occur unnoticed (dull ache)
- Most serious is hip fractures (increased vascularity → bleeding)
- Also common in wrist fractures (Colles fracture)

  colles fractures are distal radius fractures, characterized by dorsal angulation, radial deviation and impaction.

Secondary Osteoporosis:

- Drug induced :steroids (change the dose after one year to minimize side effects), alcohol, smoking, phenytoin (for Epilepsy Pt.),heparin
- Hyperparathyroidism, hyperthyroidism, Cushing's syndrome, gonadal disorders, malabsorption, mal nutrition
- Chronic diseases : RA, renal failure, tuberculosis
- Malignancy : multiple myeloma, leukemia, metastasis

Disuse Osteoporosis:

- Occurs locally adjacent to immobilized bone or joint
- May be generalized in bed ridden patients
- Awareness of and attempts for prevention (by moving the immobilized limb from time to time) are helpful

Osteomalacia vs. Osteoporosis

Osteomalacia	Osteoprosis
Any age	Post---menopause, old age
Pt. ill	Not ill
General ache	Asymptomatic till
Weak muscles	Normal
Looser zones	Nill
Alkaline ph increase	Normal
PO4 decrease	Normal

Prevention of Osteoporosis:

- Prevention of osteoporosis should start from childhood
- Healthy diet, adequate sunshine, regular exercise, avoidance of smoking or alcohol, caution in steroid use

- At some time in the past there was a recommendation of HRT (Hormone replacement Therapy) for post menopausal women ? And men; but now this is discontinued because of HRT side effects

Management of Osteoporosis:

- Drugs
- Exercise
- Management of fractures

Drug Therapy in Osteoporosis:

- Estrogen has a definite therapeutic effect and was used extensively as HRT but cannot be recommended now due to serious possible side effects
- Adequate intake of calcium and vitamin D is mandatory
- Drugs which inhibit osteoclast activities : e.g. Bisphosphonates like sodium alendronate (FOSAMAX , BONVIVA)
- Drugs which enhance osteoblast activities: bone stimulating agents like PROTELOS, FORTEO. The problem in this type of medications is the risk of malignancies.

Exercise in Osteoporosis:

- Resistive exercises
- Weight bearing exercises
- Exercise should be intelligent to avoid injury which may lead to fracture

Management of Fractures in Osteoporosis:

- Use of load shearing implants in fracture internal fixation instead of plating.

  In osteoporosis the fractures can heal but not like normal bones.

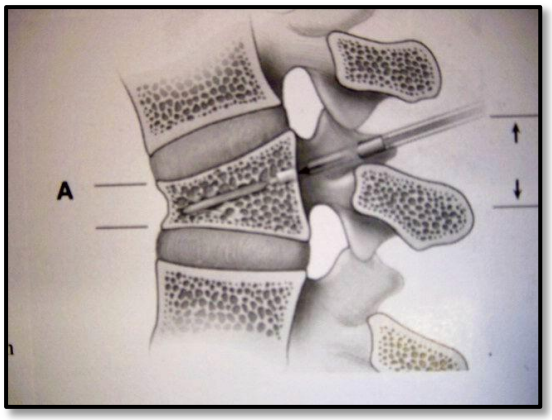
Vertebral Osteoporotic Compression Fracture:

Management of OVC Fractures:

- Pain relief
- Prevention of further fractures
- Prevention of instability
- Vertebroplasty
- Kyphoplasty

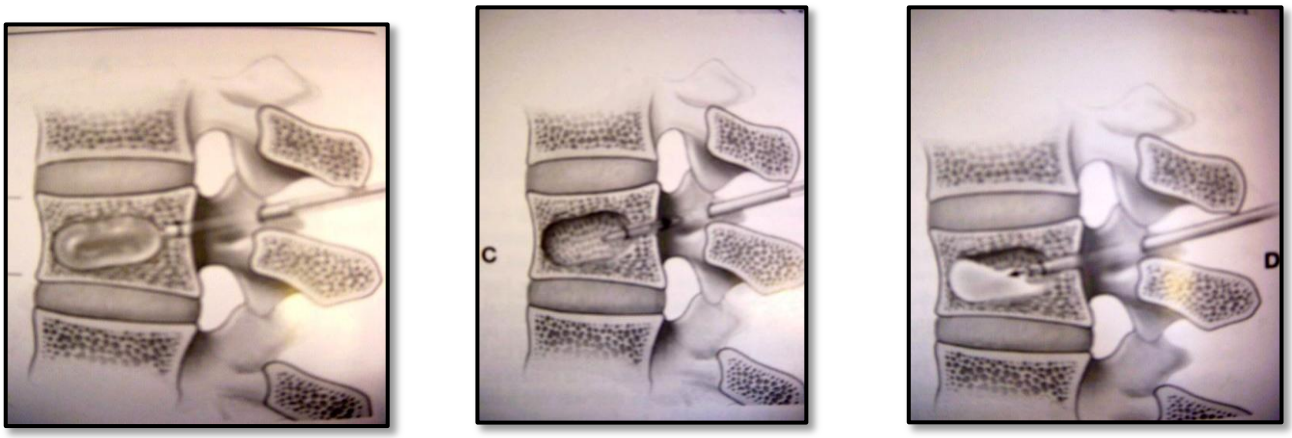
Vertebroplasty:

- Is the injection of bone cement into the collapsed vertebra
- The injection is done under X ray control (image intensifier) by experienced orthopedist or interventional radiologist
- It results in immediate pain relief
- It helps to prevent further OVF
- Possible complication is leakage of cement into spinal canal (nerve injury) or venous blood (cement PE)



Kyphoplasty:

- Is the injection of bone cement into the collapsed vertebra AFTER inflating a balloon in it to correct collapse and make a void (empty space) into which cement is injected
- It is possible that some correction of kyphosis is achieved
- It is safer because cement is injected into a safe void



Balloon Kyphoplasty

Hyperparathyroidism: (not included)

- Excessive PTH secretion : primary, secondary or tertiary
- Leads to increased bone resorption , sub periosteal erosions, osteitis manifested by fibrous replacement of bone
- Significant feature is hypercalcemia
- In severe cases : osteitis fibrosa cystica and formation of Brown tumours

Radiological changes in Hyperparathyroidism:

- Generalised decrease in bone density
- Sub---periosteal bone resorption (scalloping of metacarpals and phalanges)
- Brown tumors. Too much bone reuptake causing areas of empty bone with bleeding, this blood will accumulate like paste forming what calls brown tumors.
  DDx: multiple myeloma, metastasized cancer.
- Chondrocalcinosis (wrist, knee, shoulder)

Brown Tumors

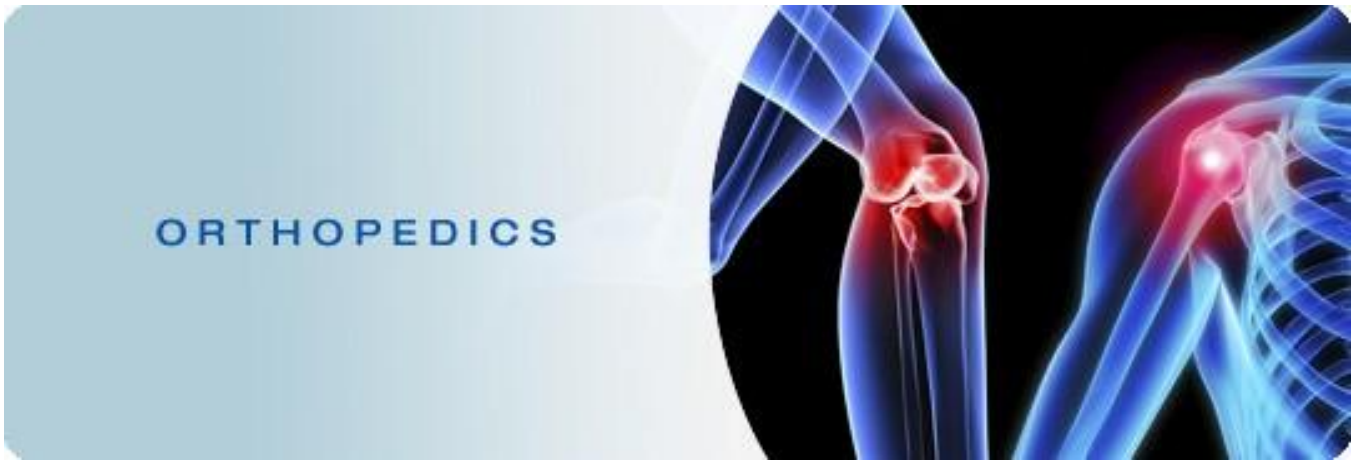
Management of Hyperparathyroidism:

By management of the cause :

- Primary hyperparathyroidism due to neoplasm (adenoma or carcinoma) by excision.
- Secondary hyperparathyroidism by correcting the cause of hypocalcaemia.
- Tertiary hyperparathyroidism by excision of hyperactive (autonomous)nodule, remove.
- Extreme care should be applied after surgery to avoid hypocalcaemia due hungry bones syndrome

Isn't it funny how someone can say "I believe in Allah " but still follow the Satan who by the way also, " believes " in Allah…

430 ORTHOPEDICS TEAM



Lecture : Sports and soft tissue Injuries.

Team Members:

Faten Al---Mohideb.	**Hanan Al---Salman.**	Aliya Al---Awaji.
Hadeel Al---Ghamdi.	Ghadeer Al---Wuhayd.	Hissa Al---Balla.
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Team Leader:

Ayedah Al---Ruhaimi.

---The slides were provided by the doctor**.**

---429 team group A---1 in **blue**.

---Important notes in **Red**.

---Copied slides in **Black**.

Doctor's notes in **green**.

