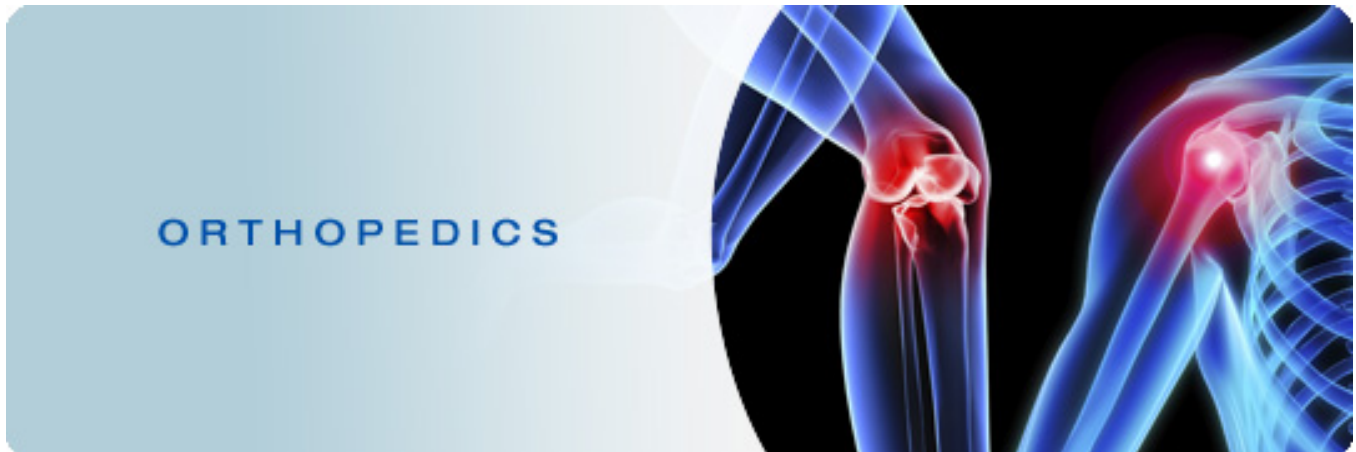


Isn't it funny how someone can say, "I believe in Allah " but still follow the Satan who by the way also, " believes " in Allah...

## 430 ORTHOPEDICS TEAM



### Lecture: Principles of Fractures and Common Adult Fractures.

#### Team Members:

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.

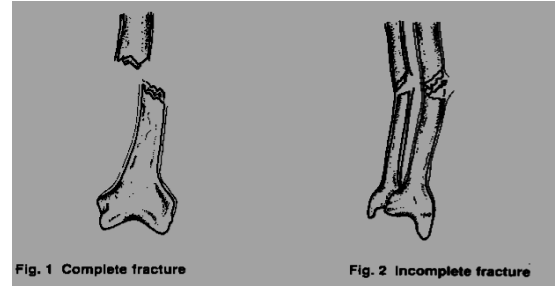
-Important notes in **Red**.

-Copied slides in **Black**.

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

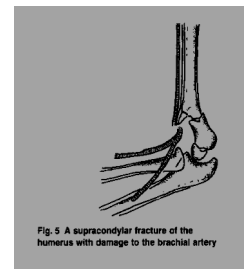
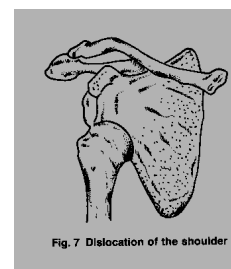
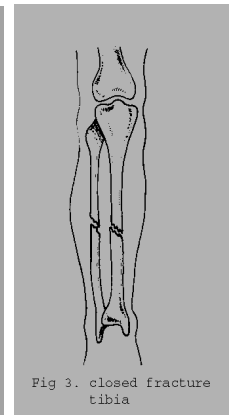
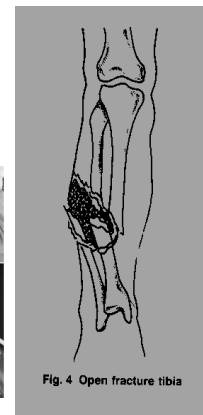
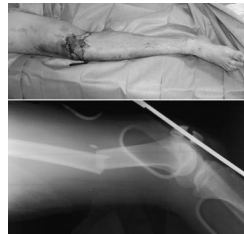
## Principles of Fractures:

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



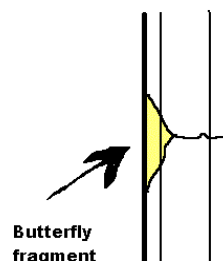
## Definitions:

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).



