Common Adult fractures

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objectives

- At the end of this lecture the students should be able to:

- know most of mechanisms of fracture injury
- make the diagnosis of common adult fractures
- request and interpret the appropriate x-rays
- initiate the proper management of fractures
- know which fractures can be treated by conservative or operative method
- know the possible complications of different fractures and how to avoid them.

Upper limbs fractures

- Clavicle
- Humeral

  (Proximal , shaft)
- Both Bone forearm

  (Radius, ulna)
- Distal Radius

Mechanism of Injuries of the Upper Limb

- Mostly **Indirect**
- Commonly described as “ a fall on outstretched hand “
- **Type** of injury depends on
  - position of the upper limb at the time of impact
  - force of injury
  - age

Fracture of the clavicle

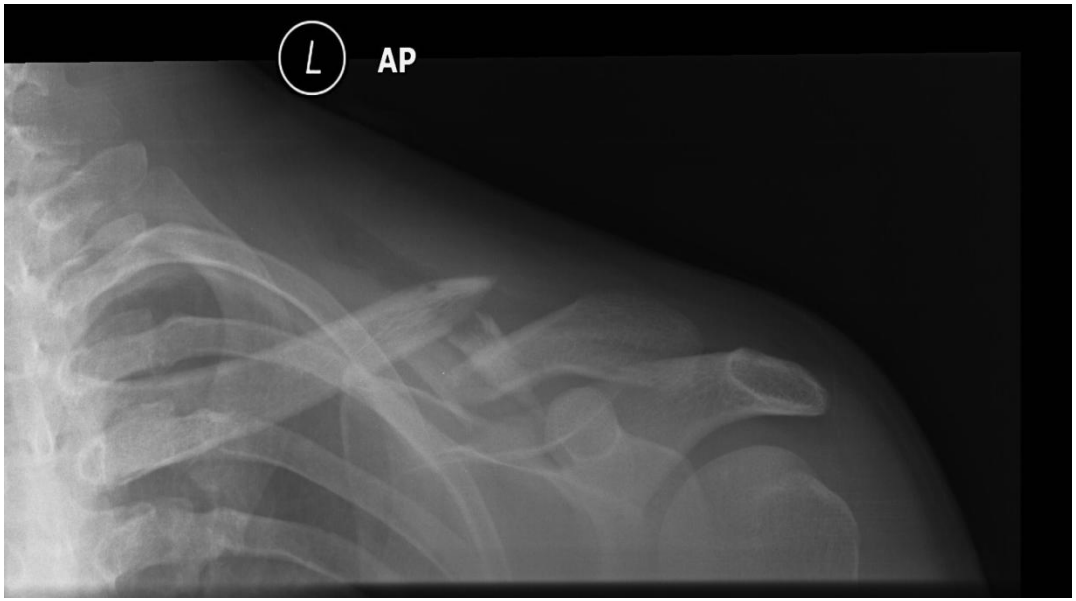
- Common fracture
- Commonest site is the middle one third
- Mainly due to indirect injury
- Direct injury leads to comminuted fracture

CLINICAL EVALUATION

- splinting of the affected extremity, with the arm adducted
- neurovascular examination is necessary
- Assessment of skin integrity
- The chest should be auscultated

RADIOGRAPHIC EVALUATION

anteroposterior radiographs



Treatment

Conservative

- arm sling or figure of eight

Operative fixation

- indicated if there is:

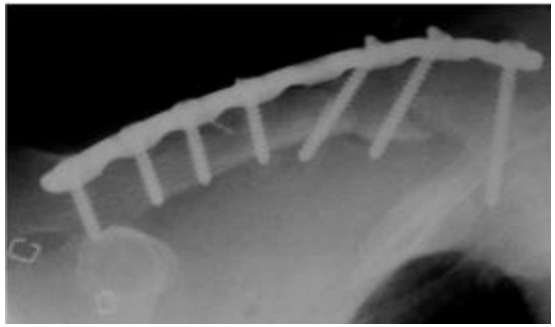
  tenting of the skin

  open fracture

  neurovascular injury

  nonunion

  - Plate and scews



COMPLICATIONS

- Neurovascular compromise
- Malunion
- Nonunion

  0.1% to 13.0%, with 85% of all nonunion occurring in the middle third.
- Posttraumatic arthritis at AC joint ,SC joint .

Humerus Fractures

- Proximal Humerus (includes surgical and anatomical neck)

  comprise 4% to 5% of all fractures and represent the most common humerus fracture (45%)

CLINICAL EVALUATION

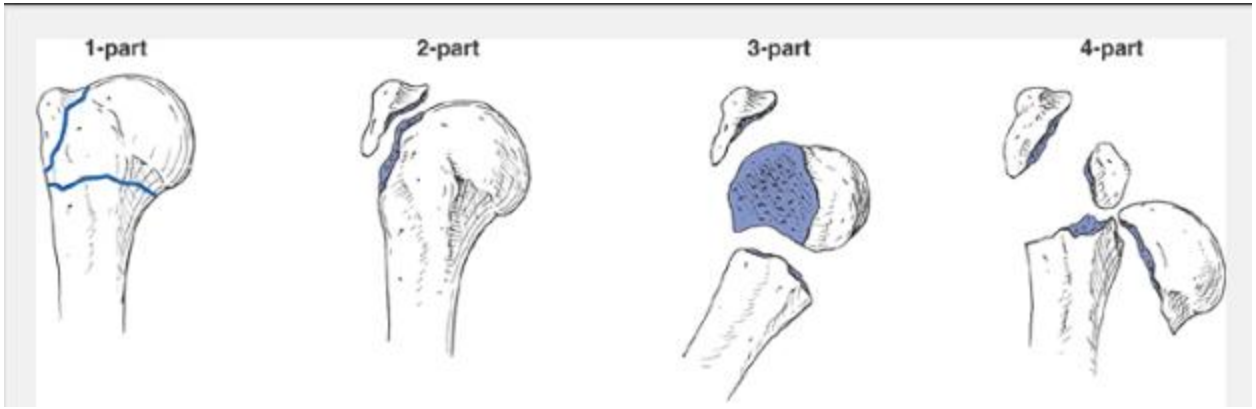
- pain, swelling, tenderness, painful range of motion, and variable crepitus. Ecchymosis
- A careful neurovascular examination is essential, axillary nerve function.

RADIOGRAPHIC EVALUATION

- AP and lateral views
- Computed tomography
- Magnetic resonance imaging

CLASSIFICATION (Neer's)

- Four parts: These are the greater and lesser tuberosities, humeral shaft, and humeral head



- A part is defined as displaced if >1 cm of fracture displacement or >45 degrees of angulation

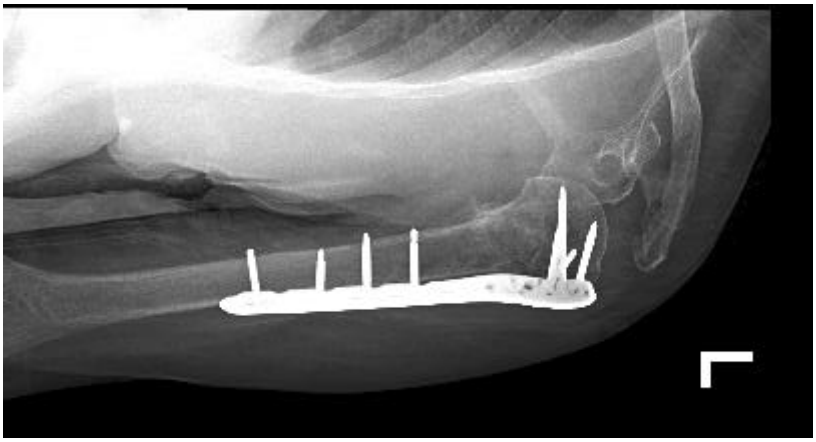
TREATMENT

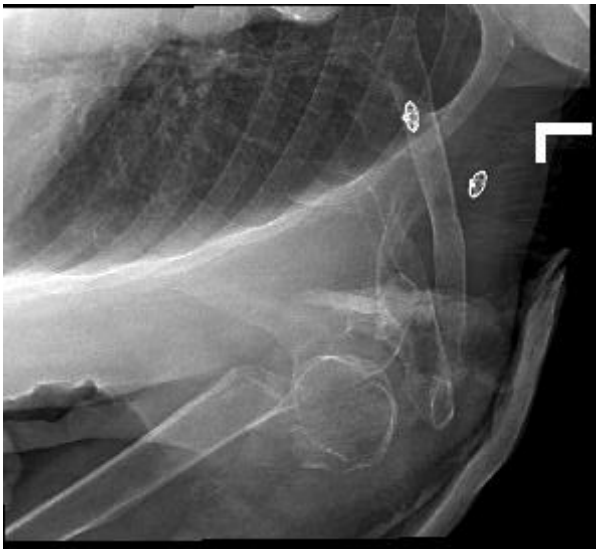
- Minimally displaced fractures
  - 85% of proximal humerus fractures are minimally displaced or nondisplaced.
  - Sling immobilization for comfort.
  - Early shoulder motion may be instituted at 7 to 10 days.
  - Pendulum exercises and passive range-of-motion exercises.
  - At 6 weeks, active range-of-motion exercises are started.

