Injuries to the lower extremity II

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Topics

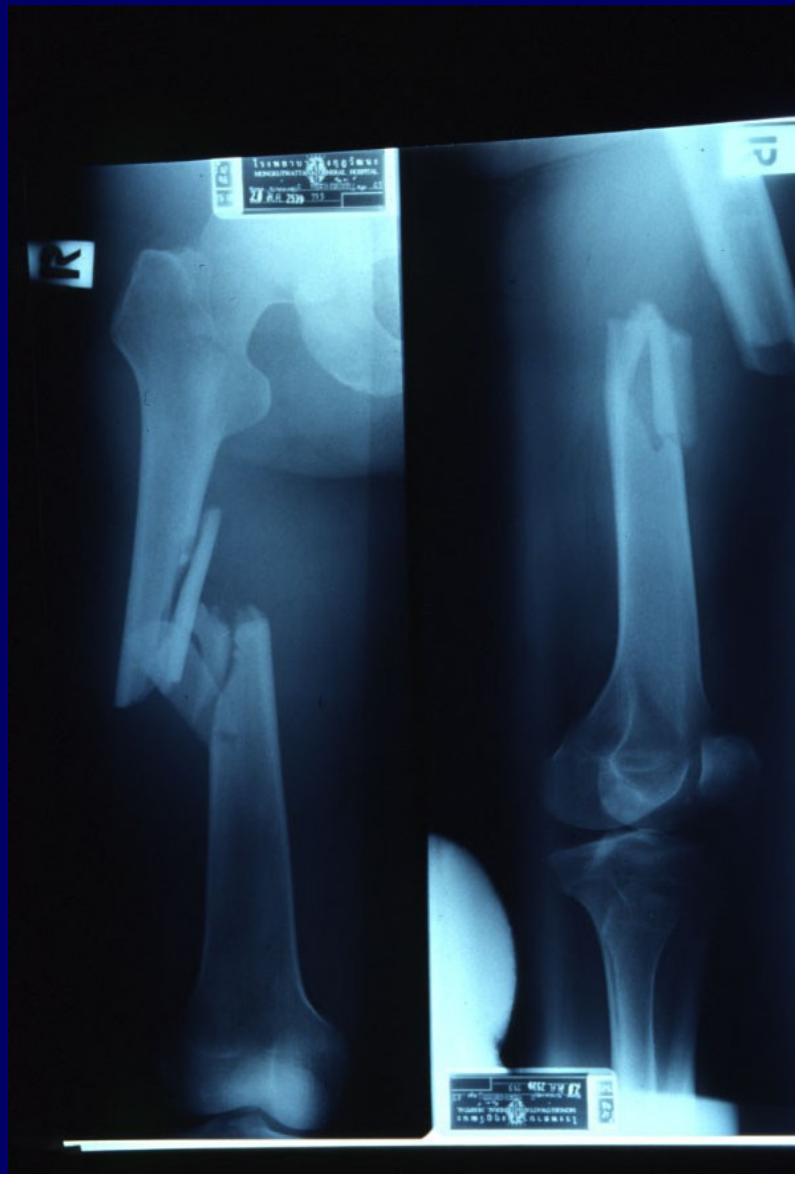
- *Fracture of the shaft of the femur*
- *Fractures around the knee*
- *Knee dislocation and fracture dislocation*
- *Fractures of tibia and fibular*
- *Fractures around the ankle*
- *Fracture and fracture dislocation of the foot*

Common symptoms and signs of fractures

- *Pain*
- *Deformity*
- *Shortening*
- *Swelling*
- *Ecchymosed*
- *Loss of function*
- *Open injury*
  - **Gross finding of fractures**