By the end of this teaching session the students should be able to

- Specify the symptoms, signs and potential immediate complications of common sport and soft tissues injuries involving muscles, tendons, and ligaments for commonly injured joints; like shoulder, knee, and ankle.
- Outline the assessment and appropriate investigation and to outline the immediate and long term management of patients with muscles, tendons, ligaments and meniscus
- Demonstrate knowledge of indications for non---operative and operative treatment and to know the most common non---operative and operative measurements used for sport/soft tissue injuries.

Soft tissues injuries

- Muscle
- Tendon
- Ligament
- Meniscus
- Knee
- Shoulder
- Ankle

Muscle injury

- The muscles most at risk are those in which the origin and the insertion cross two jointse.g. quadriceps, hamstring muscles.
- Frequently injured muscles act in an eccentric fashion (i.e., lengthening as they contract). (eg. Squats: contracted quads while knee is flexed).
- Frequently injured muscles have a relatively high percentage of type II (fast---twitch) fibers.
- **Muscle strain**
- **Muscle Contusion**
- **Muscle Laceration**
- **Delayed---onset soreness**

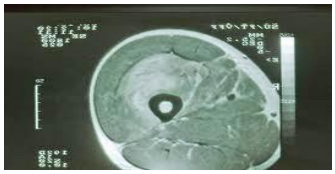
Most of muscle injury management is conservative, rarely need surgery.

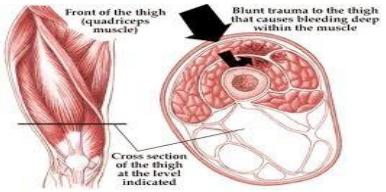
1: Muscle Strain متزززق عضلي

- The most common muscle injury suffered in sports.
- Immediate pain associated with diminished function.
- Both complete and incomplete muscle tears can occur by passive stretch of an activated muscle.
- Muscle tears also typically occur at or near to the myotendinous junction.
- Treatment
  - RICE,immediate measurement(to decrease edema).
  - NSAID
  - physical therapy

2: Muscle Contusion

- Caused by a nonpenetrating blunt injury (direct blow) to the muscle resulting in hematoma and inflammation.
- Quadriceps and Brachialis muscles are common involved regions.
- Clinical features:
  - Pain with active and passive motion +/_ swelling.
  - Decreased range of motion of joints





spanned by the injured muscles.

- Occasionally a permanent palpable mass(hematoma).

- Treatment:
  - **Short** period of immobilization (remember RICE).
  - Followed by early mobilization and Physiotherapy
  - NSAID

3: Muscle Laceration

- I&D followed by suture repair of the fascia, if possible.

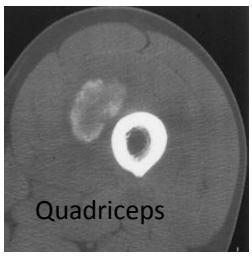
4: Delayed---onset soreness

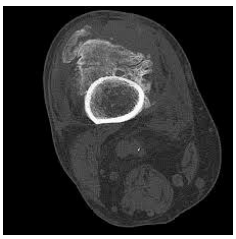
- Structural muscle injury leads to progressive edema formation and resultant increased intramuscular pressure.
- Is primarily associated with eccentric loading–type exercise. (eg. Squats)
- Clinical features: muscular pain that occurs 1---3 days after vigorous exercise.
- Treatment :
  - Will resolve in a few days
  - NSAID

Complications of muscle injures:

1) **Scar** formation and muscle weakness.
2) **Compartment syndrome**
   - At the level of the muscle fibers, capillary bleeding and edema can lead to hematoma formation and can cause compartment syndrome in areas in which the volume is limited by the fascial envelope.
   - Pt with Bleeding disorders is at high risk.(hemophilia, anti---coagulants use).
3) **Myositis ossificans (IMP)**

- Bone formation within muscle secondary to blunt trauma.
- It happens more frquently with muscle contusion because of hematoma→→ ossification.
- Clinical Features:
  - Early:
    - Pain, swelling and decreased ROM
    - Erythema, warmth, induration, tenderness,
  - Late: painless swelling with decreased ROM
- This sometimes mimics osteogenic sarcoma on radiographs and biopsy.
- Increased ESR and serum alkaline phosphatase.
- Myositis ossificans becomes apparent approximately 2 to 4 weeks post---injury.





Myositis ossificans near the bone.

Brachialis

Overuse Tendon injuries

- Function—To transfer force from muscle to bone to produce joint motion.
- Type of injuries
  1) **Overuse tendinopathies**
  2) **Tendon rupture**

1: Overuse tendinopathies

- Osteotendinous junction is the most common site of overuse tendon injury.
- Tendons are relatively hypovascular proximal to the tendon insertion. This hypovascularity may predispose the tendon to hypoxic tendon degeneration and has been implicated in the etiology of tendinopathies.
- Tendinopathy not tendenitis.

Most Common Diagnoses and Locations of Chronic Tendinopathies:

Diagnosis	Location
Rotator cuff Tendinopathy	Supraspinatus tendon insertion
Lateral epicondylosis (tennis elbow)	Common wrist extensor tendon origin (mainly involved ECRB)
Medial epicondylosis ("golfer's elbow")	Common wrist flexor tendon origin
Hamstring Tendinopathy	Hamstring tendon origin
Quadriceps Tendinopathy	Quadriceps tendon insertion
Patellar Tendinopathy (jumpers knee)	Patellar tendon origin
De Quervain's disease	Sheath/pulley of abductor pollicis longus
Achilles Tendinopathy	Sheath, midsubstance, or calcaneal insertion

Do empty can test.

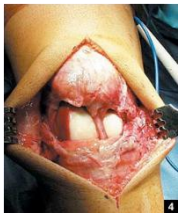
❖❖ TreatmentGoal: reduce pain and return function.

- Mainly is conservative Rx
  - Rest
  - Ice (Cryotherapy)
  - PT (stretching and eccentric strengthening)
  - Analgesics
  - Corticosteroids injection
  - Orthotics and braces
  - Other modalities: U/S, ESWT, iontophoresis and phonophoresis.
- Surgical treatment:
  - Failed conservative treatment (at least 3---6 months)
  - Excision of abnormal tendon tissue and performance of longitudinal tenotomies to release areas of scarring and fibrosis.

2: Tendon rupture

- Knee extensor mechanism
  - Quadriceps tendon
  - Patella tendon
- Achilles tendon
- Partial vs complete

High riding patella indicate patella tendon rupture.



Patella/Quadriceps tendon rupture

- Predisposing factors:
  - Steroid, chronic disease, and tendinopathy.
- Age: Patella<40>Quads
- Location: at the tendon attachment to the patella.

Physical examination:

- Tenderness at the site of the injury,hematoma, and a palpable defect in the tendon.Above patella if quads tendons and below patella if patella tendon rupture.
- They have extension lag: active extension is limited but passiveextention is okay.
- Unable to extend the knee against resistance or to perform a straight---leg raise.
- Xray
  - Patella---alta(supra)> P.T rupture
  - Patella---infera> Q.T rupture

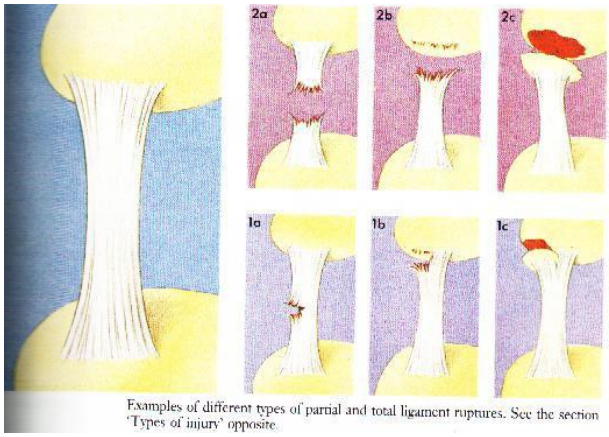
- RX: usually surgical.

Achilles tendon rupture(remember David Beckham)

- Most ruptures (75%) occur during sporting activities.
- Usually due to eccentric load, rupture occurs while performing actions requiring acceleration e.g. jumping, pushing off.
- Injuries happen during dorsiflexionwith contracted gastrocnemius muscle.
- History:
  - The patient reports a "pop" or the sensation of being kicked in the heelduring the injury.
  - weakness and difficulty walking.
- Examination:
  - Increased resting dorsiflexion with the knees flexed, a palpable gap, weak plantar flexion, and an abnormal Thompson test (lack of plantar flexion when squeezing the calf).
- Diagnosis is clinical, but MRI or ultrasound can confirm.
- Rx: usually surgically.

Knee ligaments injuries

mid--- substance tear of ligaments usually occurs in adult.
proximal avulsion usually occurs in pediatric age group in tibia because ligament is stronger than bone.



Examples of different types of partial and total ligament ruptures. See the section 'Types of injury' opposite.

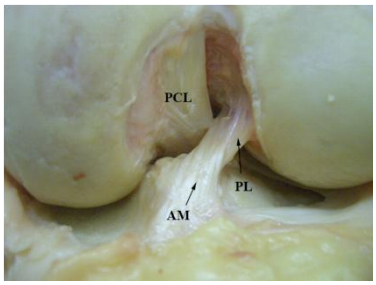
Anterior cruciate ligament injuries:common in soccer players

Anatomy

originates from between the tibial eminencespine to the medial surface of the lateral epicondyle.Needed when you change direction immediately or performing rough movements.

Mechanism of Injury

- Noncontact (70%) most common.twist knee (valgus and external rotation)or jump and land in wrong position.
  - Cutting or Pivoting (zig---zag movement)
  - Contact = MCL
- Sports---Related (80%) soccer sport.
- "Pop" sound (70%)
- Female: 2---4x > Male



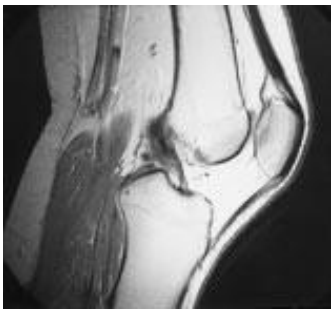
Diagnosis

- Symptoms:
  - Acute: "pop" sound &swelling (Hemarthrosis) is noted within a 1---2 days of the injury.
  - Chronic: Instability "giving way episodes"– توخوني رجلي
  - Pain if associated with meniscus tear
  - If the patient is walking straight on flat floor s/he will have no complain even with injured ACL. The problem when suddenly changing direction or walking on uneven floor→→insatbility.
- Physical examination
  - The patient need to be relaxed and comfortable.