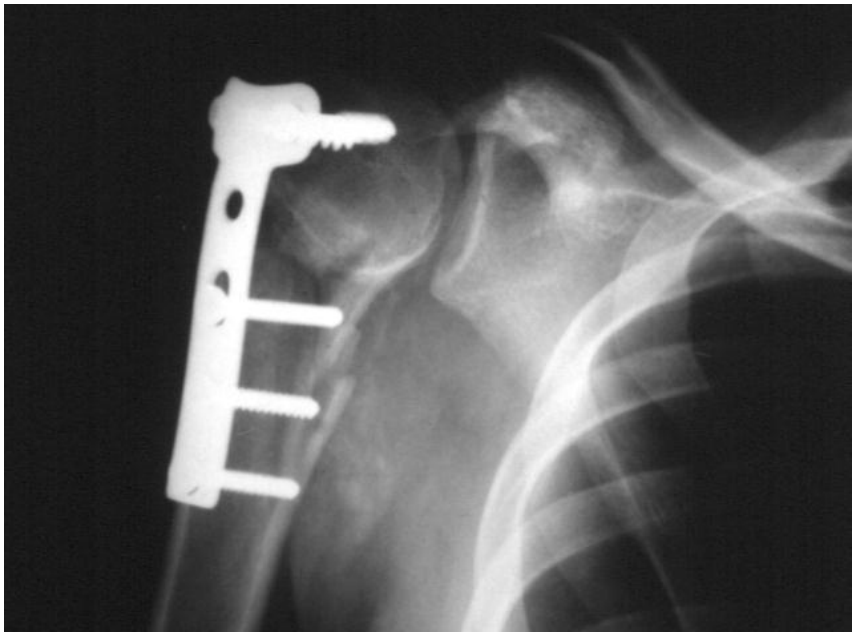
Surgical indication

- Anatomic neck fracture.
- Surgical neck fracture.
- Greater tuberosity fractures: If they are displaced more than 5 to 10 mm.
- Lesser tuberosity fractures displaced fragment blocks internal rotation or associated posterior dislocation.
- Three- and part fractures

- Four-part fractures
  - osteonecrosis ranges from 13% to 35%.
  - ORIF may be attempted in young patients
  - Primary prosthetic replacement of the humeral head for senile patient
- Fracture-dislocation







COMPLICATIONS

- Vascular injury:

  (5% to 6%) the axillary artery
- Neural injury
  - Brachial plexus injury: (6%).
  - Axillary nerve injury
- Chest injury: Intrathoracic dislocation; pneumothorax and hemothorax

- Myositis ossificans
- Shoulder stiffness
- Osteonecrosis: 3% to 14% of three-part proximal humeral fractures, 13% to 34% of four-part fractures, and a high rate of anatomic neck fractures.
- Nonunion
- Malunion

Fractures Shaft of the Humerus

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

CLINICAL EVALUATION

- pain, swelling, deformity, and shortening of the affected arm ,crepitus.
- Soft tissue abrasions and minor lacerations must be differentiated from open fractures
- careful neurovascular examination is essential, with particular attention to radial nerve function

RADIOGRAPHIC EVALUATION

AP and lateral radiographs of the humerus should be obtained, including the shoulder and elbow joints on each view

CLASSIFICATION (Descriptive)

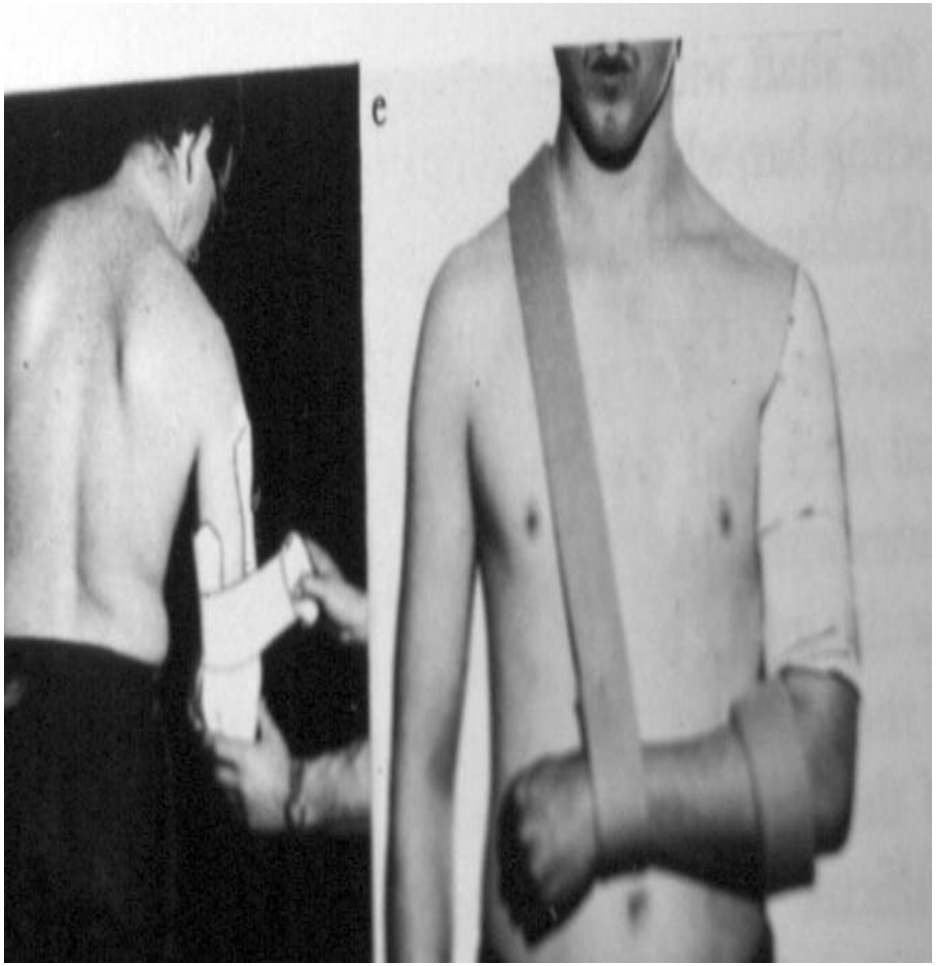
- Open vs. closed.
- Location: proximal third, middle third, distal third.
- Degree: nondisplaced, displaced.
- Direction and character: transverse, oblique, spiral, segmental, comminuted
- Articular extension.

Management of Fracture Shaft of the Humerus

- Most of the time is **Conservative**

- **Closed Reduction** in upright position followed by application of **U shaped Slab of POP** or Cylinder cast

- Few weeks later or initially in stable fractures **Functional Brace** may be used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CORFLEX

Indications for ORIF Fracture Shaft of Humerus

- Multiple trauma
- Inadequate closed reduction or unacceptable malunion
- Pathologic fracture
- Associated vascular injury
- Floating elbow
- Segmental fracture

- Intraarticular extension
- Bilateral humeral fractures
- Open fracture
- Neurologic loss following penetrating trauma
- Radial nerve palsy after fracture manipulation (controversial)
- Nonunion

Surgical Techniques

Open reduction and internal fixation using plate and screws

Surgical Techniques

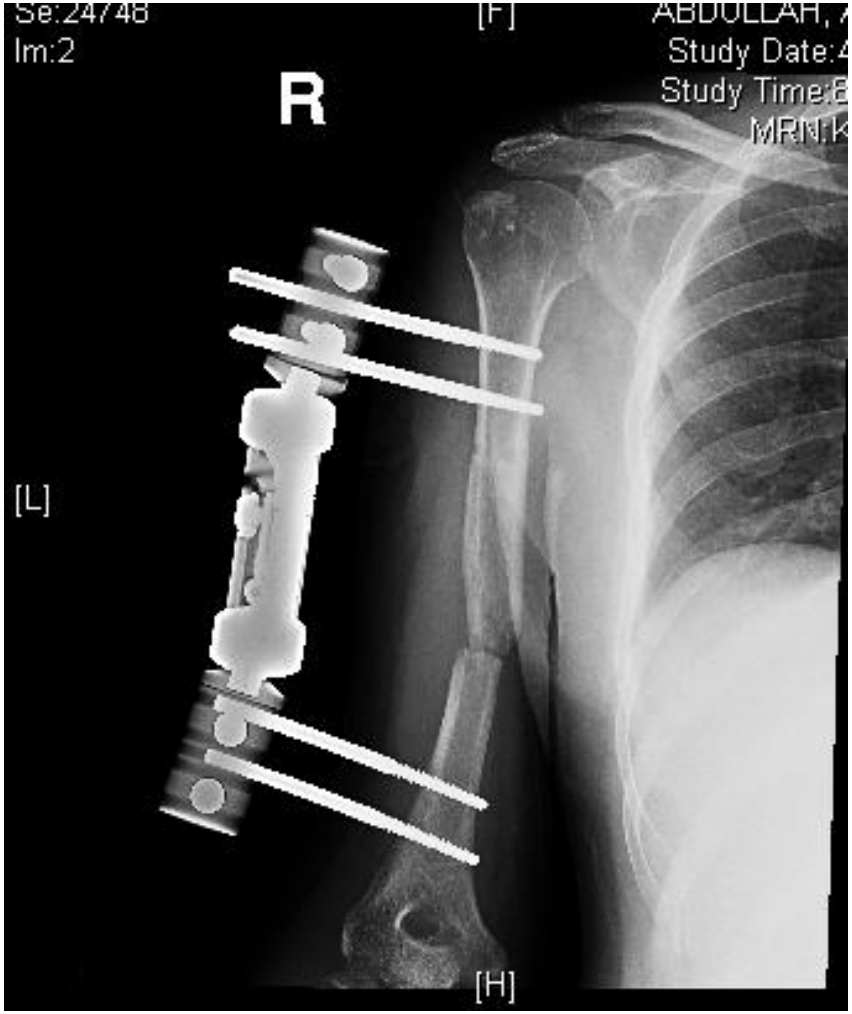
Interamadullary nail or K-wires

External fixator

Indications include:

- Infected nonunion.
- Burn patients with fractures.
- Open fractures with extensive soft tissue loss.

Complications include pin tract infection, neurovascular injury, and nonunion.