## Mechanisms:

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



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 Cancellous Bones (Spongy bones):**

- Direct force
- Indirect force:
  - **Comminuted Pattern**
  - **Burst**

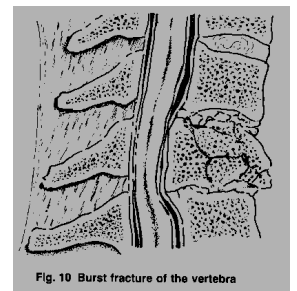


Fig. 10 Burst fracture of the vertebra

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

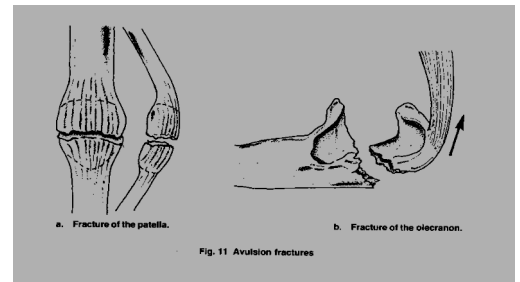


Fig. 11 Avulsion fractures

- 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:**

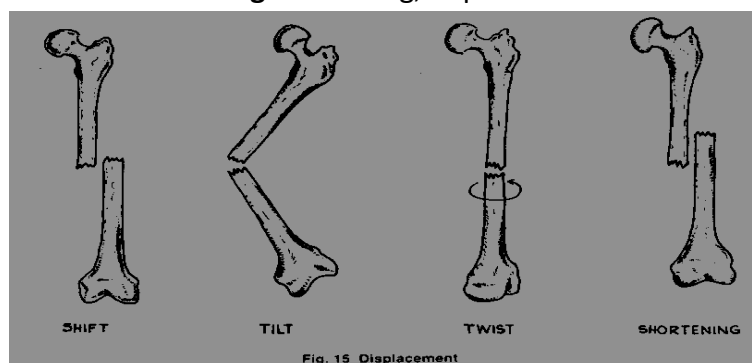
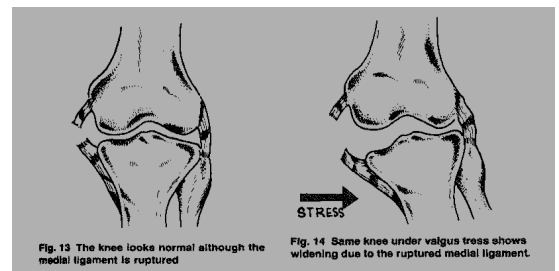
- **Two orthogonal views** (AP & Lateral).
- **Two joints** (Above & below #).

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

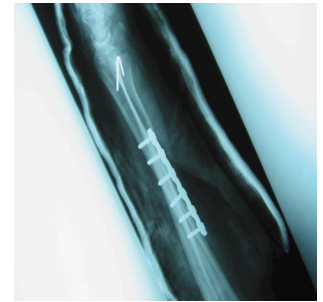




## Repair of Fracture:

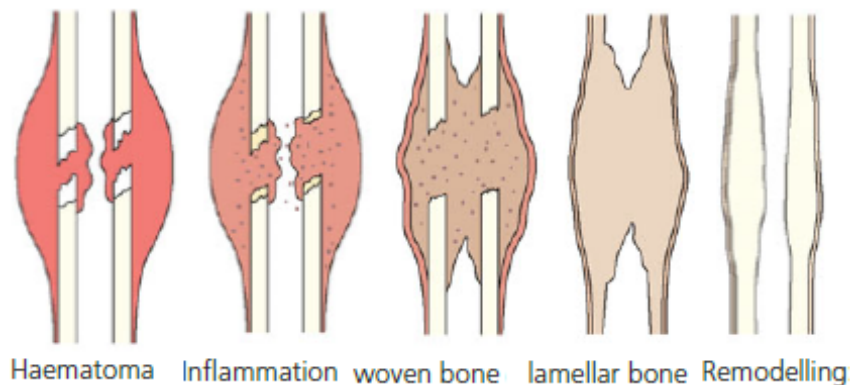
### a. Primary repair:

- **With Rigid Internal Fixation** (open the fracture take out the hematoma and fix the bone in place)
- **No Callus formation**
- **Active Haversian remodeling**
- **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)
- **Commonest type even with internal fixation** (In lower limb 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	3 weeks	6 weeks
	Transverse	6 weeks	12 weeks
Lower Limb	Spiral	6 weeks	12 weeks
	Transverse	12 weeks	24 weeks

## Fracture in children

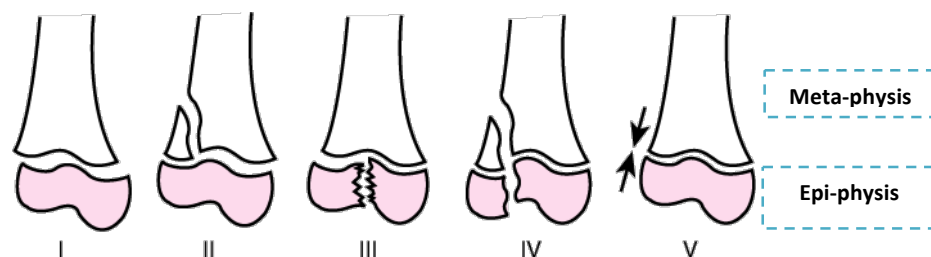
- Different from those in adults.
- Children's bones are more malleable, allowing a plastic type of "bowing" injury.
- The periosteum is **thicker** than in adults and usually remains intact on one side of the fracture (**greenstick fracture**) which helps to:
  1. stabilize any reduction,
  2. decreases 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 remodeling 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** (Osteogenesis imperfecta).
  2. **Infection** (osteomyelitis).
  3. **Fracture through a cyst.**
  4. **Metabolic diseases** (Osteoporosis, Osteomalacia, Paget's 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
- **LOCAL AIM:** Rapid recovery of the injured part and its function
- **GENERAL management:**
  - Life threatening Injuries (Shock , Head, Chest, Abdomen)
- **LOCAL management** Dangers to viability:
  - Ischemia
  - Infection
- **How to save function?**
  1. Reduction
  2. Immobilization
  3. Soft tissue treatment
  4. functional activity & rehabilitation

#### **Complications of fractures**

- **Bony 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:**

- **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



Coxavara

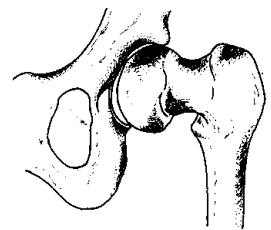


Fig. 43 Malunited fracture

**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 talus** and **head of femur**.
3. Plane radiographs shows bone sclerosis and none or delayed union.

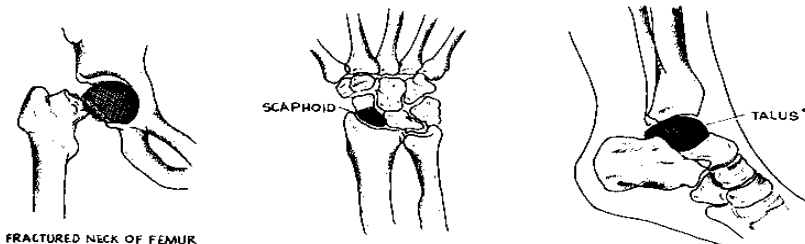


Fig. 44 Common sites of avascular necrosis



**Myositis Ossificans:** “not inflammation of the muscle! “

Sustaining a blunt injury that causes deep tissue bleeding which lead to bone formation outside 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)

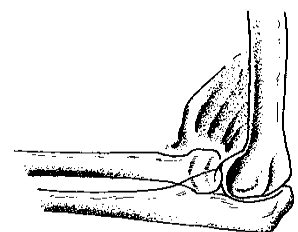


Fig. 45 Myositis ossificans of the elbow

- 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 Ossificans Progressiva.**”



### **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!
- Severe 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:

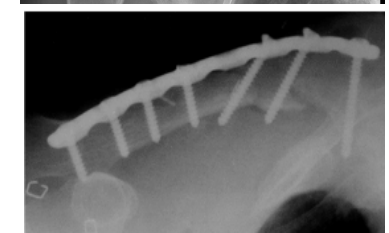
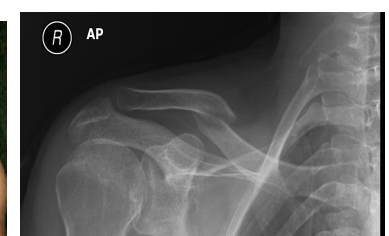
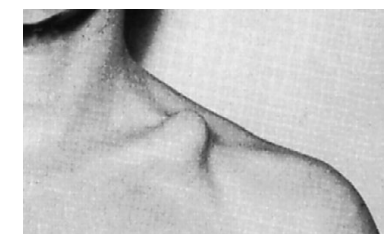
- splinting of the affected extremity, with the arm adducted (the patient is **trying to support it with the other arm**)
- Assess for skin integrity
- neurovascular examination is necessary
- The chest should be auscultated (**pleura are near to fracture site**→ **pneumothorax**)

#### 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%)

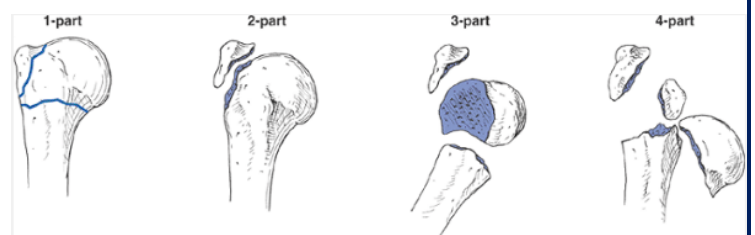
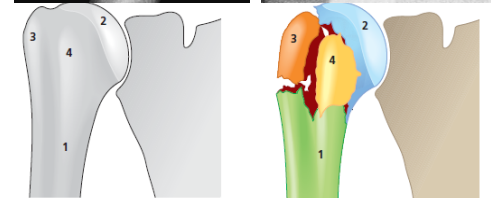
#### Clinical evaluation:

- 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**.



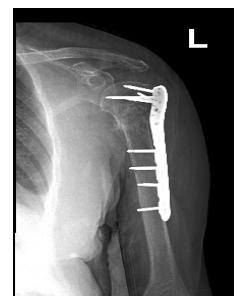
#### Radiographic evaluation:

- 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 humerus 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 the involved forearm (**think about compartment syndrome, it's the second most common site after the tibia**).
- A careful NV exam
- Open wound
- Compartment syndrome

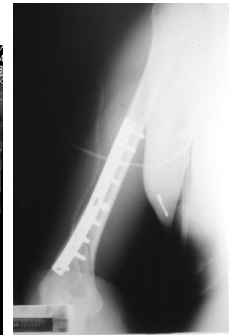
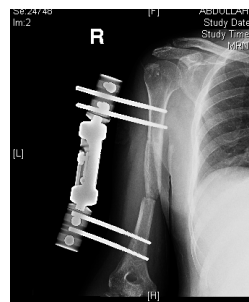
#### **Radiographic evaluation:**

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

#### **Classification (Descriptive):**

- Closed versus open
- Location
- Displacement

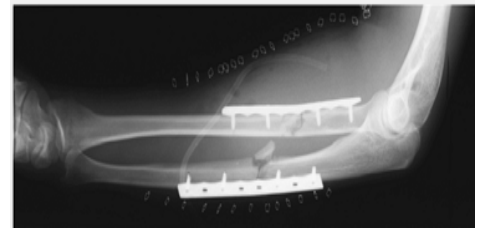
#### **Treatment:**



- **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.

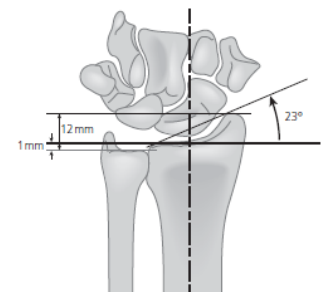
#### Clinical evaluation:

- 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.



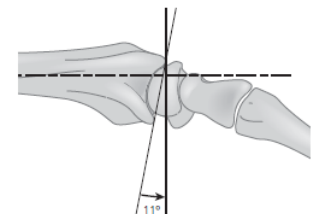
#### Radiographic evaluation:

- 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.