- Must be compared with those of the normal knee.
- A moderate to severe effusion is usually present
- ROM: in acute injury the range of motion may limited by:
  - Pain
  - Effusion
  - Hamstring spasm,
  - ACL stump impingement,
  - Meniscal pathology.
- Special tests:
  - Lachman's test
  - Anterior drawer test.
  - Pivot shift test : is pathognomonic for ACL injury (best in the chronic setting).
- Investigations:
  - In acute stage: X---ray will be normal, it is done to rule out fractures.
    - MRI (ACL injury is a clinical diagnosis, no need for MRI except if suspecting other injuries).
- In the skeletally mature patient, the femoral insertion or midsubstance is usually the site of disruption.
- In the skeletally immature patient, the tibial attachment may be avulsed with or without a piece of bone.

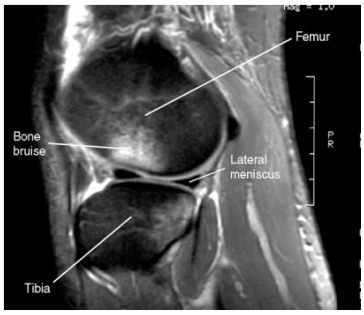
Tibial spine avulsion in pediatric(wedge shaped) , ACL is intact but the tibial attachment is avulsed , same symptoms and signs of torn ACL.

Segond fracture Avulsion of antrolateralcapsculeattachemt,pathognoic of ACL injury but it's a rare finding in x-ray. most common finding in ACL injury is



Normal ACL

Torn ACL



performed in acute stage and shows: bone bruise, posterior part of tibia hits thelateralfemoral condyle(kissing lesion).

Injuries associated with ACL disruption

- Injuries of the ACL rarely occur in isolation. The effects of other injuries, including:
  - Other ligament sprains (MCL)
  - Meniscal tears
  - Articular cartilage injuries
  - Bone bruises ,
- Complicate the treatment and eventual outcomes of ACL disruptions.
- Long term complications with meniscal damage results in early osteoarthritis (meniscal injury in young patients is major cause for ACL reconstruction in all young people).

❖❖ **Treatment**

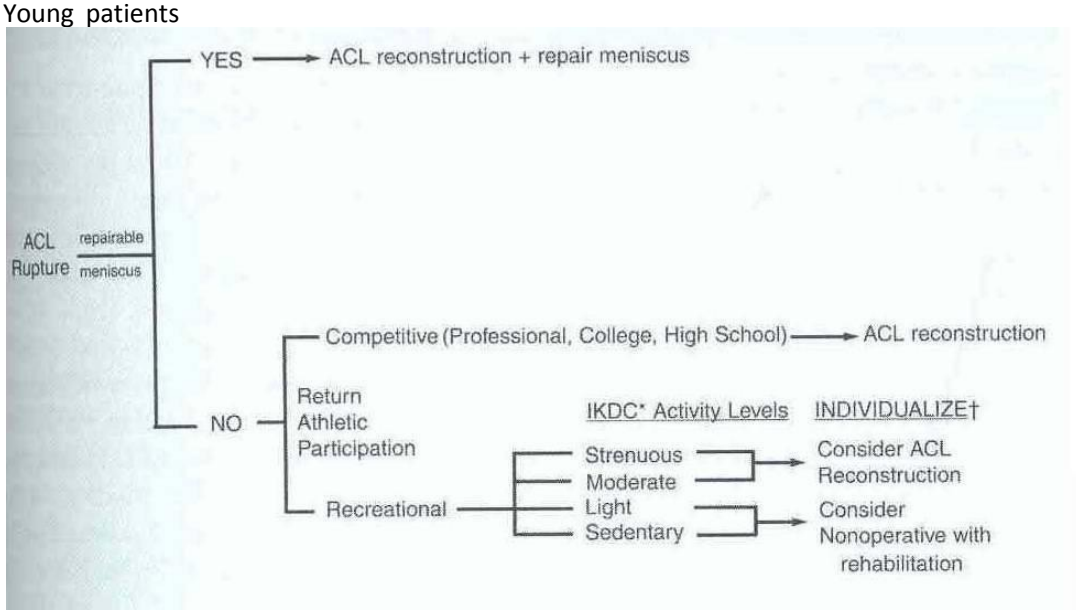
Nonsurgical treatment

- Appropriate for asymptomatic or old patients with partial injuries to the ACL.
- Older or less physically active may elect to modify their activities and proceed with nonsurgical treatment.
- Nonsurgical treatment involves rehabilitation to strengthen hamstrings and quadriceps, as well as proprioceptive training.
- Activity modification is also an important part of nonsurgical management, as patients who avoid cutting and pivoting sports are at lower risk for knee instability.

- ACL sports braces have not been shown to prevent abnormal anterior tibial translation.

Surgical (done for young and symptomatic patients)

- Reconstruction not repair.
- Athletes with ACL injuries rarely return to cutting and pivoting sports (e.g. basketball, football, soccer) without first undergoing surgery.
- For individuals who wish to return to such sports, surgery is generally recommended to avoid instability and secondary meniscal and/or articular cartilage damage.
- Individuals who work in occupations that may involve physical combat, such as police officers, or risk, such as firefighters, should have ACL reconstruction before returning to work.
- Most patients can function well and perform activities of daily living (ADLs) without instability after a complete ACL injury. However, some have difficulty performing even simple ADLs because of ACL deficiency---related instability, and they may require surgery.
- Young patients



Medial collateral ligament

- The main function of this complex is to resist valgus and external rotation loads.
- The tibial MCL is the most commonly injured ligament of the knee.
- Usually result from contact injury like a direct blow to the lateral aspect of the knee.
- Concomitant ligamentous injuries (95% are ACL)
- Concurrent meniscal injuries have been noted in up to 5% of isolated medial ligamentous injuries.

Physical examination

- Valgus stress test should be performed with the knee at 0° and 30° of flexion.
  - Laxity at 30°: isolated MCL
  - Laxity at both 0° and 30°: concurrent injury to the posteromedial capsule and/or cruciate ligaments.
- Rule out associated injuries (ACL and M. Meniscus)

Investigation

- Is a clinical diagnosis and most of the time dose not need further investigation.
- If the injury is sever or suspecting associated injuries (e.g. significant knee effusion) then the MRI will be modality of choice.

- Xray: to R/O fracture (lateral tibia plateau fracture)

Treatment

- Conservative Rx
  - Is the mainstay of treatment for the isolated MCL injuries
  - Crutches, RICE, and anti---inflammatory/pain medication.
  - No brace is usually required for partial tear
  - A knee brace is recommended for complete tear.
- Surgical Rx:
  - if failed conservative Rx + complete tear + associated with other ligaments injury

Lateral Collateral Ligament

- The LCL is the primary restraint to varus stress at 5° and 25° of knee flexion.
- Less commonly injuries than MCL
- Injuries to the lateral ligament of the knee most frequently result from motor vehicle accidents and athletic injuries.
- Rx:
  - Isolated injury: non operative
  - Combined injury: surgical

Posterior Cruciate Ligament

- Originates from lateral surface of medial epicondyle to posterior aspect of tibia.
- The PCL is the primary restraint to posterior tibial translation in the intact knee.

- Mechanism of injury
  - A direct blow to the proximal aspect of the tibia is the most common cause of PCL injury.
  - Dashboard injury
  - In athletes >a fall onto the flexed knee with the foot in plantarflexion, which places a posterior forces on the tibia and leads to rupture of the PCL.
- PCL insuffiency significantly increased the risk of developing medial femoral condyle and patellar cartilage degeneration over time.
- Rx
  - Non operative
  - Surgical if combined ligamnet injury

Knee dislocation

Multiligament Knee Injuries

Knee dislocation (IMP because it's a limp threatening condition)

- Multiligament knee injuries are usually caused by high---energy trauma and are often considered knee dislocations.
- Less frequently, low---energy trauma or ultra---low---velocity trauma in obese patients can also result in this injury pattern.
- Most patient will have spontaneous reduction.
- A bicruciate (ACL+PCL) injury or a multiligament knee injury involving three or more ligaments should be considered a spontaneously reduced knee

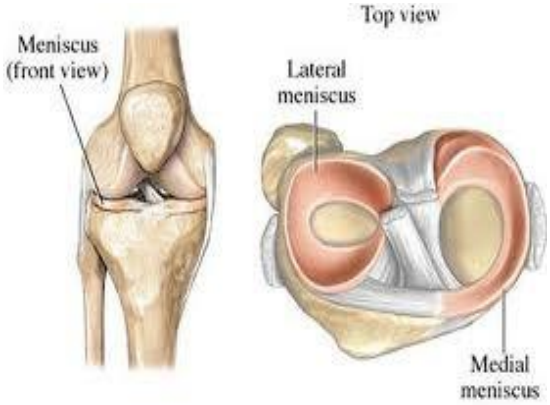
dislocation.

- A knee dislocation should be considered a limb---threatening injury, and careful monitoring of vascular status after the injury is imperative.
- Popliteal artery (estimated at 32%) or peroneal nerve injury (20% to 40%) also can occur.
- Vascular examination is critical in an acutely dislocated knee.
    - Pulse and ankle---brachial index (ABI) should be carefully assessed. An ABI of less than 0.90, and most certainly less than 0.80, should be considered abnormal.
    - If there is any concern about an abnormal vascular examination, there should be a low threshold for ordering an angiogram.
    - If pulses are still abnormal or absent following reduction of the dislocation, immediate vascular surgery consultation with intraoperative exploration should be the next step in management.
    - A vascular injury in a knee dislocation is a limb---threatening injury and needs to be corrected within 6 to 8 hours. If not corrected, amputation may be required.
- Neurologic examination is also critical, as peroneal nerve injury can occur with multiligament injuries, particularly in concomitant lateral/posterolateral corner injuries.
- emergent closed reduction and splinting or bracing should be performed immediately. Postreduction radiographs should be taken to confirm knee reduction.