COMPLICATIONS

- Radial Nerve Injury (**Wrist drop)**

  fracture humerus in up to 12% of fractures

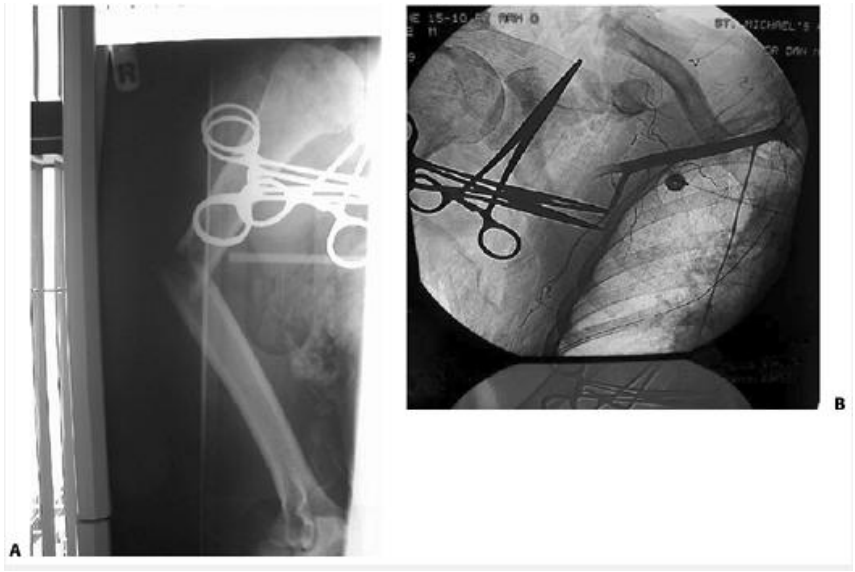
  2/3 (8%) of Radial injury are Neuropraxia

  1/3 (4%) are nerve lacerations or transection

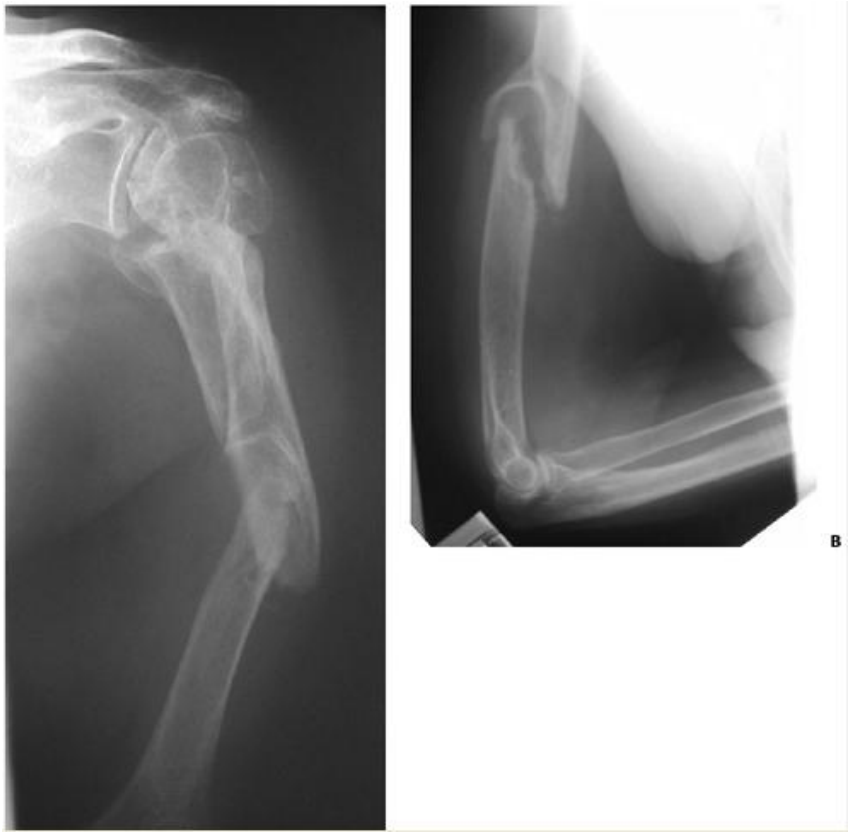
Management of Radial Nerve injury

- open fractures ; immediate exploration and ± repair
- closed injuries treated conservatively
- If No spontaneous recovery occurs in 6weeks confirmed by NCS and EMG go for nerve exploration after 12 weeks
- Recovery usually starts after few days but may take up to 9 months for full recovery

Vascular injury(B. Artery)



Nonunion (up to 15%)



Both Bone forearm
(Radius, ulna)

- Forearm fractures are more common in men than women;
- motor vehicle accidents, contact athletic participation, altercations, and falls from a height

Clinical Evaluation

- gross deformity of the involved forearm, pain, swelling, and loss of hand and forearm function.
- A careful neurovascular
- open wound
- compartment syndrome

Radiographic Evaluation

Anteroposterior (AP) and lateral views

Radiographic evaluation should include the two joints.

Classification
Descriptive

- Closed versus open
- Location
- Comminuted, segmental, multifragmented
- Displacement
- Angulation
- Rotational alignment

Treatment
(Nonoperative)

- a well-molded, long arm cast in neutral rotation with the elbow flexed to 90 degrees.
- follow-up to evaluate for possible loss of fracture reduction.

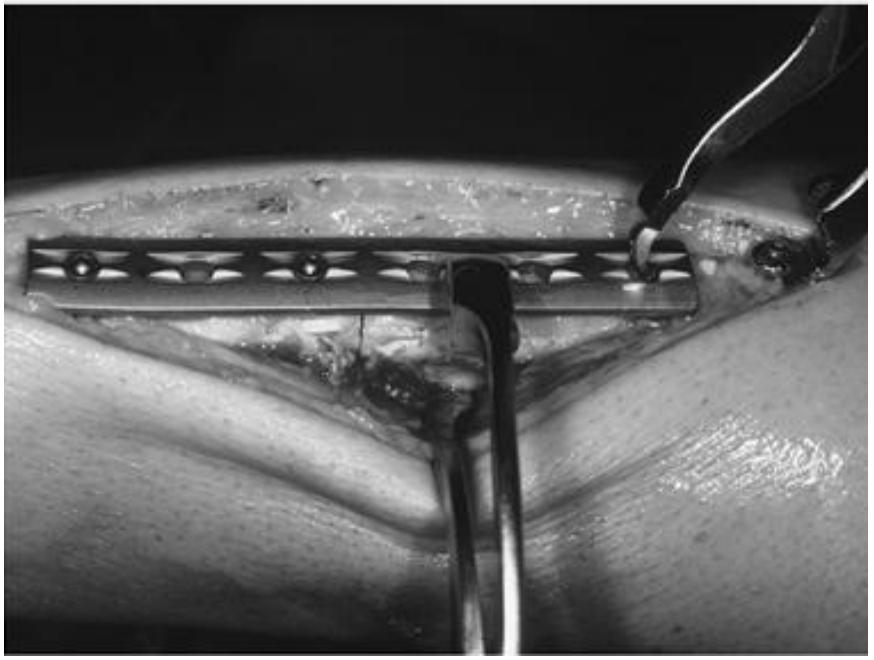
Operative

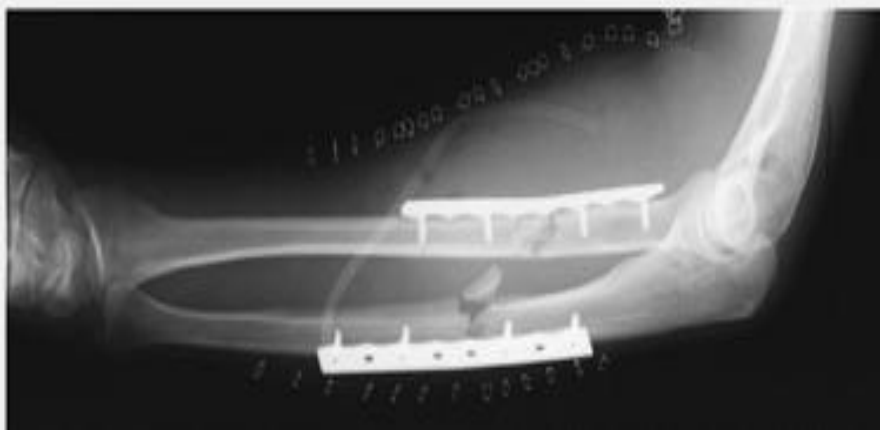
A. Open reduction and internal fixation

B. External fixation

indication

1. severe bone
2. soft tissue loss
3. gross contamination
4. infected nonunion
5. open elbow fracture-dislocations with soft tissue loss.





Complications

a. Nonunion and malunion

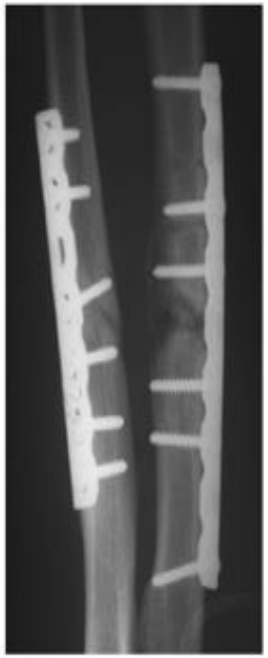
b. Infection:

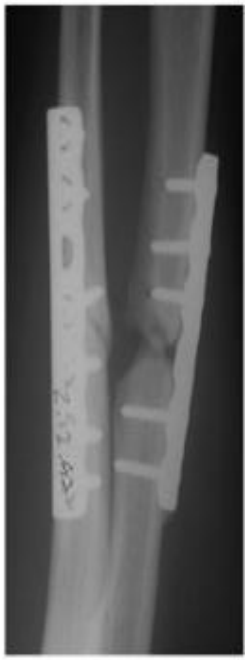
c. Neurovascular injury

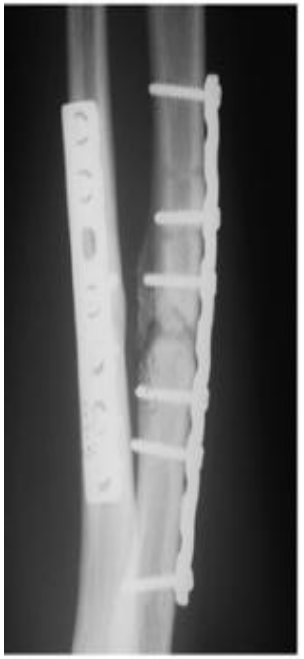
d. Volkman ischemia

follow CS

e. Posttraumatic radioulnar synostosis (3% to 9%)







Distal Radius

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

CLINICAL EVALUATION

- The wrist is typically swollen with ecchymosis, tenderness, and painful range of motion.
- neurovascular assessment

  median nerve function. Carpal tunnel compression symptoms are common (13% to 23%)
- Look for ?open fracture.