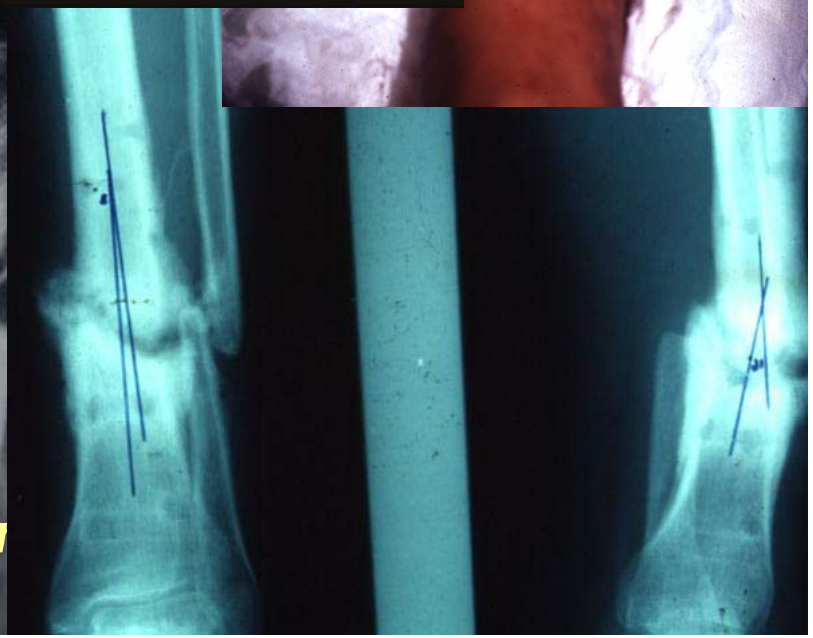
Radiographic evaluation for fractures

- ***At least, 2 different planes of Fx site***
  - ***Includes joint above and below***
  - ***Some types of Fx, special views***
  - ***Sometimes, 2 different times***
  - ***Sometimes, calls second opinion***



Complications

- *General*
  - *Delayed union*
  - *Nonunion*
  - *Malunion*
  - *Shortening*
  - *Infection*
- *Severe*
  - *Neurovascular injuries*
  - *Compartment syndrome*
  - *Fat embolism*
  - *Adult respiratory distress syndr*



Fat embolism

- *Common in Fx of long bone and pelvis*
- *Multiple Fxs >> single Fx*
- *Respiratory insufficiency*
- *Usually manifests within 48 hr*
- *Clinical*
  - *Fever*
  - *Tachepnea*
  - *Tachycardia*
  - *Alters consciousness*
- *Treatment*
  - *Respiratory support*
  - *Early Fx stabilization*

Compartment syndrome

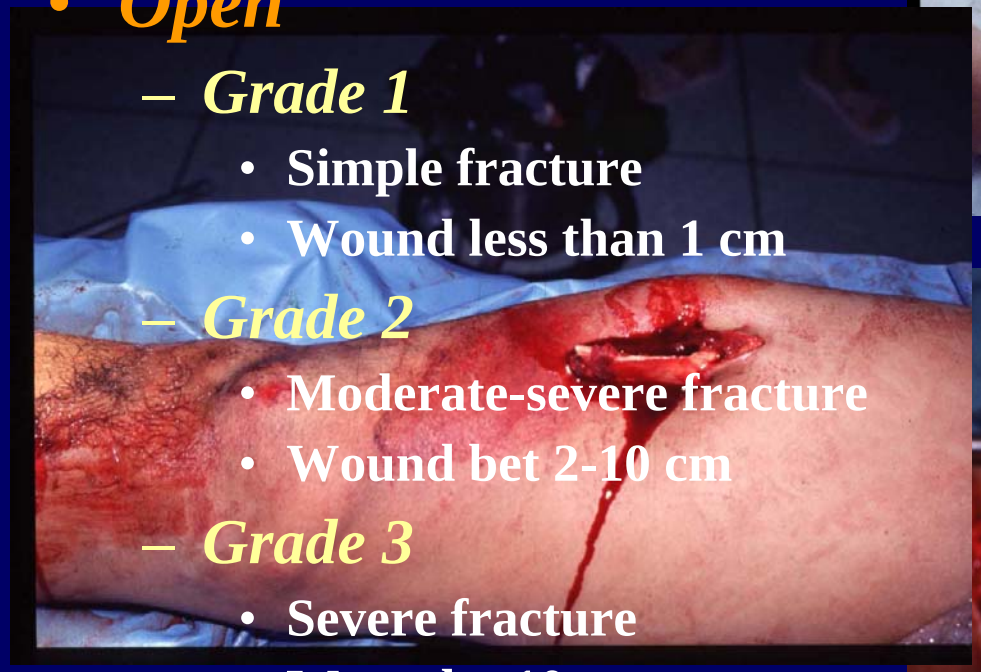
- *Impaired circulation and function of tissues within a closed space*
- *Most common: closed Fx in*
  - *Leg, forearm*
- *Irreversible damage to muscles if > 6 hr*
- *Irreversible damage to nerves if > 12 hr*
- *Clinical*
  - *Pain out of proportion, pain with passive ROM*
  - *Discolation*
  - *Paresthesia*
  - *Paralysis*
  - *Pulseless*