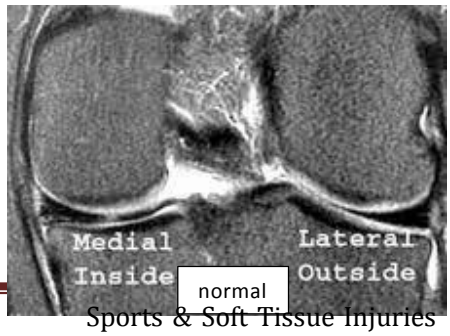
Meniscus Tear

Anatomy

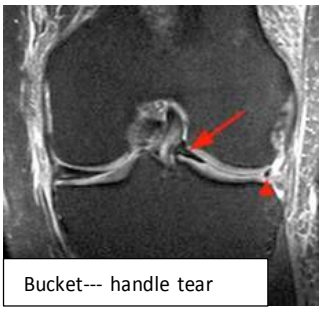
- The menisci are crescent---shaped, with a triangular appearance on cross---section.
- The lateral meniscus covers 84% of the condyle surface; it is 12 to 13 mm wide and 3 to 5 mm thick.
- The medial meniscus is wider in diameter than the lateral meniscus; it covers 64% of the condyle surface and is 10 mm wide and 3 to 5 mm thick.



- Meniscus function
    - The meniscus provides stability, absorbs shock, increases articular congruity, aids in lubrication, prevents synovial impingement, and limits flexion/extension extremes.
    - The most important function of the meniscus is load---sharing across the knee joint, which it accomplishes by increasing contact area and decreasing contact stress.
- Epidemiology of meniscus injuries
    - Meniscus injuries are among the most common injuries seen in orthopaedic practices.
    - Arthroscopic partial meniscectomy is one of the most common orthopaedic procedures.



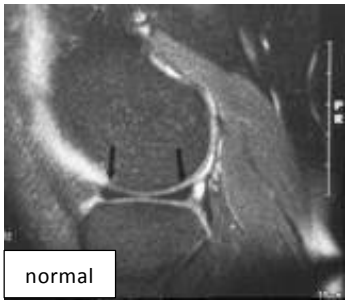
- Meniscus tears are unusual in patients younger than age 10 years.
- Most meniscus tears in adolescents and young adults occur with a twisting injury or with a change in direction.
- Middle---aged and older adults can sustain meniscus tears from squatting or falling.



Bucket--- handle tear

History:

- With an acute meniscus tear, an effusion may develop slowly several hours after injury. This differs from an anterior cruciate ligament (ACL) injury, where swelling develops rapidly within the first few hours.
- Patients with meniscus injuries localize pain to the joint line or posterior knee and describe mechanical symptoms of locking or catching.
- Pain in weight bearing and knee pending position e.g. squats.(في االلاصقة االتلدهشد)
- Chronic meniscus tears demonstrate intermittent effusions with mechanical Symptoms
  - In acute ACL lateral meniscal injury, in chronic ACL medial meniscal injury.



normal

Physical examination

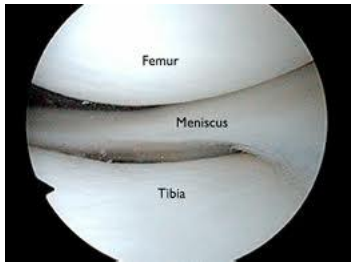
- Small joint effusions and joint line tenderness with palpation are common findings with meniscus tears.
- Manipulative maneuvers, including the McMurray and Apley tests, may produce a palpable or audible click with localized tenderness, but they are not specific for meniscal pathology.
- Range of motion is typically normal, but longitudinal bucket---handle tears may block full extension of the knee joint.

Tear in post. horn of meniscus.

- Standard knee radiographs should be obtained for evaluating for
  - Bone injuries or abnormalities.
  - Osteoarthritis.
- MRI remains the noninvasive diagnostic procedure of choice for confirming meniscal pathology.

Differential diagnosis

- Differential diagnosis Prior to MRI, several large studies demonstrated accuracy of the clinical diagnosis of meniscus tears to be 70% to 75%.
- The differential for meniscus tears includes intra---articular and extra---articular diagnoses.
  - Intra---articular possibilities include osteochondritisdissecans, medial patella plica, patellofemoral pain syndromes, loose bodies, pigmented villonodular synovitis, inflammatory arthropathies, and osteonecrosis.
  - Extra---articular possibilities include collateral ligament injuries, slipped capital femoral epiphysis, bone or soft---tissue tumors, osteomyelitis, synovial cyst, pes or medial collateral ligament bursitis, injury, reflex sympathetic dystrophy, lumbar radiculopathy, iliotibial band friction, and stress fracture.

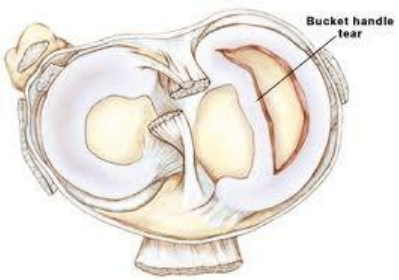


Treatment

Nonsurgical Management

- Not all meniscus tears cause symptoms, and many symptomatic tears become asymptomatic.

- Nonsurgical management can include ice, nonsteroidal anti---inflammatory drugs, or physical therapy for range of motion and general strengthening of the lower extremities, weight reduction.
- Surgical indications:
  - Failure of conservative treatment (more than 6 months).
  - Locked knee.
  - Concomitant ACL surgery.
  - Bucket---handle tear.



- Type of surgical intervention:
  - Excision (Arthroscopic partial/subtotal/ or total meniscectomy)
  - Repair

Ankle Sprain

- Ankle sprain is a common sports related injury.
- Lateral sprains (inversion) accounting for 85% of all such injuries.

Classification of Acute Lateral Ankle Sprains:

Grade	Description
I	**Mild** injury to the lateral ligamentous complex . No frank ligamentous disruption is present. Mild swelling, little or no ecchymosis on the lateral aspect of the ankle, and no or mild restriction of active ROM. Difficulty with full weight bearing is sometimes seen. No laxity on examination.
II	**Moderate** injury and partial tear to the lateral ligamentous complex. Restricted ROM with localized swelling, ecchymosis, hemorrhage, and tenderness of the anterolateral aspect of the ankle. Abnormal laxity may be mild or absent. May be indistinguishable from a grade III injury in the acute setting.
III	**Complete** disruption of the lateral ligamentous complex. Diffuse swelling, tenderness and ecchymosis on the lateral side of the ankle and heel.++ instability

History and physical examination

- History suggestive of inversion injury
- Localized tenderness, swelling, and ecchymosis over the lateral ankle.
- The anterior drawer test may demonstrate anterior talar subluxation.
- The talar tilt stress test may demonstrate positive tilt to inversion stress.
- If pain and patient can't walk do x---ray to rule out fractures.

Treatment

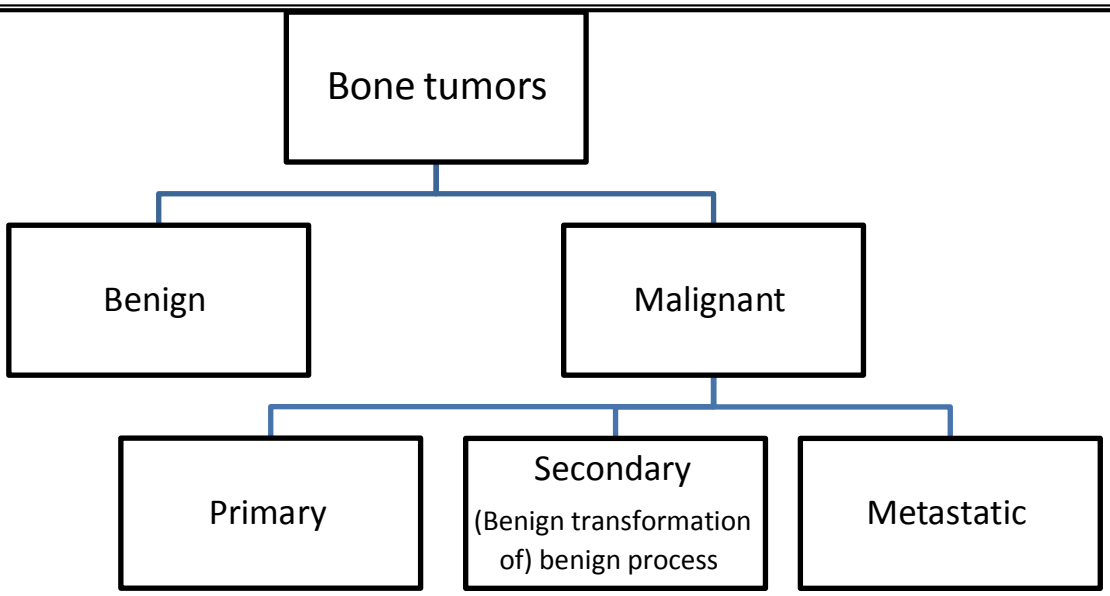
- Nonsurgical
  - Initial treatment consists of RICE.
  - Early weight bearing and use of a protective brace during functional activities facilitates recovery better than non–weight bearing or

immobilization.

- Functional instability may result and should be treated with a course of physical therapy and proprioceptive training.
- Residual mechanical instability may be managed effectively with bracing or taping.
- Patients may return to unrestricted activity when cutting, running, and hopping on the affected leg are no longer painful.
- Ninety percent of acute ankle sprains resolve with RICE and early functional rehabilitation.