RADIOGRAPHIC EVALUATION

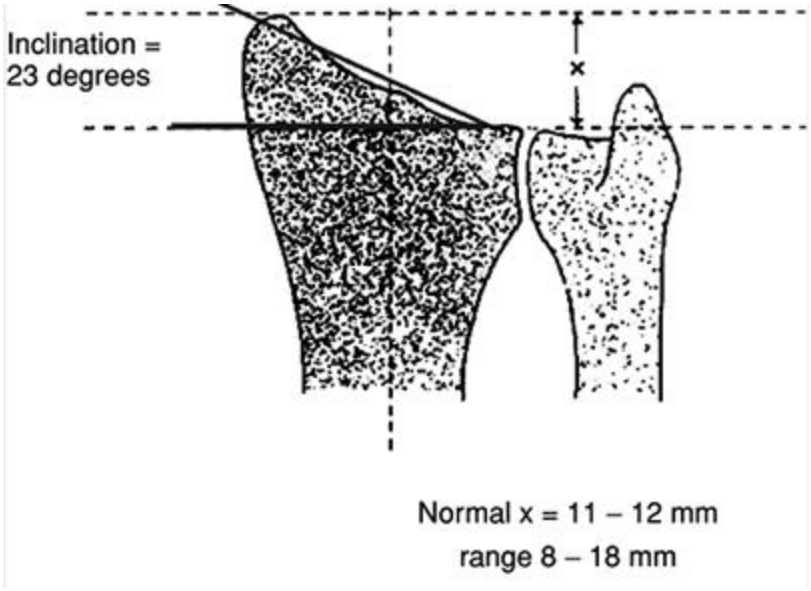
Posteroanterior and lateral views

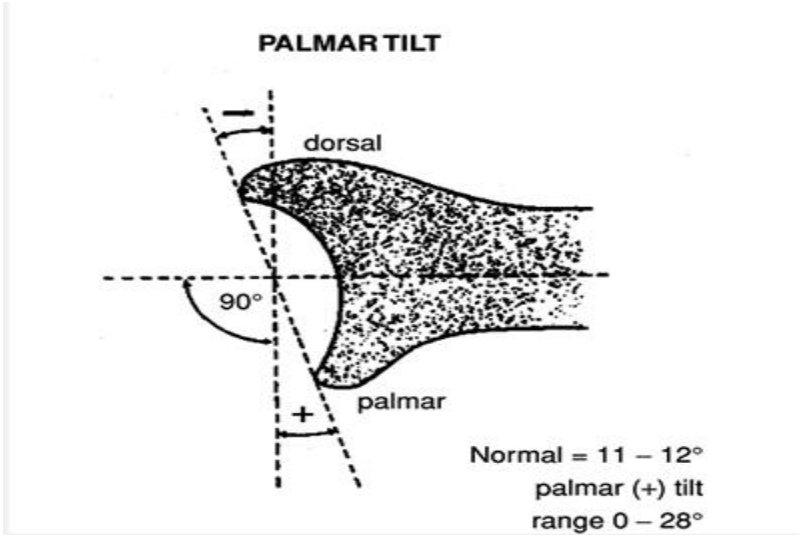
Normal radiographic relationships

a.Radial inclination: averages 23 degrees (range, 13 to 30 degrees)

b.Radial length: averages 11 mm (range, 8 to 18 mm).

c.Palmar (volar) tilt: averages 11 to 12 degrees (range, 0 to 28 degrees).





RADIOGRAPHIC EVALUATION

CLASSIFICATION
Descriptive

- Open versus closed
- Displacement
- Angulation
- Comminution
- Loss of radial length

Colles’ fracture

• extraarticular fractures.

• 90% of distal radius fractures

• dorsal angulation (apex volar), dorsal displacement, radial shift, and radial shortening.

•Clinically .dinner forka deformity.

•a fall onto a hyperextended, radially deviated wrist with the forearm in pronation.

Barton fracture

•a fracture-dislocation or subluxation of the wrist in which the dorsal or volar rim of the distal radius is displaced with the hand and carpus. Volar involvement is more common --ORIF

•a fall onto a dorsiflexed wrist with the forearm fixed in pronation

Smith fracture
(reverse Colles fracture)

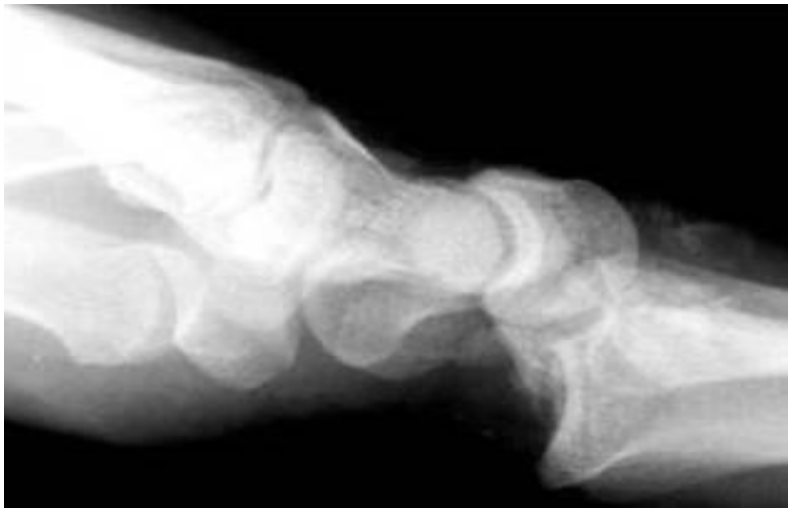
- A volar angulation (apex dorsal) of the distal radius with an garden spades deformity or volar displacement of the hand and distal radius ----ORIF
- a fall onto a flexed wrist with the forearm fixed in supination

TREATMENT

- Acceptable radiographic parameters for a healed radius in an active, healthy patient include:
  - Radial length: within 2 to 3 mm of the contralateral wrist.
  - Palmar tilt: neutral tilt (0 degrees).
  - Intraarticular step-off: <2 mm.
  - Radial inclination: <5-degree loss.

Nonoperative

Closed reduction and below elbow colle's cast



Operative

- indications
  - High-energy injury
  - Secondary loss of reduction
  - Articular comminution, step-off, or gap
  - Metaphyseal comminution or bone loss
  - Loss of volar buttress with displacement
  - DRUJ incongruity

Operative Techniques

- Percutaneous pinning

ORIF

External fixation

COMPLICATIONS

- Median nerve dysfunction
- Malunion or nonunion
- Complications of external fixation include reflex sympathetic dystrophy, pin tract infection, wrist and finger stiffness, fracture through a pin site, and radial sensory neuritis

- Tendon rupture, most commonly extensor pollicis longus
- Midcarpal instability
- Posttraumatic osteoarthritis
- Finger, wrist, and elbow stiffness

Lower limbs Fractures

- Pelvic
- Hip fractures
  (Neck , intertrochantric)
- Femoral shaft
- Tibia shaft
- Ankle
  (Medial malleolus ,Lateral malleolus, B.M)

Mechanism of fractures

- Lower limb fracture is a result of a high energy trauma like MVA, fall , except in elderly people or diseased bones

- Types of fracture are depend on position of limb during impaction and magnitude of forces applied.

Management

- The proper way to treat a patient with high energy trauma is to look at the patient as whole ,not to injured limb alone!

- So the aim to treat such patient is to save life first, then save limb ,finally to save function.

- A.B.C.D

Pelvic fractures

- Classifications. (Tile)

Type A. Stable

Type B. Rotationally Unstable ,Vertically Stable.

Type C. Rotationally and Vertically Unstable

Pelvic fractures

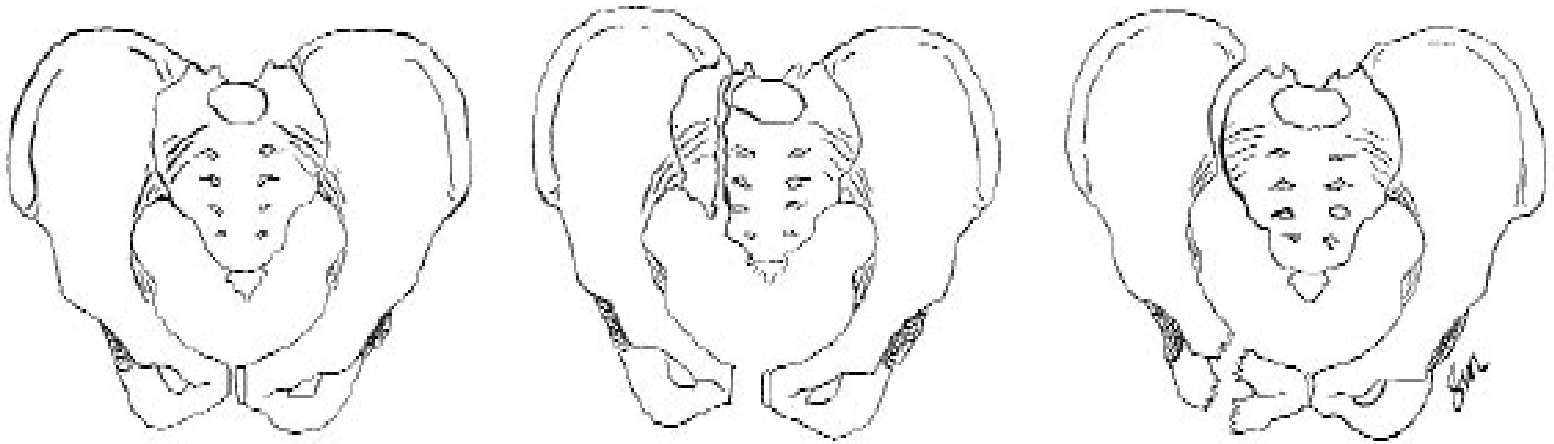


Figure 20. Illustration of the Tile Classification of Pelvis Fractures

Type A

Type A stable Fracture of superior & inferior pubic remi & no diasthesis of SP

Type B

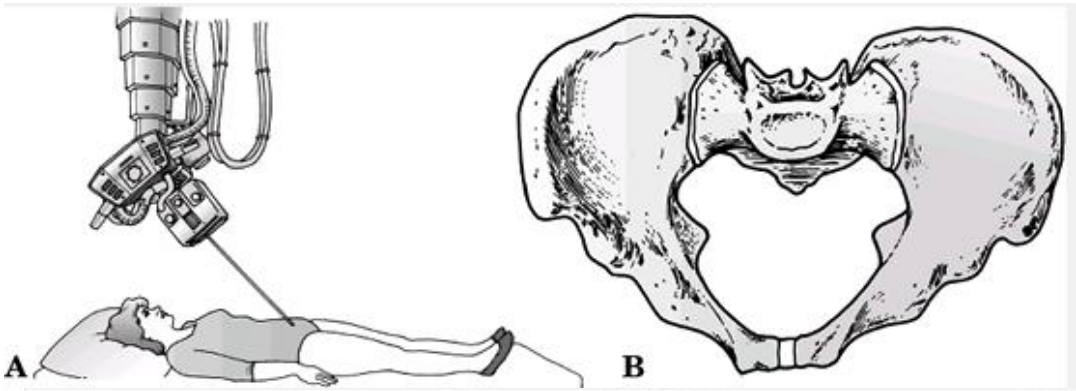
Type B open book fracture Diasthesis of SP more than 2cm