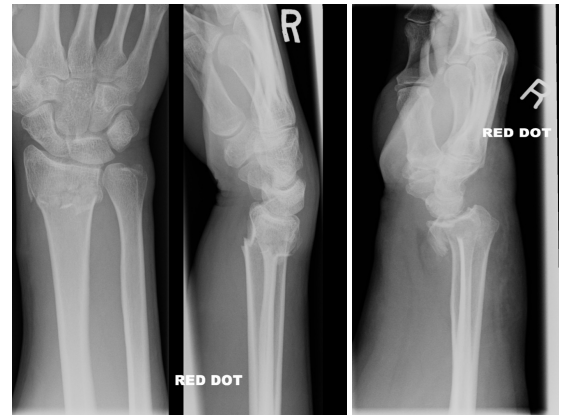
**Smith's fracture (reverse Colles' fracture):**

"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.

**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.



Colles' #

Smith's #



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).



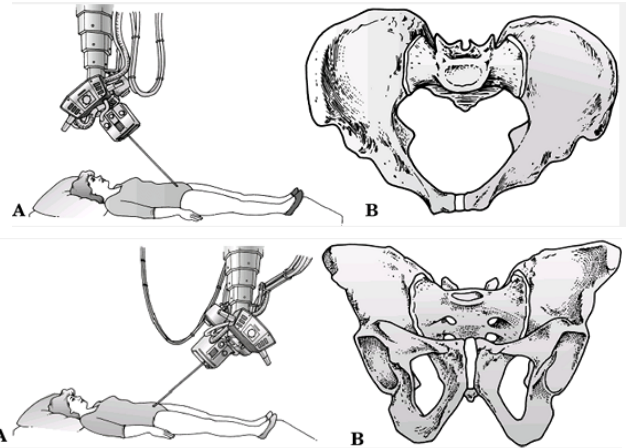
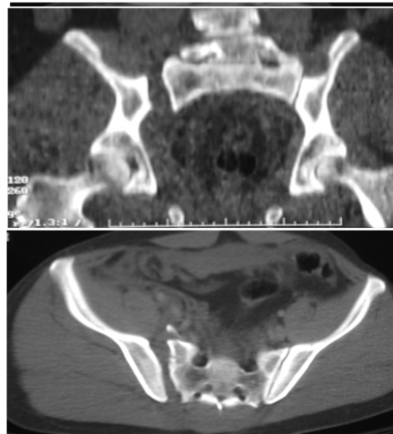
#### **Classifications:**



**Figure 20. Illustration of the Tile Classification of Pelvis Fractures**

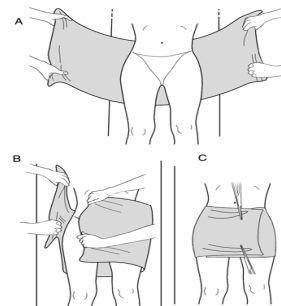
### Radiographic evaluation:

- AP of the pelvis
- Inlet radiograph to see the ring from inside
- Outlet radiograph
- CT



### Management:

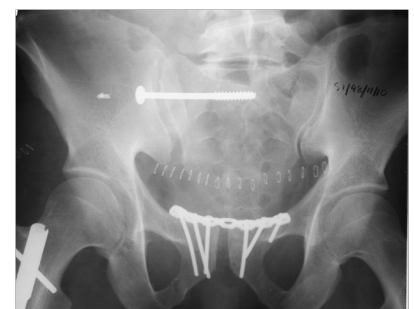
- ATLS guidelines
- **Type A:** Conservative treatment



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



Type B



Type C

### Complications:

- Hemorrhage (hypovolemic shock, life threatening)
- Infection 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:**