- Surgical—Surgery is a reasonable option when an adequate trial of nonsurgical treatment fails to control symptoms for grade III.

Musculoskeletal Tumors

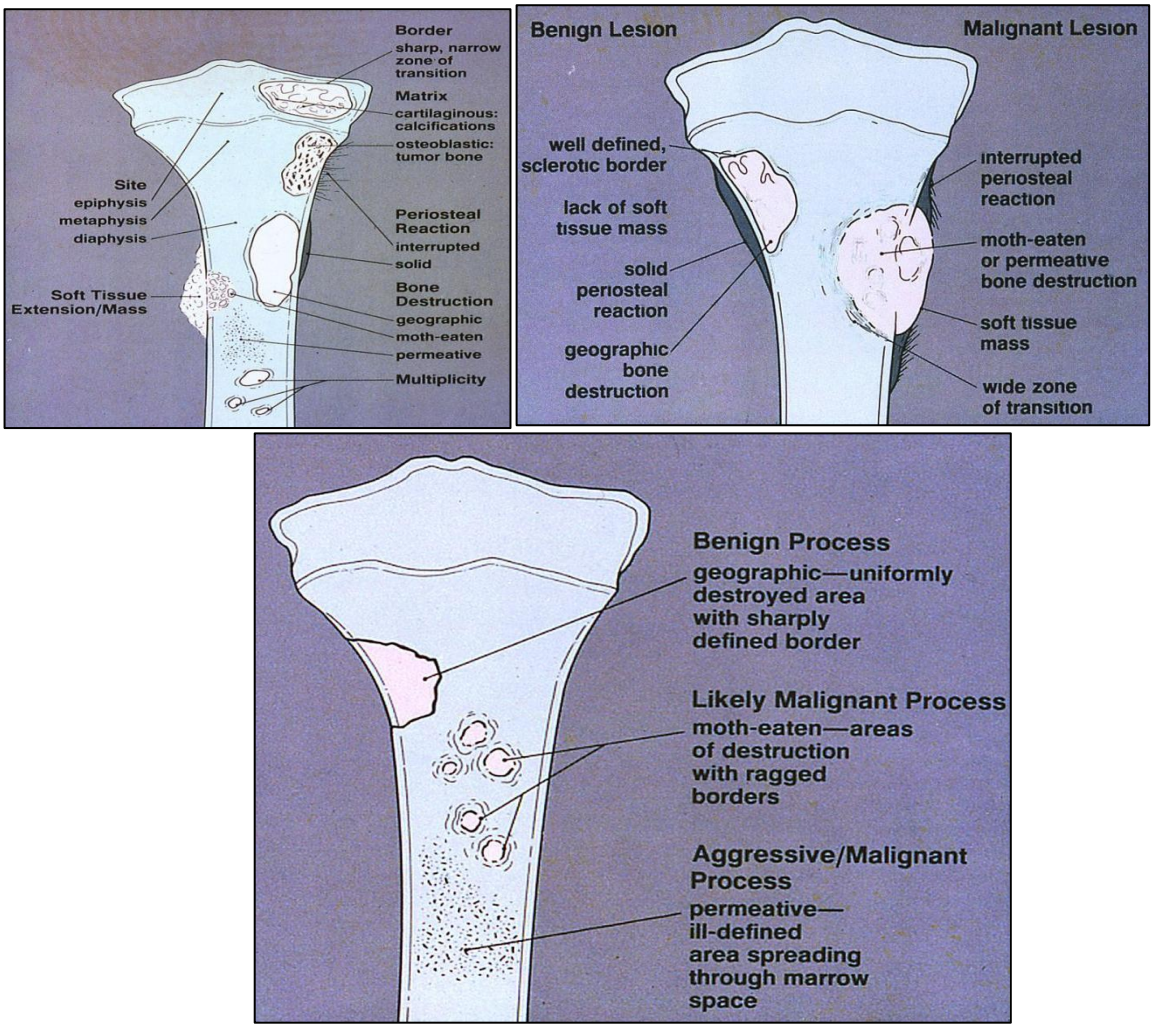


- Most common **bone Tumors** → BENIGN.
- Most common **benign** tumors → OSTEO CHONDROMA.
- Majority of **Malignant tumors** → METASTATIC of other tumors elsewhere in the body.
- Most common **primary malignant** tumors → M. MYELOMA THEN OSTEOSARCOMA.
- **Malignant Bone tumors** are called SARCOMA
- **Primary Malignant bone tumors** is minority
- **Benign bone tumors** do not invade the soft tissue nor do they affect the cortex
- Certain tumors have predilection for some bones (favorite places) it can recognized by X-ray.
  E.g.: **Ewing's sarcoma** most commonly in the DIAPHYSIS. **Giant cell tumors** are almost always found in a subarticular position, i.e. METAPHYSIC location.

◈ Classification according to the cell origin:

Bone (osteogenic)	Ostoidosteoma Osteoblastoma	Osteosarcoma (most common in epiphysis)
Cartilage (chondrogenic)	1- Enchodroma 2- Chondroblastoma	Chondrosarcoma
Bone & cartilage (both)	Osteochondroma	
Fibrous (fibrogenic)	Fibrous cortical defect	
Bone marrow (hematopoitic)	Gaint cell tumor	1- Multiple myeloma 2- Ewing's sarcoma (most common in diaphysis)
Unknown (lesion like tumor)	1- Simple cyst. 2- Aneurismal bone cyst (ABC).	
Metastasize		Metastasis

◈ How to describe bone tumors?

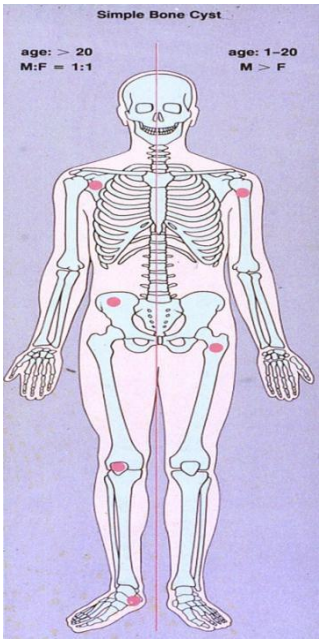


1- **Site:** Epiphysis, Diaphysis or Metaphysic whish most of the tumor arises from metaphysic.
2- **Centric** (away from the border) or eccentric (in the bone border).
3- **Border** of the tumor:
   a. Well define & sharp border → usually in benign tumors.
   b. Ill-defined →usually in malignant.
   c. Sclerotic margin: sign of benign tumors.
4- **Matrix** of the tumor :
   a. Sclerotic: it means forming bone .so on x-ray →opaque.
   b. Lytic: it means forming tissue other than bone (it may be cartilage, fibrous tissue or cyst) on X-ray →translucent.
   N.B. this calcification (lytic and sclerotic) helps in the differentiation b/w the tumors .i.e. you can't say from this calcification that this tumor is benign or malignant.
5- **Periosteal reaction** :
   -occur in some bone tumors:
      A. Characteristic periosteal reaction: mostly occur with malignant tumors (teeth like)
      B. Smooth periosteal reaction: with benign tumor.
6- **Geographic appearance** :
   Describe the tumor: e.g. oval shape, surface tumor, multiple tumor, etc.
7- **Soft tissue extension**: occurs mostly with malignant tumors or aggressive benign.

◈ Benign VS malignant:

Description	Benign	Malignant
Border	**Well-defined**	**Ill –defined**
Periosteal reaction (PR)	**Smooth PR**	**Characteristic PR**
Matrix	**Lytic or sclerotic**	**Lytic & sclerotic**
Soft tissue extension	**No**	**Usually**
Geographic app.	**Uniform shape**	**Doesn't have specific shape**
Symptoms	**Usually swelling, proceed the pain**	**Usually the pain proceed the swelling**

1) Simple bone cyst (unicameral cyst)



- The most common tumor like legion
- Usually in children age group up to 20 years old ,Male > Female
- After 20 Male=Female
- Not progressive

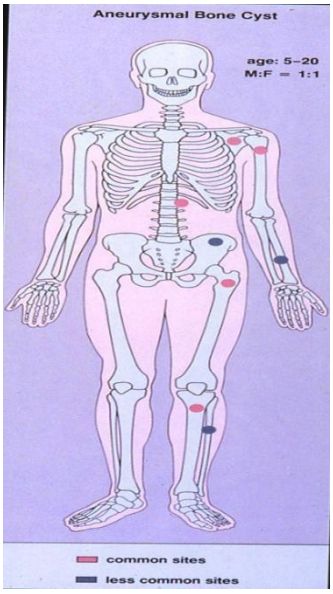
- **Sites**
  - Common in the end of long bones (e.g. proximal humerus).
  - Upper & lower femur
  - Pelvic (iliac crest)
  - Calcenum
  - Scapula
  - Patella

- **Presentation:**
  - The patient may present with pathological fracture → cause pain (after trauma , & cyst may correct after fracture)
  - **Usually its presentation is incidental**. (Most resolve within 2 yrs.)

- **Radiological feature** :
  - (x-ray is the main investigation in benign tumors)
    1. Metaphysic lytic lesion.
    2. Sclerotic margin, well define.