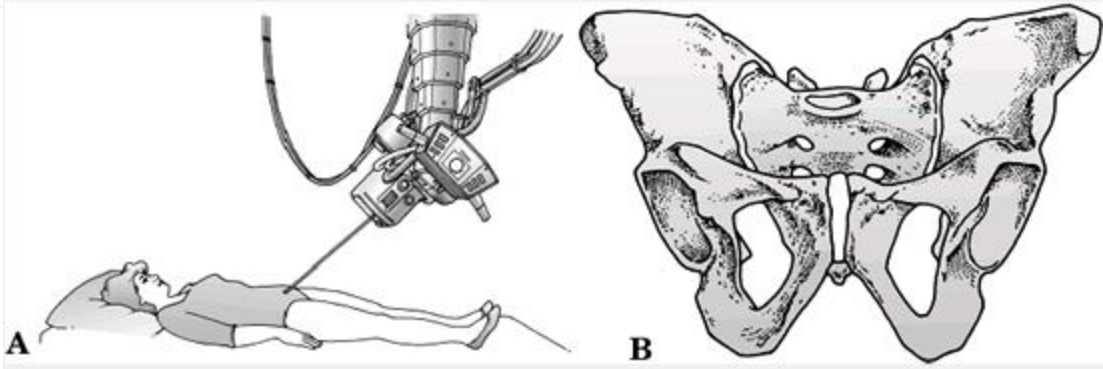
Type c

Type c fracture there is diasethsis of SP & vertical shear & SIJ involvement

RADIOGRAPHIC EVALUATION

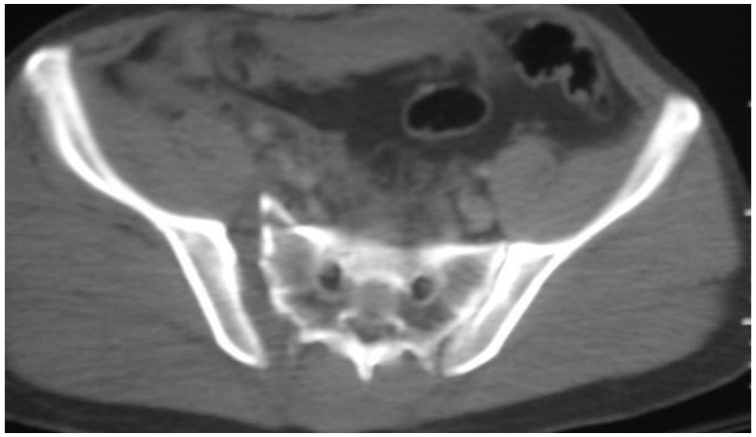
a. AP of the pelvis
b. Inlet radiograph
c. Outlet radiograph
d. Computed tomography
e. Magnetic resonance imaging

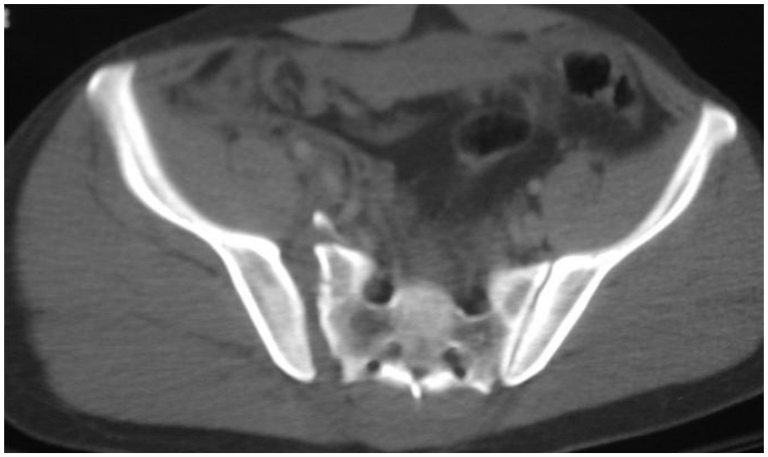


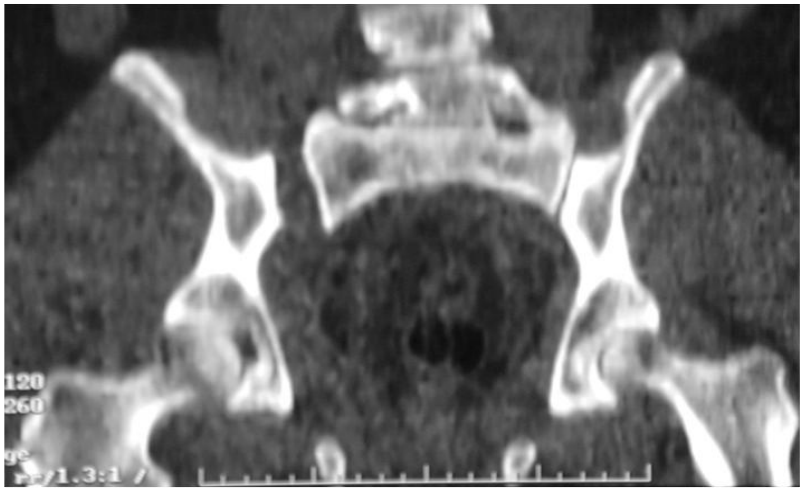


CT give you clear idea about bony & soft tissues you can asses the degree of distrubtion

coronal CT here showing distrubtion in anterior & posterior of LT SIJ







MANEGEMENT

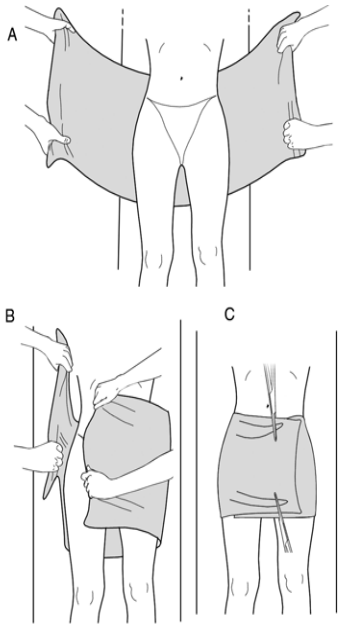
- Aggressive treatment . By A.B.C. D
- Think in systemic approach.
- Specific treatment:

  type A . Bed rest& symptomatic treatment

  type B .ORIF with plates& screws ,External Fix.

  Type C . ORIF with plates & screws. Both AP.

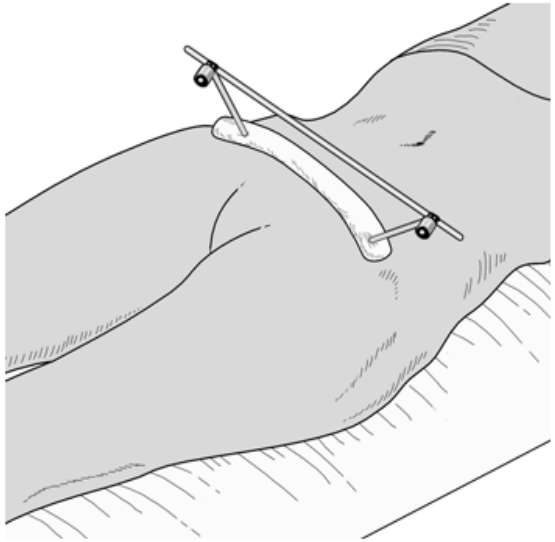
pelvic banding



Source: Simon RR, Sherman SC, Koenigsknecht SJ: *Emergency Orthopedics, The Extremities*, 5th Edition: http://www.accessemergencymedicine.com

Circumferential pelvic anti-shock sheeting. ***A.*** A sheet is placed under the pelvis. ***B.*** The ends are brought together anteriorly. ***C.*** Hemostats are used to secure the sheet snugly.

external fixation



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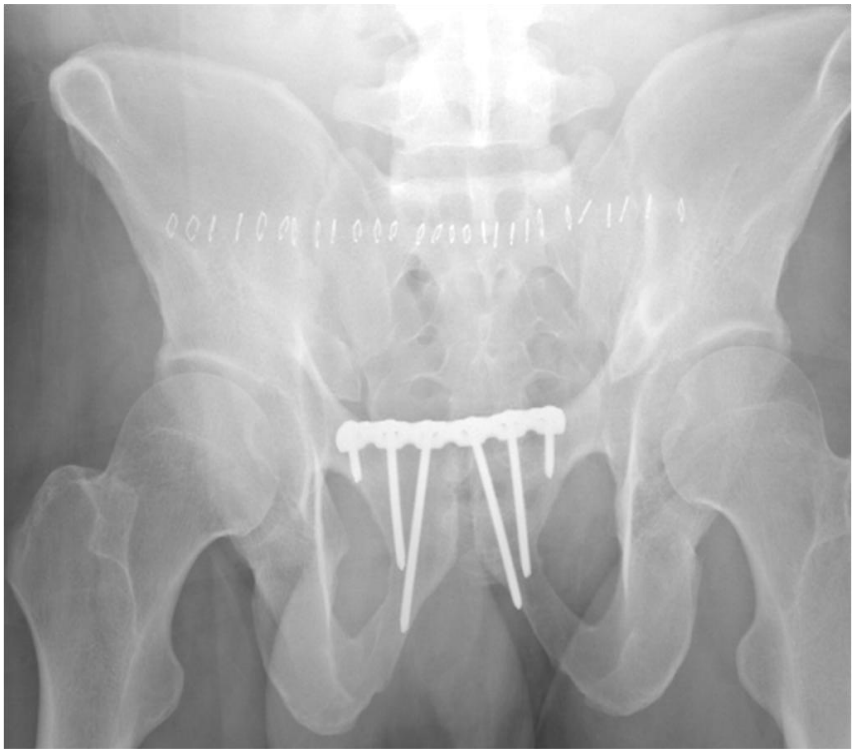
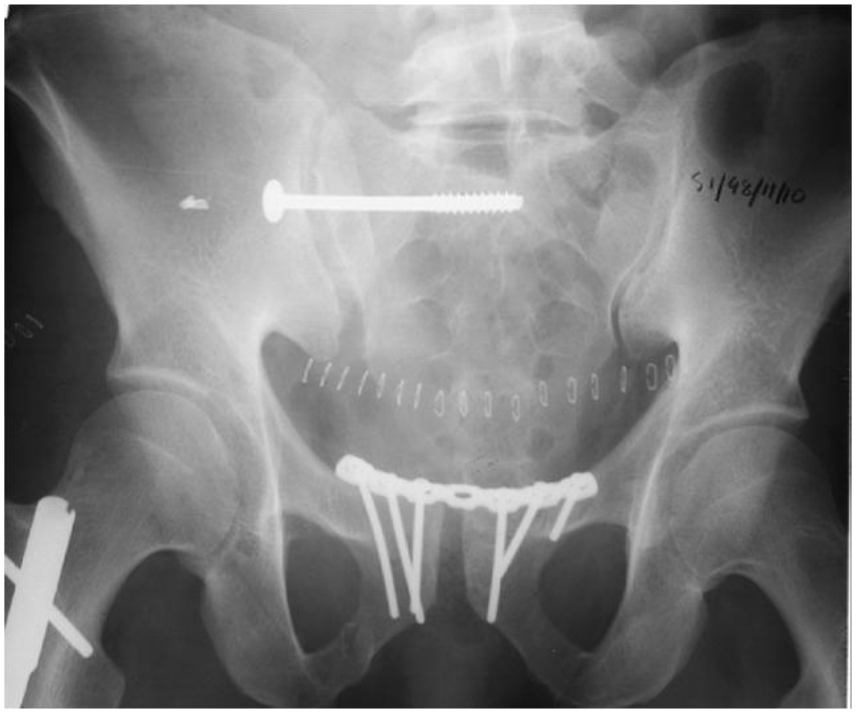
Anterior external fixator.