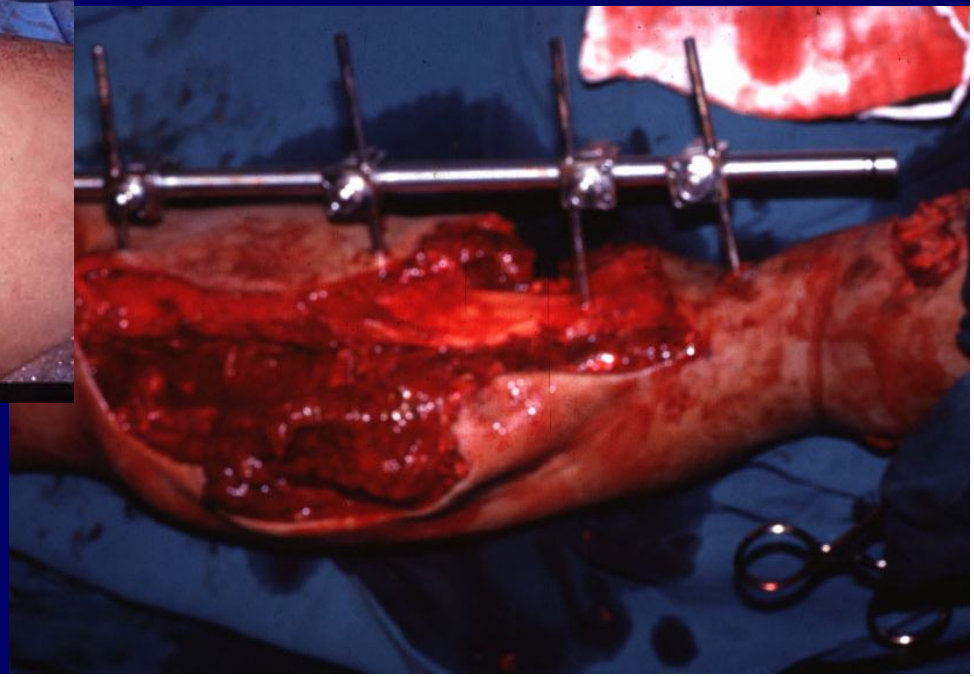
Compartment syndrome

- *Risks injuries*
  - *Fx tibia*
  - *Knee dislocation*
  - *Crush injury: leg, foot*
  - *Prolong Fx with vascular compromised*
- *Treatment*
  - *Fasciotomy*