- **Treatment**
  - X-ray of pathological fracture in child age group
  - Nothing to do it except conservative treatment for the fracture ,& till the patient that you may have fracture in this area
  - The same fracture in older age with displacement & angulation
  - ORIF (Open Reduction and Internal Fixation) + Bone graft to fill the space

2) Aneurysmal bone cyst



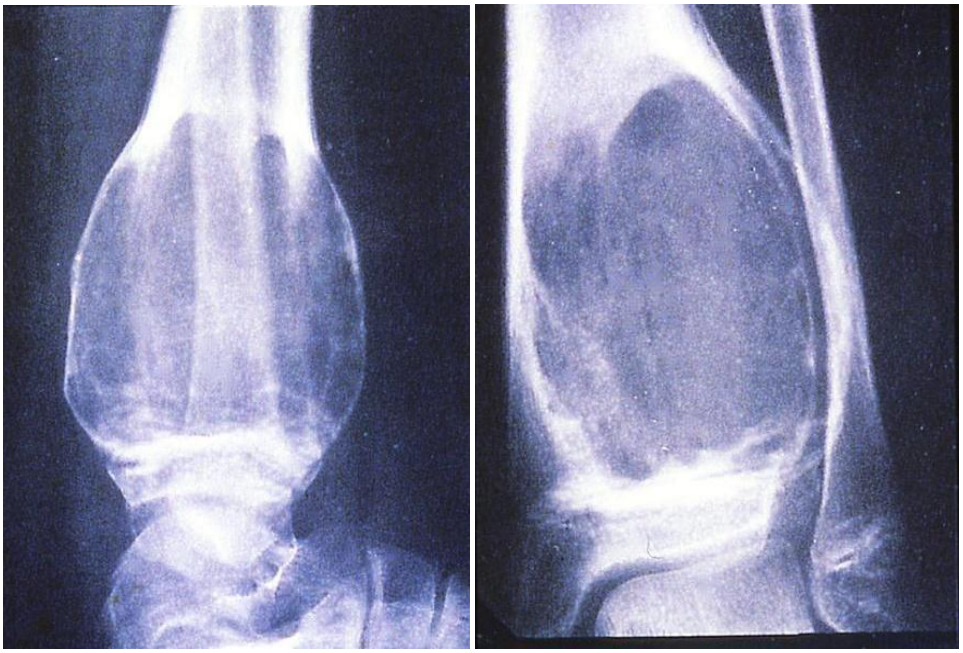
- Aggressive and balloon-like.
  - Progressive tumor like legion.
- Arteriovenous formation.
- Recurrence rate is high.
- Fusiform cyst.
- Aneurismal cysts have bloody content, while simple cysts have straw colored fluid.

■ **Site (common site):**
- Upper humerus.
- Upper femur.
- Spine (neural arch: lamina &pedicle) may give pressure effect.
- Proximal tibia.
- Scapula.

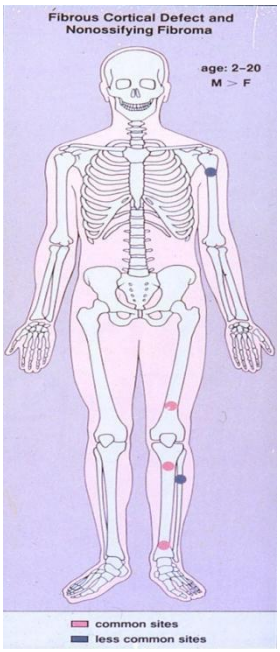
■ **Presentation :**
- The usual presentation is **swelling**.
- Patient may present with pathological fracture → pain.

■ **Radiological feature:**
- X-ray shows different content inside aneurysmal cyst unlike simple cysts.
- Metaphyseal lytic lesion.
- Well- defined, sclerotic margin.
- Expansile →thin cortex (like egg shell)

■ **Treatment**
- ORIF + BONE graft (from fibula as support BCZ lesion is very big)
- Sequestration = divide it to small champers
- Aspiration with alcohol ,phenol & steroid



1) Fibrous Cortical Defect (Non Ossifying Fibroma)



- **Benign** lesion since birth
- Not site for fracture.
- Never transfer to malignant.
- Ec-centric lesion.

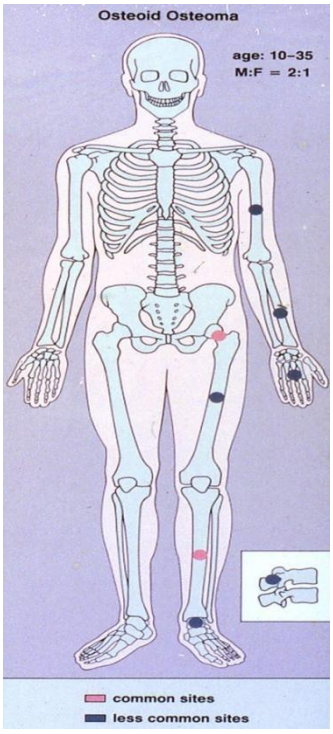
- **Site:**
  - Around knee: (lower femur, upper tibia).
  - Lower tibia.

- **Presentation :**
  - **Asymptomatic** (no pain, no swelling &no pathological fracture) →discovered incidentally.

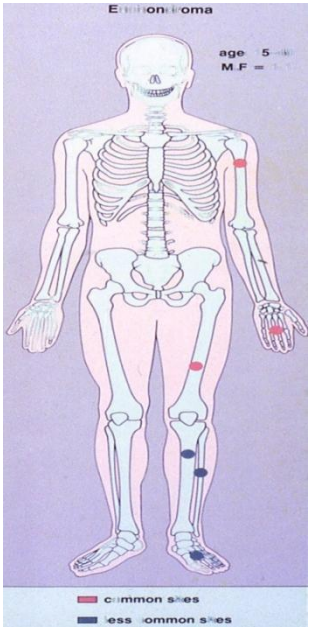
- **RADIOLOGICAL FEATURE :**
  - Metaphyseal lytic lesion (inside the cortex)
  - Well defined, sclerotic margin.

- **Treatment :**
  - Self-limited, healed by itself.
  - Reassurance is the Rx.
  - If pain-full → curettage +bone graft.

2) Osteoid Osteoma:



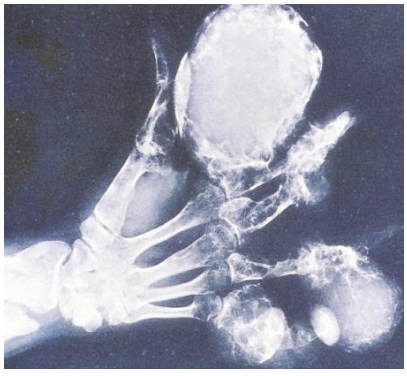
- Benign tumor which has different behavior → main presentation is pain.
- Usually affects young patients 10-35 and more common in males.
- May arise in the cortex of long bones, or occasionally in the cancellous bone of the spine and less commonly talus
  - **Presentation**
    - Usually well localized pain that is **worse at night** and prevents patients from sleep.
    - Character of pain :
      1. Pain at the site of tumor.
      2. Aggravated by activity.
      3. Relived by aspirin & NSAID.
  - **Radiological features :**
    - Metaphyseal or diaphyseal lesion.
    - Lytic lesion inside patch of sclerotsis.
    - The lytic lesion called ((nidus)) , nidus is the part which surrounded by a reactive zone of dense sclerotic *new bone formation*, therefore in the treatment →we **remove nidus only**.
  - **Investigation:**
    1. X-ray→ a nidus surrounded by a **thick cortex** (sclerosis).
    2. CT scan →nidus
    3. Bone scan used sometimes.→↑uptake.
  - **Treatment**
    - NSAIDs for 3-6 weeks
    - If not relived A CT-guided needle can be inserted in to the nidus and the lesion ablated with radiofrequency coagulation (also called radiofrequency ablation).
    - If it easy to access > excise it &lable it then send it to histopathologist to make sure all the lesion was excised

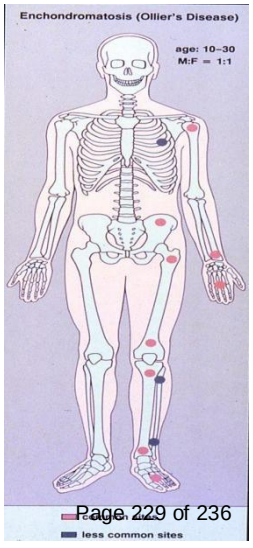


3) Endochondroma

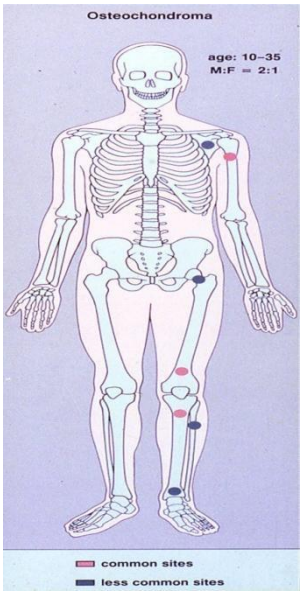
- 15-50 age group
- Tumor grows within the bone and expands it **(ballooning)**
- It composed of translucent hyaline cartilage and content inside is**chondroid**.
- The affected bone is expanded by the tumor and its cortex is thinned.
  - **Sites**
    - **Mainly small bone** e.g. phalangese in hand & foot …etc.
    - Fairly common in Femur, humerus and less commonly tibia &fibula
  - **Presentation**
    - Usually found incidentally
    - Swelling.
    - **Pathological fracture** which may cause pain.
    - Affect one side e.g. one hand
  - **Radiological features**
    - Metaphyseal or diphyseal lytic lesion.
    - Well defined.
    - Sclerotic margin.
    - Multicentric
    - Location and contents is different than aneurismal bone cysts. X- RAY of enchondroma is more hyperdense due to the chondroid.
  - **Treatment**
    - If it symptomatic (pain , become bulky) >> surgery (curettage + bone graft) and fixation
      N.B. any pathological, you must take a biopsy.

  - **Endochondromatosis**
    - Multiple enchondroma of the major long bones occur mainly in the rare condition called multiple enchonromatosis.
    - Benign ,affect both sides ,low grade destructive lesion
    - Usually starts in children, and carries a high risk of becoming a secondary tumor (malignant transformation).