Operative treatment

Surgical correction of type B open book fracture by anterior plating [ORIF]



Surgical correction of type C fracture by percutanous screw & plating of SP anterior[ORIF



Complications

- Infection up to 25%
- Thromboembolism
- Malunion
- Nonunion
- Hemorrhage –life threatening –hypovolemic shock
- Bladder (15%)/bowel injuries
- Neurological damage (L5-S1)
- Obstetrical difficulties
- Persistent sacro-iliac joint pain

HIP FRACTURE

Epidemiology

- common fracture in elderly (greater incidence of osteopenia)
- female > male
- in osteopenic individual, fracture may precede simple fall (muscle stronger than bone)
- in younger individual, fracture related to high energy injury
    - markedly displaced
    - associated with other injuries

Diagnosis

- characteristic history, unable to bear weight on affected limb
- limb shortened, externally rotated, painful ROM, antalgic gait
- obtain AP of pelvis and lateral of involved hip
- if findings equivocal - bone scan and tomograms

1. Subcapital Fractures

- ❑ fracture between femoral head and intertrochanteric line
- ❑ main vascular supply to femoral head from distal arterial ring to proximal head through femoral neck
- ❑ fracture interrupts blood supply
    - articular surface restricts blood supply to femoral head
    - AVN risk depends on degree of displacement

Table 12. Garden Classification of Subcapital Fractures

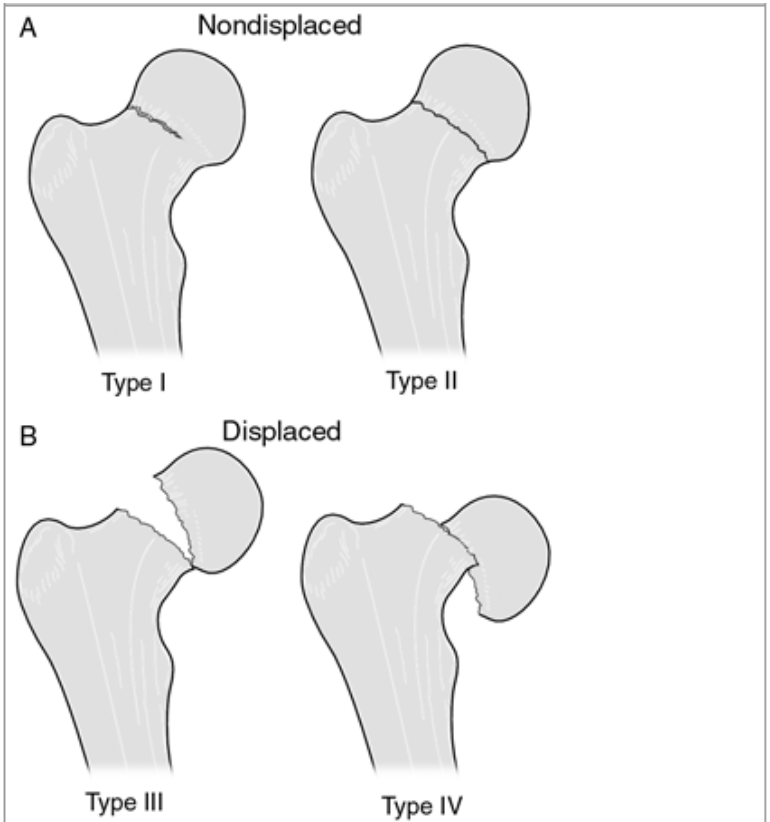
Type	Extent	Displacement	Alignment	Trabeculae
I	Incomplete	Impacted	Valgus	Malaligned
2	Complete	None	Neutral	Aligned
3	Complete	Some	Varus	Malaligned
4	Complete	Marked	Varus	Aligned

Treatment

- ❑ if needed, treat osteoporosis
- ❑ restore anatomy, attempt to save head (AVN head CAN heal)
- ❑ type of treatment depends on displacement and patient age
- ❑ undisplaced (Garden 1,2) - ORIF to prevent displacement
- ❑ displaced (Garden 3,4) - depends on patient
    - older patient, poor health —> unipolar hemiarthroplasty
    - younger patient with higher demand lifestyle —> bipolar hemiarthroplasty vs. total hip replacement vs. reduction and internal fixation
    - younger patient with OA of hip —> total hip replacement

Complications

- ❑ AVN
- ❑ non-union



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Femoral neck fractures.

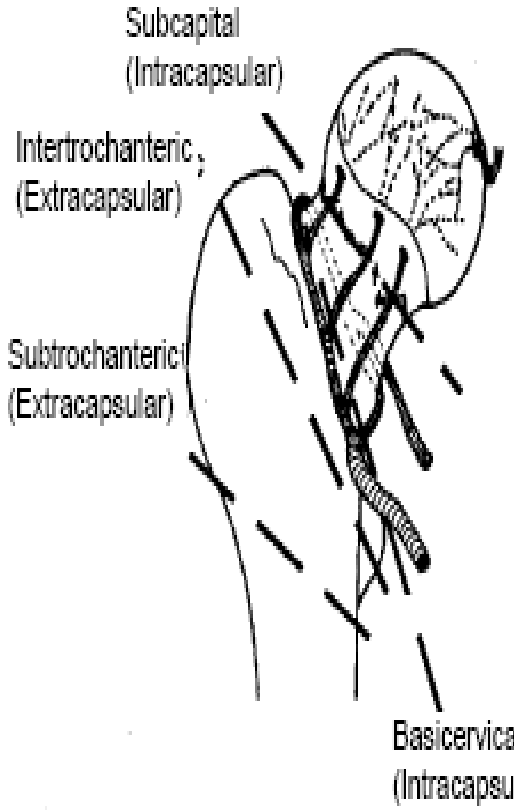


Figure 21. Blood Supply to Femoral Head and Fracture Classification

2. Intertrochanteric Fracture

- extra-capsular fracture, therefore good femoral head viability
- fracture stability determined by amount of compromise to calcar femorale (medial cortex at neck/shaft junction)
- greater and lesser trochanters may be separate fragments
- posterior fragment may be avascular, therefore possible delayed union

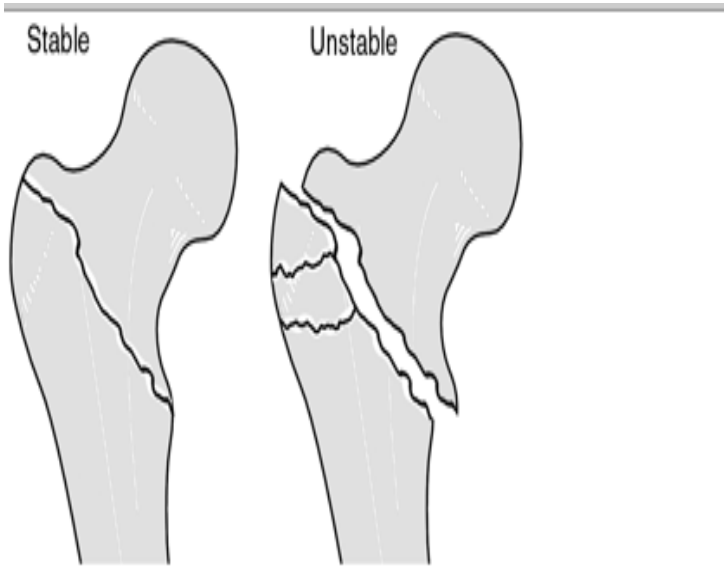
Classification

- 2 part - stable, trochanter intact
- 3 part - one trochanter separated, unstable if large calcar fragment
- 4 part - unstable, both trochanters separated

Treatment

- ORIF (sliding hip screw) to preserve femoral head

Intertrochanteric fracture



Source: Simon RR, Sherman SC, Koenigsknecht SJ: *Emergency Orthopedics, The Extremities*, 5th Edition: http://www.accessemergencymedicine.com

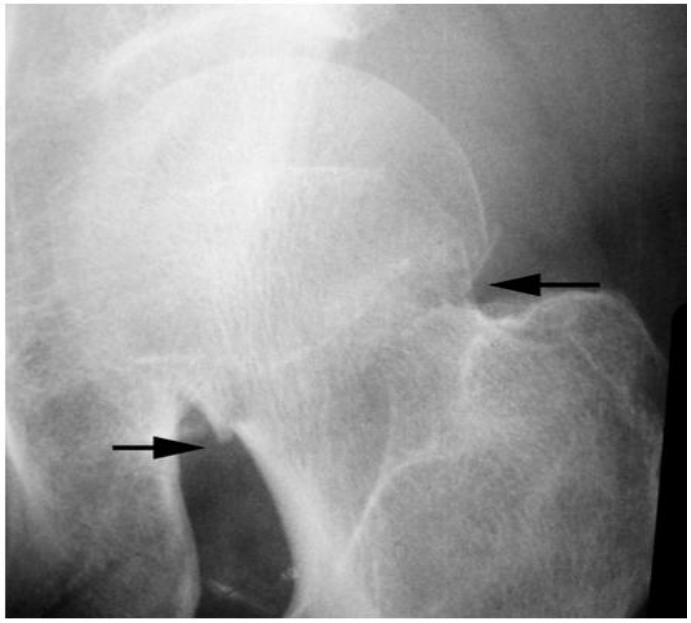
Intertrochanteric fractures.

clinical picture

Source: Simon RR, Sherman SC, Koenigsknecht SJ: *Emergency Orthopedics, The Extremities*, 5th Edition: http://www.accessemergencymedicine.com

Patient with a displaced femoral neck fracture on the right. Note that the leg is shortened and externally rotated.