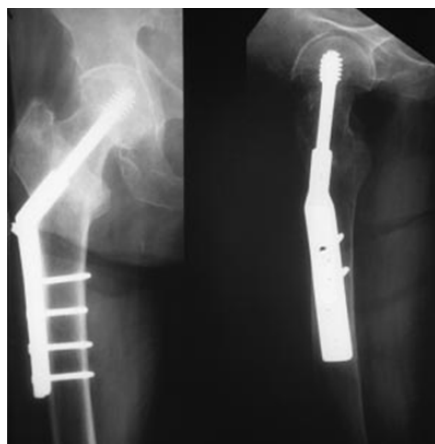
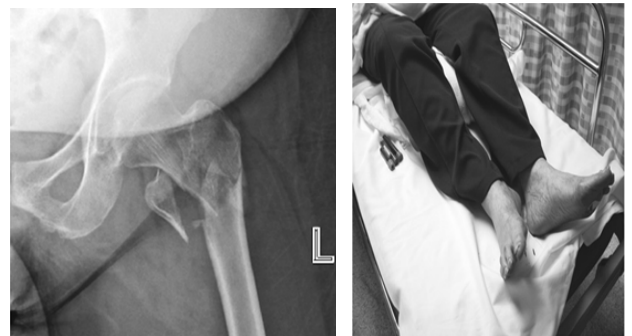
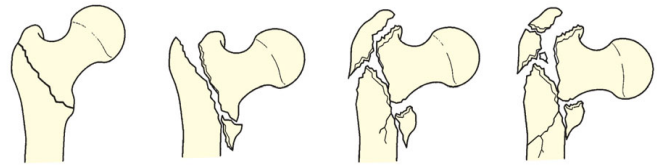
- Inability to bear-weight
- Limb is short, abducted and externally rotated

**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 in intertrochanteric 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**

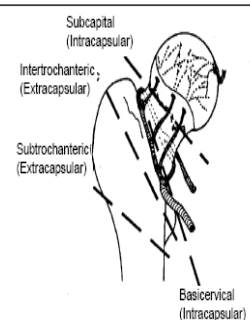


Figure 21. Blood Supply to Femoral Head and Fracture Classification

supply to leading to avascular necrosis of the femoral head.

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

#### Treatment:

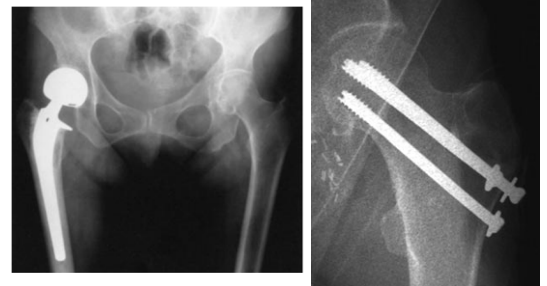
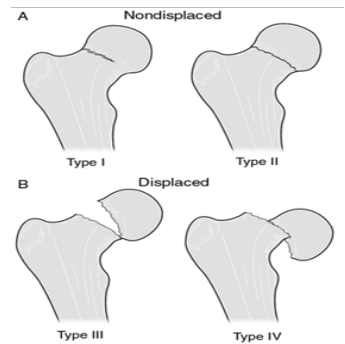
- **Only surgical**
- **Fixation:** nondisplaced, displaced and young (45-55 yrs)
- **Replacement:** displaced and elderly

#### 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 joints)

#### Treatment:

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



IM nail

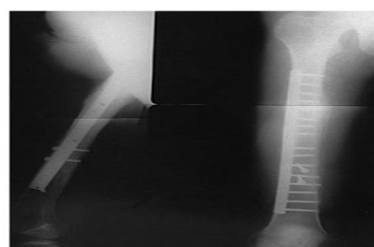


Plate fix (not the ideal).

➤ **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 common 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

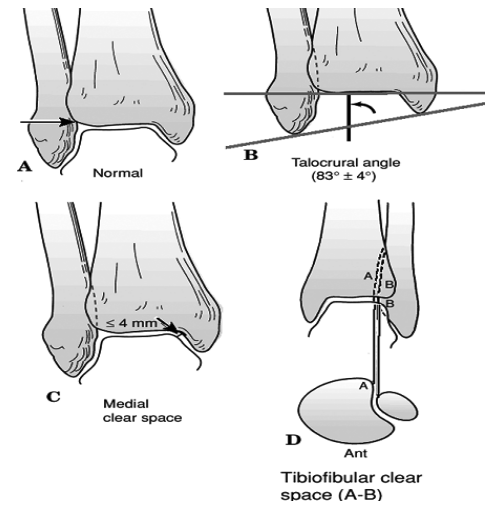
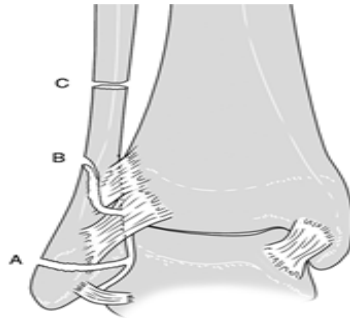
#### **Denis –Weber classification:**

- 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