Type of fractures

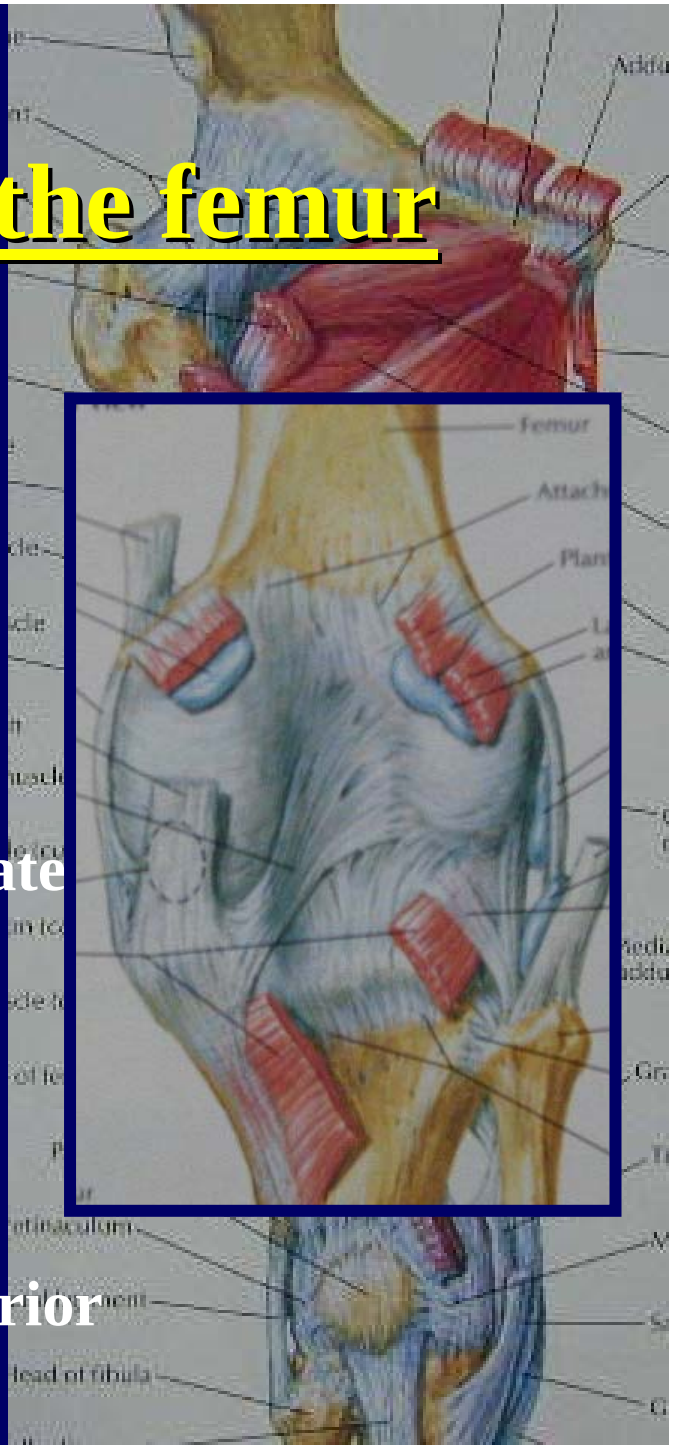
- *Closed*
  - *No wound connects to Fx site*
- *Open*
  - *Grade 1*
    - Simple fracture
    - Wound less than 1 cm
  - *Grade 2*
    - Moderate-severe fracture
    - Wound bet 2-10 cm
  - *Grade 3*
    - Severe fracture
    - Wound > 10 cm
    - Loss of skin coverage
    - Vascular compromised