AP View



Source: Simon RR, Sherman SC, Koenigsknecht SJ: *Emergency Orthopedics, The Extremities*, 5th Edition: http://www.accessemergencymedicine.com

A nondisplaced femoral neck fracture.

Source: Simon RR, Sherman SC, Koenigsknecht SJ: *Emergency Orthopedics, The Extremities*, 5th Edition: http://www.accessemergencymedicine.com

A displaced femoral neck fracture.

Source: Simon RR, Sherman SC, Koenigsknecht SJ: *Emergency Orthopedics, The Extremities*, 5th Edition: http://www.accessemergencymedicine.com

Lesser trochanteric and subtrochanteric fractures.

Source: Simon RR, Sherman SC, Koenigsknecht SJ: *Emergency Orthopedics, The Extremities*, 5th Edition: http://www.accessemergencymedicine.com

Intertrochanteric fracture. Note that the fracture line runs in a reverse oblique direction and into the subtrochanteric bone, making this fracture unstable.

Source: Simon RR, Sherman SC, Koenigsknecht SJ: *Emergency Orthopedics, The Extremities*, 5th Edition: http://www.accessemergencymedicine.com

An unstable intertrochanteric femur fracture.

Treatment

NO rule for non operative

For neck and intertrochantric

Femur fractures

Treatment
neck of femur

Nondisplaced fracture of neck of femur can be treat with canulated screws

Displaced fracture ---------DHS in patient less than 60 years.

Age > than 65 years look for.

. Level of activities.

. Status of the acetabulum.

then chose THR(if acetabulum is disease!) vs. hemi arthoplasty.

COMPLICATIONS

- Nonunion

  5% of nondisplaced fractures and up to 25% of displaced fractures

  12 months as groin or buttock pain

- Osteonecrosis

  10% of nondisplaced fractures and up to 27% of displaced fractures.

- Fixation failure

  osteoporotic bone or technical problems

Femoral shaft

FEMORAL DIAPHYSIS FRACTURES

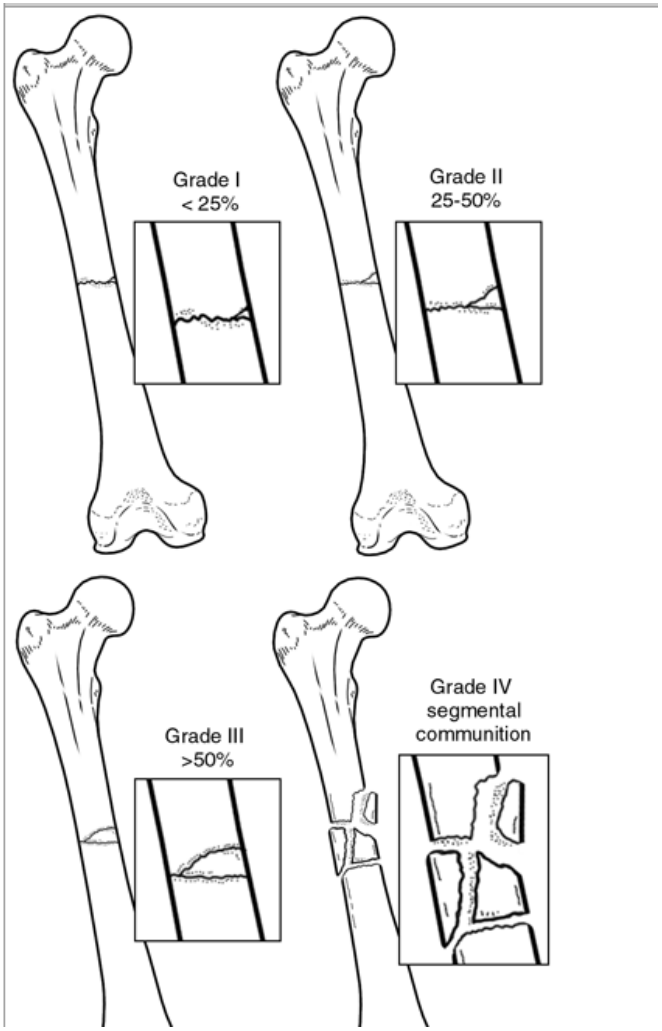
- high energy (MVA, fall from height, gunshot wounds)
- low energy (spiral fracture in children)
- high morbidity/mortality (hemorrhage, fat embolism, ARDS, MODS)
- blood replacement often required
- frequently comminuted
- soft tissue trauma

Clinical

- leg is shortened, externally rotated
- unable to weight bear
- assess neurovascular status
- r/o: open fracture, soft tissue compromise
- r/o: child abuse with spiral fractures in children

Treatment

- ABCs of trauma are essential
- immobilize leg with Thomas Splint
- adequate analgesia
- surgical fixation (intramedullary nail) within 24 hours
    - high rate of surgical union after 6 to 12 weeks
- early mobilization of hip and knee


Grade I
< 25%
Grade II
25-50%
Grade III
>50%
Grade IV
segmental
communition

The best treatment of is I.M.N

Mid shaft femur fracture

intramedullary femoral nail

Open reduction and plate fixation for femur fracture

Tibia shaft fracture

TIBIAL DIAPHYSIS FRACTURE

- high intensity injury
  - associated with crush injuries and MVAs
- soft tissue, nerve and vessel injury common
  - assess neurovascular status
  - r/o open fracture
- displacement is difficult to control
- good reduction is required
  - shortening: < 1 cm
  - angulation in varus/valgus plane: < 5 degrees
  - angulation in antero-posterior plane: < 10 degrees
  - rotation neutral to slight external rotation
  - apposition: ≥ 50%
- healing time: 16 weeks on average

Treatment

- ABCs
- closed injuries = closed reduction
  - long leg cast x 4-6 weeks
  - followed by BK cast until healed
- open injuries
  - ORIF with external fixator
  - wounds on anterior surface heal poorly and may necrose
- unstable injuries or failed closed reduction require IM nail
- high risk of compartment syndrome
  - closed reduction and cast; admit and observe for compartment syndrome surgery; prophylactic fasciotomy if operating on tibia fracutre

Table 16–1. Related Anatomy of Tissue Compartments of the Leg

Compartment	Muscles	Vessels	Nerves	Pain
Anterior	Anterior tibialis, extensor hallucis longus, extensor digitorum longus, peroneus tertius	Anterior tibial artery	Deep peroneal • **Weakness:** Ankle dorsiflexion, toe extension • **Paresthesia:** Web space of 1st and 2nd toes	Ankle plantar flexion, toe flexion
Lateral	Peroneus longus and brevis	None	Superficial peroneal • **Weakness:** Ankle dorsiflexion, foot eversion • **Paresthesia:** Dorsum of foot	Ankle plantar flexion, foot inversion
Deep Posterior	Posterior tibialis, flexor digitorum longus, flexor hallucis longus	Peroneal artery, posterior tibial artery	Posterior tibial • **Weakness:** Ankle plantarflexion, foot inversion, toe flexion • **Paresthesia:** Plantar aspect of foot	Ankle dorsiflexion, foot eversion, toe extension
Superficial Posterior	Gastrocnemius, soleus, plantaris	None	Sural • **Weakness:** Ankle plantarflexion • **Paresthesia:** Lateral foot	Ankle dorsiflexion

Classification

Descriptive

- Open versus closed
- Anatomic location: proximal, middle, or distal third
- Fragment number and position: comminution, butterfly fragments
- Configuration: transverse, spiral, oblique
- Angulation: varus/valgus, anterior/posterior
- Shortening
- Displacement: percentage of cortical contact
- Rotation
- Associated injuries

Clinical examination

Look to injured limb for.

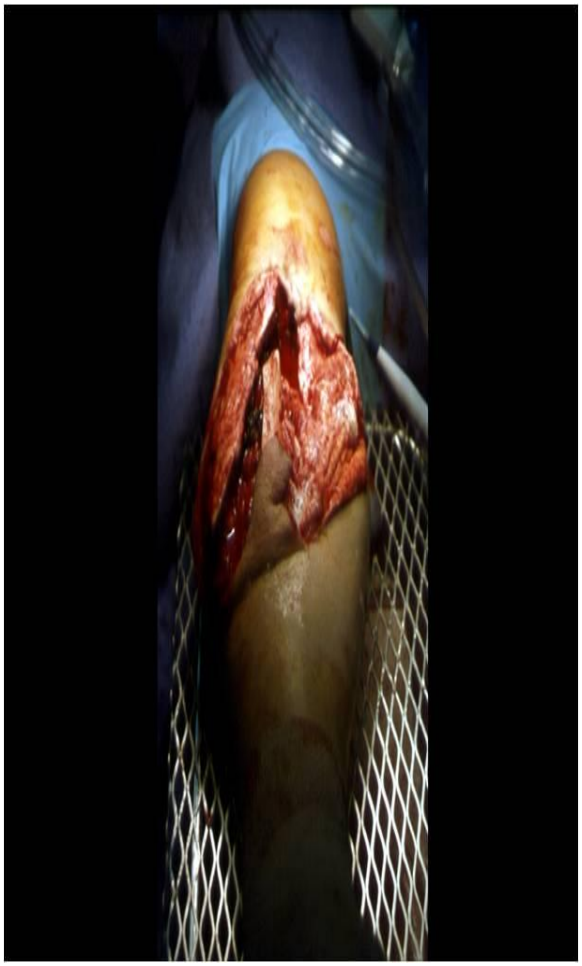
a. Soft tissue condition
b. R/O open fracture
c. Deformity

Feel for

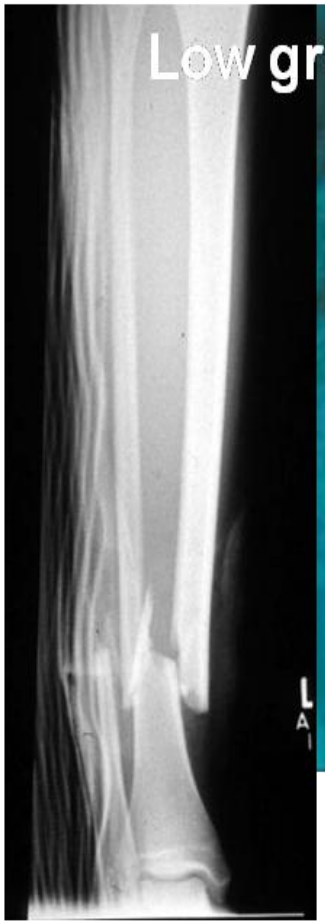
a. Tenderness , pain .