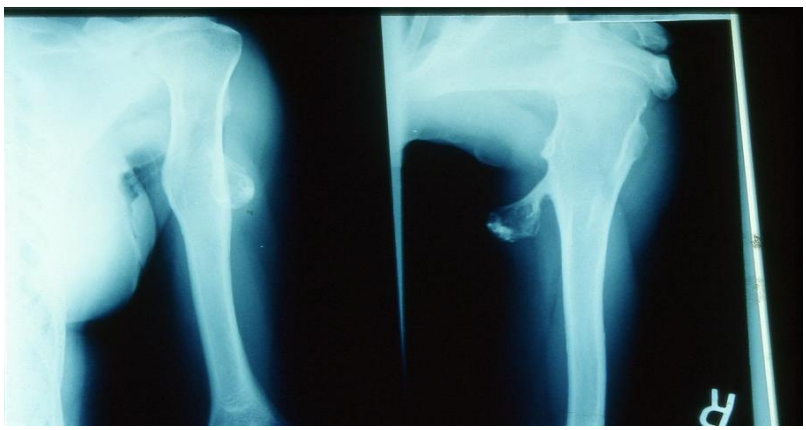


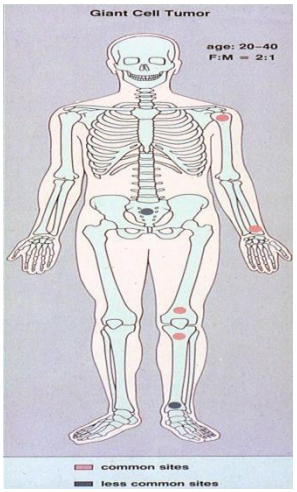
4) Osteo chondroma



- **Commonest benign tumor of bone**.
- The only surface tumor, (outside the bone) .therefore, we call it exostosis or pedunculated.
- It is acombination of both bone & cartilage.
- Usually in 10-20 age group and Male > Female.
- Painful in children due to growth plate compression and pressure effects on adjacent nerve or vascular structures.
  - **Sites**
    - The commonest are(around knee) distal femur + proximal tibia
    - Scapula, neck of femur.
  - **Presentation:**
    a. Swelling : it can reach huge size .(keeps on growing)
    b. Symptom of complication :
    1- Pressure symptom:
    - Pseudo-aneurysm.→ artery.
    - Hypothesis or parasethesia →nerve.
    - Rendering the movement → tendon.
    - Restrict the movement of the movement nearby the joint
    - Adventitia bursea.

    2- Fracture especially with pedunculated type.
    3- If transfer to malignant
  - **Radiological feature:**
    - Metaphyseal lesion.
    - Mushroom-like stalk of the bony tumor. (connected to the bone)
    - On x-ray the cartilaginous cap: which is the cartilaginous part of the tumor not seen (translucent).it is located around the bony part.
    - Direction of the tumor →away from the bone.
      - Start from the growth plate & in the direction of Ms. Tendon.
      - Stop growing when patient stop to growth usually at 18 yrs.
    - According to the shape of the neck of the tumor , we divide it into :
      1- Pedunculated type: has long & thin neck.
      2- Sessile type: has short & thick neck.
  - **Treatment**
    - Usually we do nothing, just reassure the patient.
    - Surgery (just excision , no need for bone graft b/c it is surface tumor) & the surgery is indicated in :
      a. When there is complication.
      b. Cosmetic.





5) Giant cell tumor

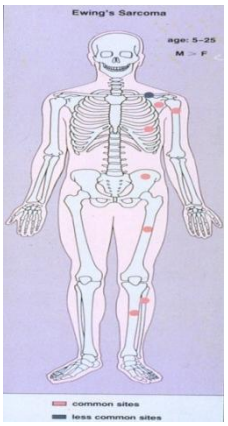
- From bone marrow
- Occurs most commonly in young adults, 20-40 age groups.
- Benign aggressive tumor.
- It's only the benign bone tumors that can metastases to the lung. So it's important to get chest x-ray.
- Origin: osteoclast, therefore it is sometimes called **osteoclastoma**.
- Very destructive tumor
  - **Sites**
    - Most common distal epiphysis of radius
    - Less common are distal tibia ,sacrum
    - Very bad one in sacrum because it will affect nerve roots
  - **Presentation**
    - Mostly patient present first with: pain, then swelling & later on pathological fracture.
    - Not clear
    - Osreopenia.
  - **Radiological feature :**
    - Epiphyseal lytic lesion.
    - No new bone formation b/c this new bone will be eaten by the osteoclast.
    - Ill define margin.
    - Radiograph shows lucent regions, lytic destruction of the bone with expansion of the cortex, without a sclerotic rim.
    - Ill-defined borders when aggressive or pre-malignant
    - Usually looks like a bone cyst, definite diagnosis made by biopsy.
    - No marginal sclerosis.
    - Soft tissue extension.
  - **Investigation :**
    - The assessment depends on :
      a. Soft tissue extension: by MRI.
      b. Joint extension: the articular cartilage is a very resistant against progression of the tumor from going to the joint.
      c. Bone extension: by CT scan.
      d. Further investigation :
        - Bone scan: for metastasis.
        - CBC: FOR ASSESMENT of general condition of patient.
        - Biopsy: for confirmation it doesn't convert to malignant tumor.

So, the tumor will not destruct the joint. But the surgeon during treatment will destruct the joint b/c he has to remove the entire region around the joint.

  - **Treatment**
    - No place for conservative treatment.
    - In general we do : excision followed by either : (depend on the site of the tumor)
      1- Bone graft.
      2- Prosthesis.
        a. If the tumor in non-weight bearing area (e.g. lower radius) → radical excision + bone graft + arthrodesis for nearby joint
        b. If the tumor in weight bearing area (e.g. lower femur) →excision + prosthesis (N.B. no bone graft here).

  - **Radiotherapy &chemotherapy are indicated in :**
      1- Frank malignancy.
      2- Recurrence of the tumor.
    - Recurrence rate is 50% ,it will be more aggressive with metastasis

1- Ewing's sarcoma



- Origin: from the **endothelial lining of the bone marrow canal**.
- Most of the Ewing's sarcoma is miss-diagnosed firstly as acute osteomyelitis. (Mimic the OA) because of systemic symptoms and elevated ESR.
- Young age group 5-25
- Pulmonary metastasis can occur.
  - **Sites:**
    - It is the only bone tumor which takes it origin **from diaphysis** → so; we will find a diaphyseal lesion.
    - The diaphyses of the femur are the most common sites, followed by the tibia and the humerus.
  - **Presentation :**

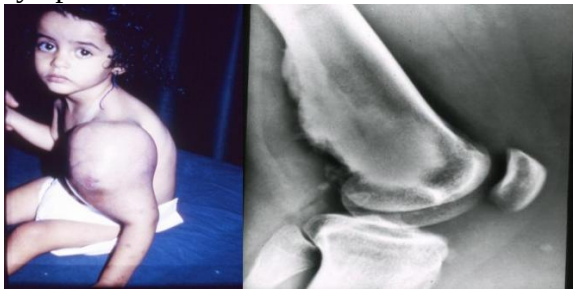
    Very characteristic:
    1- Febrile patient.
    2- High WBC's.
    3- Local Pain & redness
    4- Ulceration of skin.
    5- swelling

    } like the presentation of infection

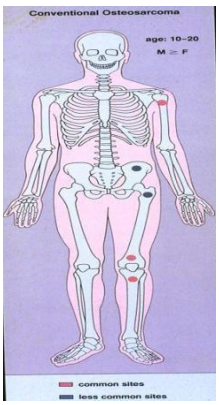
    + Scapula, less commonly clavicle.
  - **Radiological feature:**

    X-ray: peal onion reaction.

    --- You think it is AOM→YOU do aspiration for drainage of pus →there will be no pus &you will find tumor tissue →biopsy →Ewing's sarcoma.
    - So, it is a diaphyseal lytic lesion (not sclerotic).
    - Ill- defined.
    - Sometimes →soft tissue extension.
    - N.B: you can't differ it from osteosarcoma unless you do biopsy.
  - **Investigation :**
    - Definite diagnosis made by MRI and biopsy.
  - **Management**
    - In history usually asymptomatic unless it cause pressure in vital structures or in late stage
    - Blood investigations , ESR
    - Radiology (X-ray ,bone scan ,CT,MRI)
    - Biopsy –same surgeon who will do surgery should take the biopsy- To avoid contamination then spreading the tumor
  - **Treatment**
    - It is sensitive to chemotherapy
    - So start with chemotherapy –to decrease the tumor in size so it will be easy to excise it & to control metastasis (microcell) everywhere in the body as in bacteremia.
    - Tumor treated by operative excision and disarticulation and You may need amputation

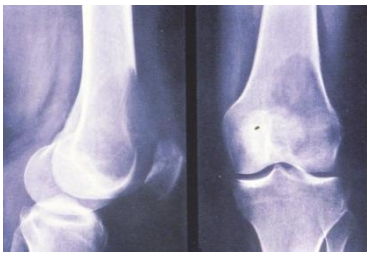


2- Osteo sarcoma

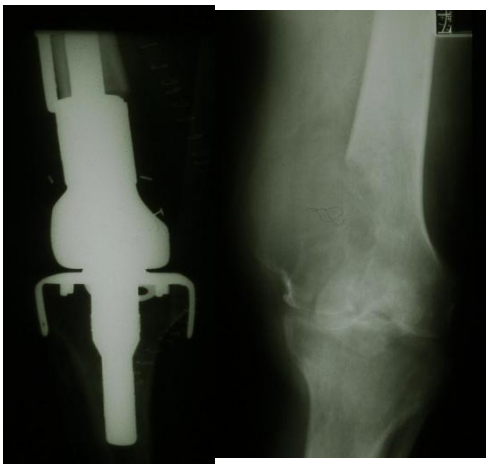


- Most common primary malignant tumor .{ remember the most common malignant tumor is metastatic }
- More common than Ewing's sarcoma
- 10- 25 year old and Male > Female
  - **Sites**
    - Arises from primitive bone-forming cells
    - Around the knee.
    - Common in the lower femur, upper tibia, and upper humerus.
    - Less commonly clavicle
  - **Presentation :**