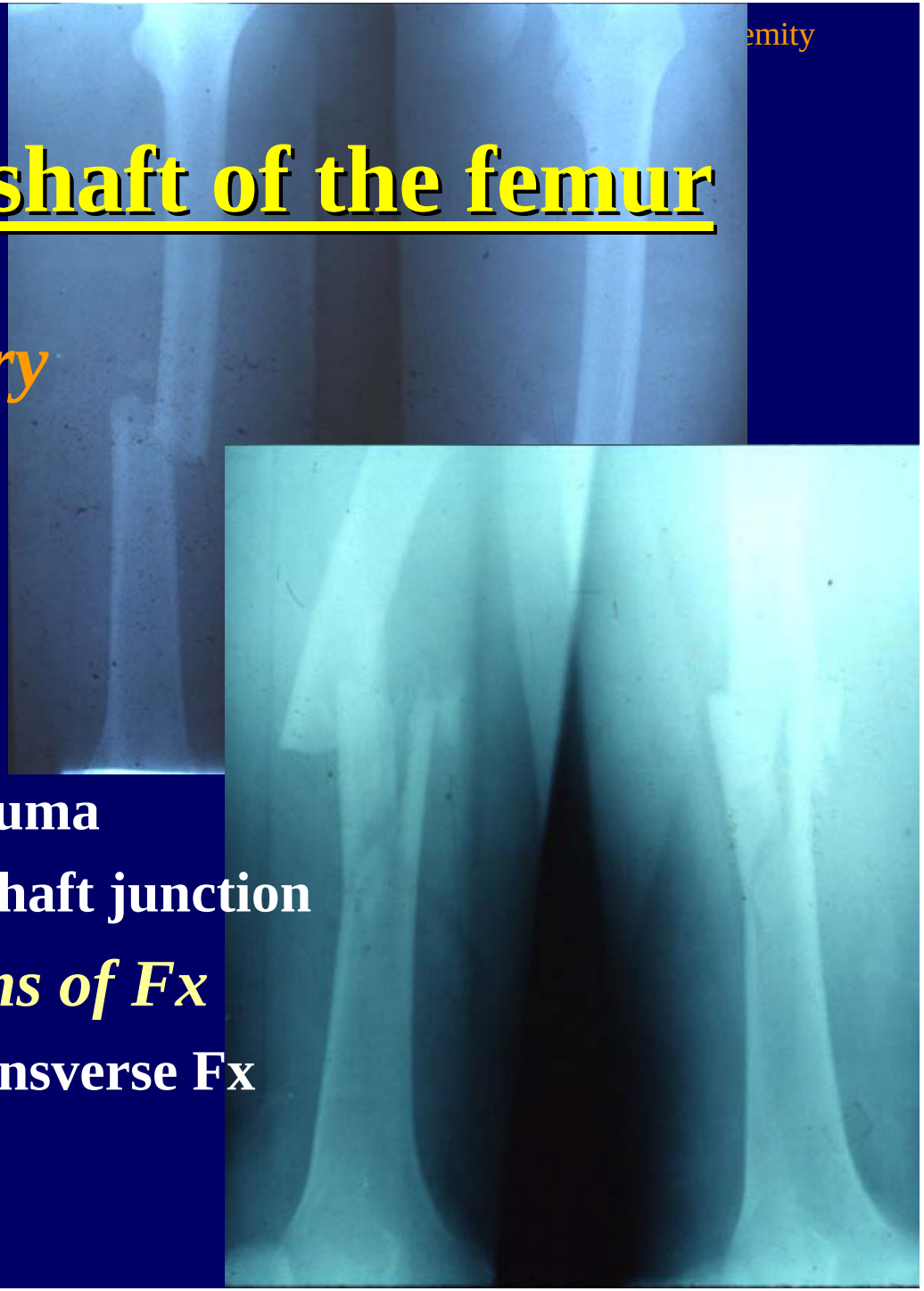
Fracture of the shaft of the femur

- *General*
  - *The strongest and longest bone*
  - *Canal widening: proximal and distal*
  - *Gluteal and psoas muscles*
    - **Proximal third: flex, external rotate abduct**
  - *Adductors*
    - **Varus deformity**
  - *Gastrocnemius muscles*
    - **Supracondylar: distal part: posterior angulation**