Move

a. ROM



R/o and start treatment for open



Radiological study

Spiral # of distal tibia \\ twisting injury

Transverse # of distal tibia caused more sever inj. To soft tissues due to direct trauma

AP view of mid shaft tibia

Lateral view showing two joints

Nonoperative

- Cast with the knee in 0 to 5 degrees of flexion
- After 4 to 6 weeks, the long leg cast may be exchanged for a patella-bearing cast or fracture brace.
- Union rates as high as 97% are reported, although with delayed weight bearing related to delayed union or nonunion.
- The average union time is 16±4 weeks

Treatment

NON operative

By casting if

a.Shortening <1cm

b.Angulation in varus/valgus plane< 5 degree

c.Angulation in anter-posterior plane <10 degrees

d. Rotation neutral to slight external rotation.

e, bone appostion >50%

Operative treatment

the best treatment

for mid shaft tibia fracture is Intramedullary (IM) Nailing

But

The most complication is anterior knee pain!!

External fixation

Indication for E. F

a. Open fracture 3
b. Soft tissue injury (burn, blister, infection)
c. poly trauma
d. Fracture with vascular injury

Union rates: Up to 90%, with an average of 3.6 months to union

The incidence of pin tract infections is 10% to 15%.

Plates and Screws

- the metaphysis or epiphysis.
- success rates as high as 97%. Complication rates of infection, wound breakdown, and malunion or nonunion increase with higher-energy injury patterns.

Ankle Fractures

- the incidence has increased
- an elderly women
- Most ankle fractures are isolated malleolar fractures
- Open fractures are rare < 2%.
- MOI: position of the foot at time of injury,
  the magnitude, direction, and rate of loading

CLINICAL EVALUATION

- pain and discomfort, with swelling, tenderness, and variable deformity
- Neurovascular status
- The extent of soft tissue injury possible open injuries and blistering
- A dislocated ankle should be reduced and splinted immediately (before radiographs if clinically evident)

RADIOGRAPHIC EVALUATION

AP view

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

Lateral view

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

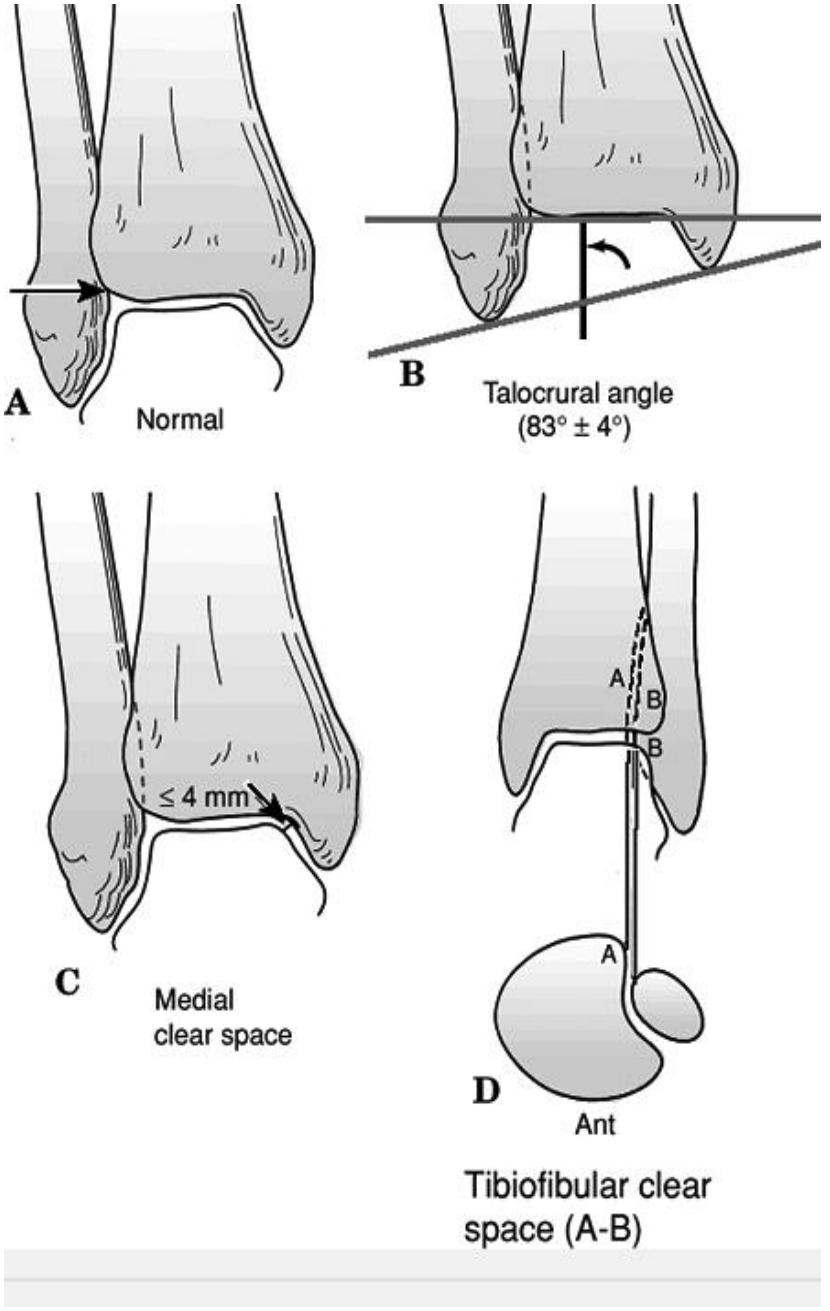
Mortise view

the foot in 15 to 20 degrees of internal rotation

A medial clear space >4 to 5 mm is abnormal and indicates lateral talar shift

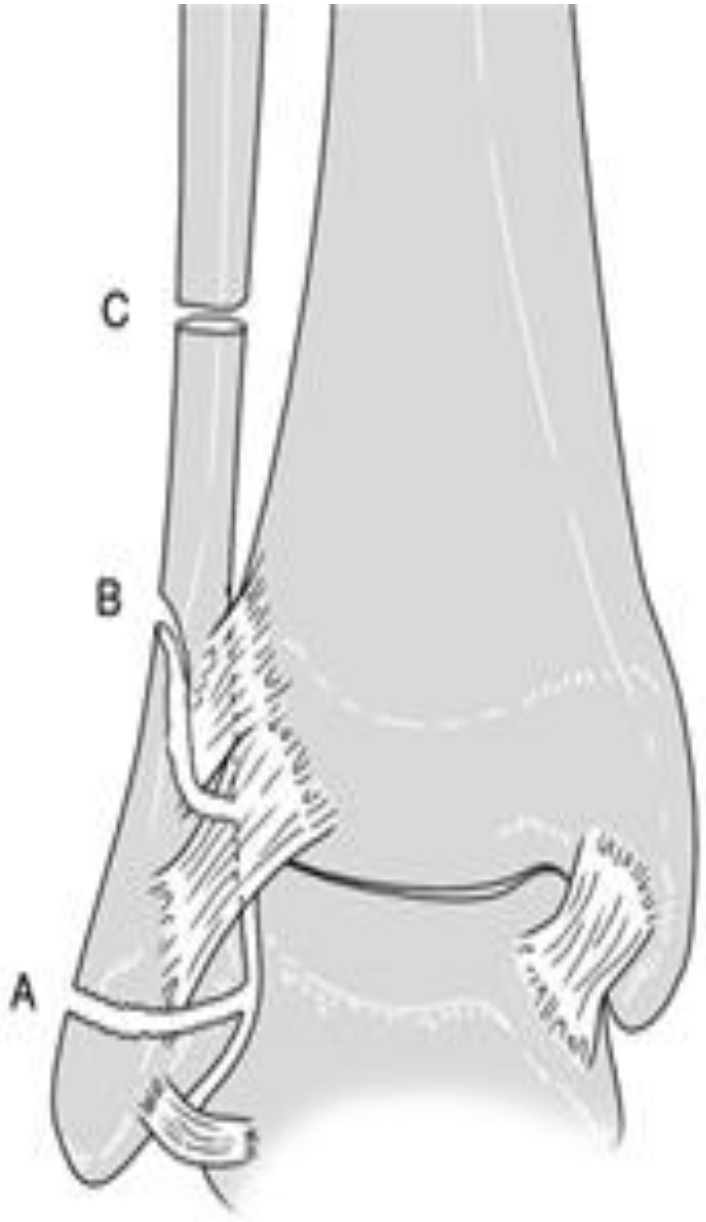
Tibiofibular overlap <1 cm indicates syndesmotic disruption

Talar shift >1 mm is abnormal.



Denis –weber classification

A. infra-syndesmotic
B. Trans-syndesmotic
C. supra-syndesmotic



Danis-Weber Classification

- level of fibular fracture relative to tibial plafond
- Type A (infra-syndesmotic)
  - pure inversion injury
  - avulsion of lateral malleolus below plafond or torn calcaneofibular ligament
  - +/– shear fracture of medial malleolus
- Type B (trans-syndesmotic)
  - external rotation and eversion
  - avulsion of medial malleolus or rupture of deltoid ligament
  - spiral fracture of lateral malleolus starting at plafond
- Type C (supra-syndesmotic)
  - pure external rotation
  - avulsion of medial malleolus or torn deltoid ligament
  - fibular fracture is above plafond
  - frequently tears syndesmosis
  - Maisonneuve fracture if at proximal fibula
  - posterior malleolus avulsed with posterior tibio-fibular ligament

Treatment

- undisplaced fractures: NWB BK cast
- displaced fractures: reduction asap
- 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
- prognosis dependent upon anatomic reduction
  - high incidence of post-traumatic arthritis

Treatment

Stable weber B fracture (BKC)

Bimalleolar fracture need ORIF

Displaced MM fracture --ORIF

Tri malleolar fracture --ORIS

X-ray showed

Bimalleolar ankle fracture with talar sublaxation and tilting

Treatment

ORIF

Bimalleolar fracture ---

Percuteneous screw fixation

complications

- Post traumatic arthritis .
- Stiffness.
- Skin necrosis.
- Malunion or nonunion.
- Wound infection.
- Regional complex pain syndrome.