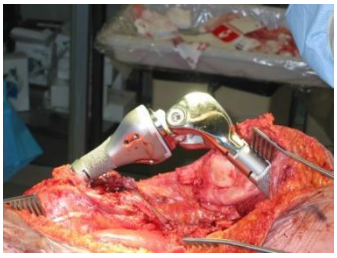
    - Patient present firstly with pain, then swelling, lastly pathological fracture (typical presentation of malignant tumor). Overlying skin is warm due to high vascularity.
    - May present as cachectic (in lated& advanced case).
  - **Radiological presentation**
    - Very dense
    - Irregular medullary and cortical destruction of the metaphysis.
    - Sun rise periosteal reaction (surrounded by low dense)
    - Could be lytic or sclerotic."mixed"
    - Ill defines no sclerotic margin.
    - Metaphyseal lesion.
    - Definite diagnosis made by biopsy



  - **Investigation :**
    1- CT scan = bone extension.
    2- MRI = soft tissue extension.
    3- Bone scan = metastasis.
    4- Searching for metastasis

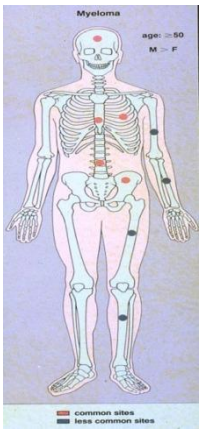


  - **Treatment**
    - Surgical intervention :
      1- **Limb salvage procedure**: which is radical excision of the affected bone & the affected compartements (e.g. flexor compartement of thigh , adductor compartment of the thigh … etc)around the bone + followed by reconstruction (reconstruction may be :prosthesis , bone graft , or bone cement) + lastly we do radiotherapy &chemotherapy .
      2- **Amputation** : is indicated:
         a. The whole compartment around the bone is involved (e.g. the flexor, adductor & extensor compartment of the thigh). If there the Vessels involved you can do bypass graft
         b. Pathological fracture.
      3- in all stages: chemotherapy → surgery → chemotherapy
      4- survival rate is 80 %



N.B. CHEMOTHERAPY TO AT LEAST ↓ED SIZE OF THE MASS.

3- Multiple myeloma



- Arise from plasma cells in the bone marrow. Plasma cells are responsible for antibodies production (gamma globulins).
- The most common primary malignant tumor.
- Arises from the plasma cells of the bone marrow
- Tumor of bone marrow, occurring in older adults > 50 and predominantly Males.
- **Bence Jones proteins test** found in 24-hour urine collection.
- Disseminates too many parts of the skeleton through the blood stream, thus usually multiple.

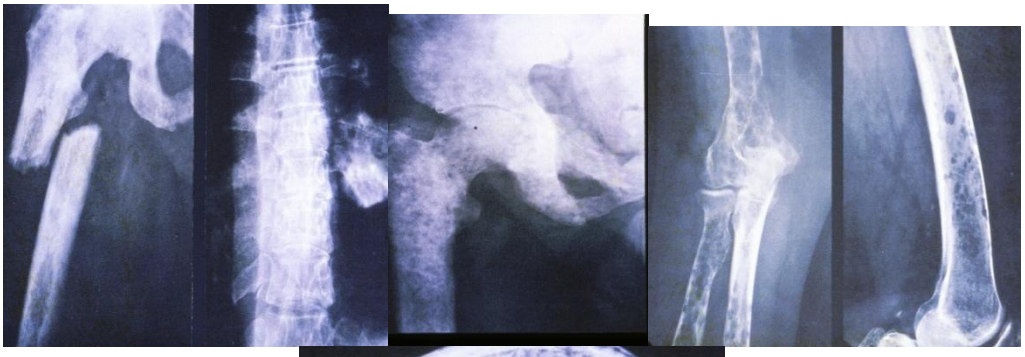
■ **Site:**
- Central bones (axial skeleton): skull, ribs, pelvic girdle. & spine.
- It may be solitary, multiple (commonest) or generalized osteoporosis (mylometosis: multiple myeloma + only generalized osteoporosis).

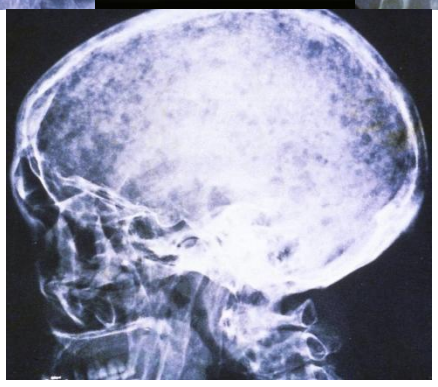
■ **Presentation :**
- Pt ill (decreased immunity)
- Sclerotic (no more elasticity) so more prone to fractures
- In skull there will be pepper (lytic) &salt (sclerotic)... {if sclerotic →un flexible →easy to fracture) mottled appearance).
- P.t came with bone ach (backache) + osteopenia.
- More common in periphery than center
- The only one definitive to diagnose it, is Bone marrow aspiration."Biopsy".

■ **Treatment**
- Bone marrow transplant
  - Success rate is 30%
  - Cost million $
- Radiotherapy.
- Chemotherapy.

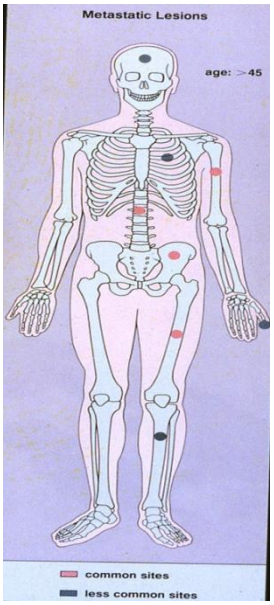
} all 3 done by oncologist.

- The rule of orthopedic surgeon is only when you have pathological fracture →do internal fixation.





4- Metastatic lesions



- Tumor outside the bone. The most common tumors are: prostate, thyroid, breast, lung and kidney.
- More than 45 in age, F<M.
- More common than primary tumors in later adult life.
- Affect SAME SITE which affected by multiple myloma.
- Take biopsy to know where is the primary
- If there is fracture do curettage first then fixation.

■ **Presentation :**

- Patient present & primary tumor is known & the patient is treating from it.
- May present with secondary metastasis. So, we have to search for the primary and try to treat it.
- Usually metastasis occurs in the highly vascular bones e.g. vertebral body, ribs, pelvis, upper end of femur, and humerus.

■ **Radiological feature :**

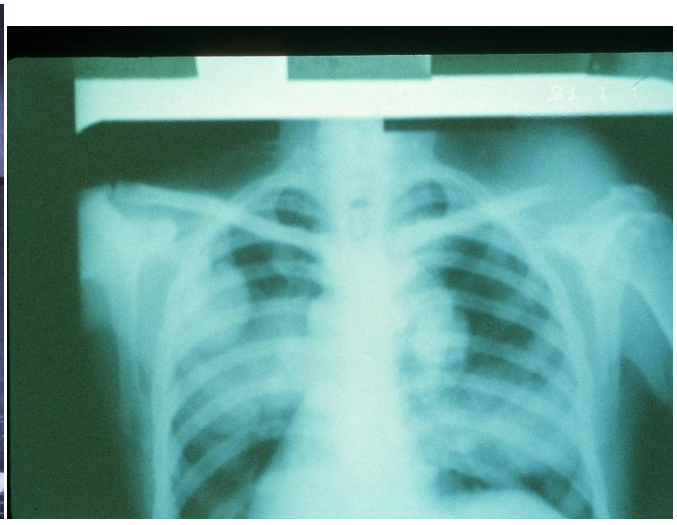
- It may be solitary or multiple (common) or just osteoporosis (called carcinomatosis).
- It differs from multiple myeloma because it may present with lytic or sclerotic lesion while the M.M only present with lytic lesion.
- If the primary tumor is from the **prostate** →the lesion will be **sclerotic**.
- If the primary tumor is from the **breast** → the lesion will be **lytic**.

■ **Investigation :**

- Same as Multiple myeloma
- X-ray shows decreased bone density (bone eaten away) with thinning of the cortex. Resembles bone cysts but the age group directs the diagnosis.
- Metastasis usually of the lung → sarcoma
- CT- scan of the chest performed for definite diagnosis.

■ **TREATMENT :**

- Same as Multiple myeloma



Some IMP Notes From 427

All bone tumors all metaphyseal except:

1- Osteoid osteoma: metaphyseal + diaphyseal.
2- Enchondroma: metaphyseal + diaphysis.
3- Chondroblastoma + giant cell tumor: epiphysis.
4- Ewing's sarcoma: diaphyseal tumor.

Most of the tumor occurring in children or growing age (>25) except:

1- Osteoid osteoma: 10-35.
2- Osteoblatoma: 10-35.
3- Osteochondroma: 10-35.
4- Enchondroma: 15-40.
5- Giant cell tumor: 20-40.
6- Multible myeloma & metastasis: old age <50.

Most of the tumor occurs more common in male except:

- Giant cell tumor: F<M.
- MUTIPLE myeloma +metastasis: f <m
- Simple bone cyst +ABC+ enchondroma: F=M.

Benign tumor that may transfer to malignant:

1- Osteoblastoma.
2- Osteochondroma.
3- Giant cell tumor.
4- Chondromatosis.

- Metastatic tumor more common than primary tumor.
- Most common primary benign tumor: osteochondroma.
- Most common primary malignant tumor: multiple myeloma then osteosarcoma.

Important tumors (study them very well)

1- Simple cyst.
2- Know the difference between osteblastoma& osteoid osteoma.
3- Enchondroma&condroblastoma: بلعرياطلا
4- Osteosarcoma: مهأيش
5- Ewing sarcoma: pay attention to its presentation.
6- Multiple myeloma: pay attention about it investigation.