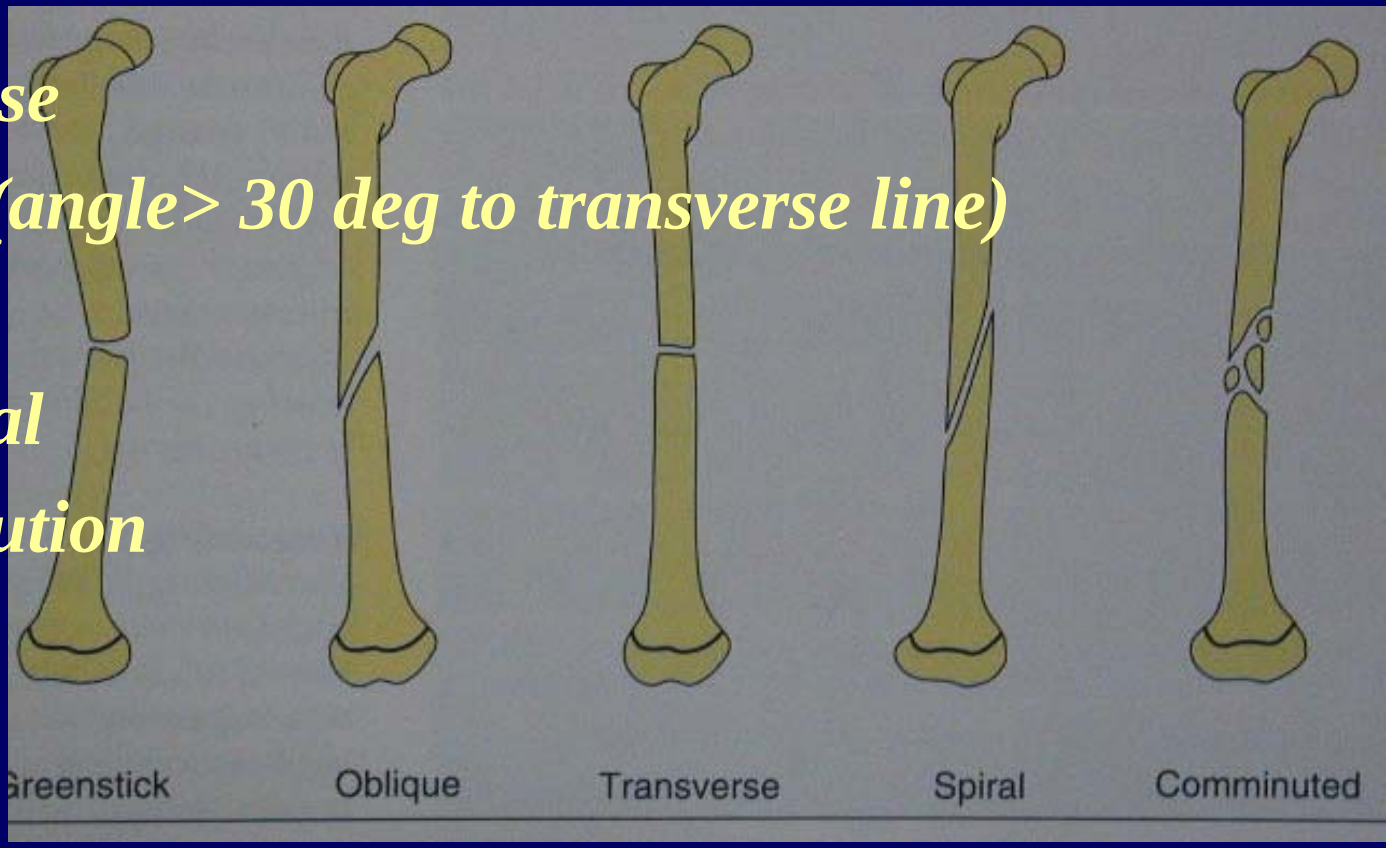
Fracture of the shaft of the femur

- *Mechanisms of injury*
  - *General*
    - Major trauma
    - High-energy injury
  - *Pathological*
    - Lesser degree of trauma
    - Often: metaphysis-shaft junction
  - *Common mechanisms of Fx*
    - Bending load >> transverse Fx



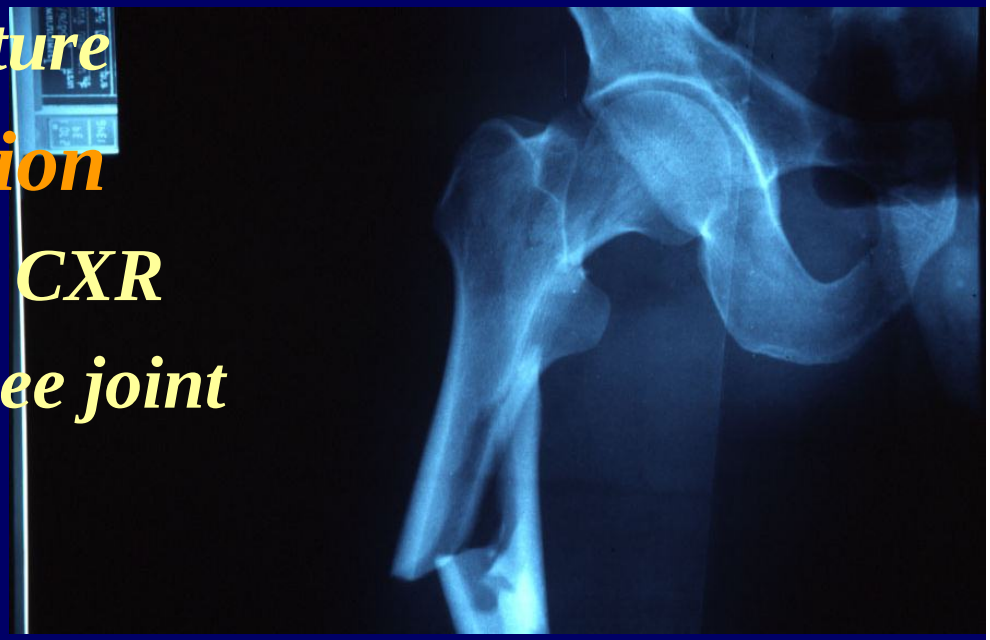
Fracture of the shaft of the femur

- *Type of fractures (according to geometry of Fx line)*
  - *Transverse*
  - *Oblique (angle> 30 deg to transverse line)*
  - *Spiral*
  - *Segmental*
  - *Comminution*



Fracture of the shaft of the femur

- *Symptoms and signs*
  - *Common S&S of fracture*
- *Radiographic evaluation*
  - *Standard: AP, lateral, CXR*
  - *Including: hip and knee joint*
  - *Findings: fracture*



Fracture of the shaft of the femur

- *Initial evaluation and management*
  - *Live support: as major traumatized patient*
- *Assessment of associated orthopaedic injuries*
  - **Pelvic fracture**
  - **Hip fracture**
  - **Ligamentous injury: around the knee**
  - **Neurovascular injury**
- *Immobilization*

Fracture of the shaft of the femur

- *Complications*
  - *Commom Fx complications*
  - *Fat embolism*
  - *ARDS (multiple Fx)*

Fracture of the shaft of the femur

- *Treatment*
  - *Nonoperative*
    - **Traction**
    - **Cast brace**

Fracture of the sh

- *Treatment*
  - *Operative*
    - Plating
    - Intramedullary nailing
    - External fixator

Fracture of the shaft of the femur

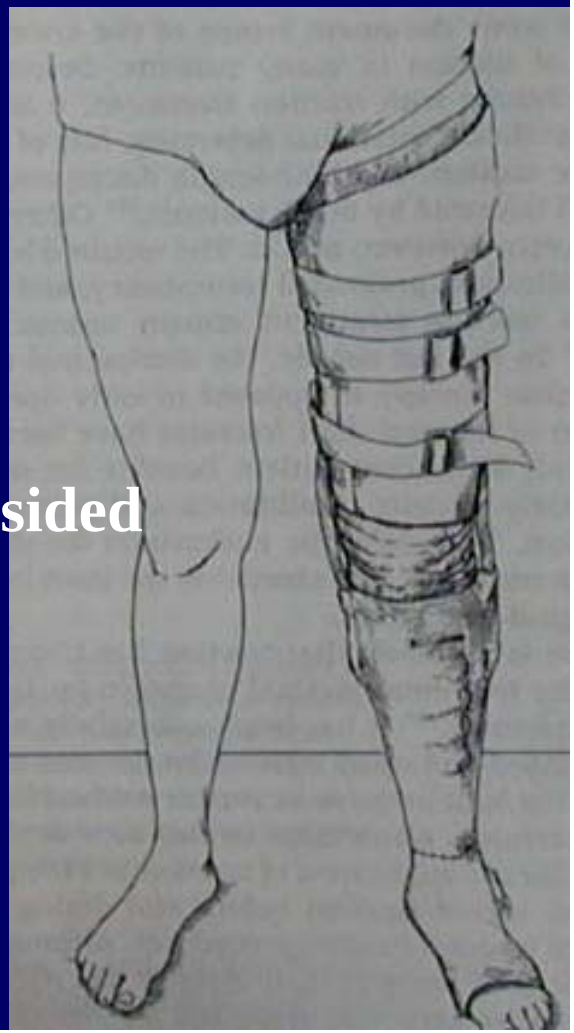
- *Traction*
  - *Commonly used in the past*
  - *Now, indicated in*
    - Fracture in children
    - Temporary purpose
    - Surgery is limited
  - *Type*
    - Skeleton
      - Proximal tibia
      - Distal femur
    - Skin

Fracture of the shaft of the femur

- *Traction*
  - *Disadvantages*
    - **Limited rotational control of fracture**
    - **Limb-length discrepancy**
    - **Loss of range of motion (ROM)**
    - **Prolonged hospitalization**
    - **Pin tract infection**

Fracture of the shaft of the femur

- *Cast brace*
  - *Provides external support effect*
  - *Permits progressive weight bearing*
  - *Prerequisites*
    - **Good reduction**
    - **Traction until pain swelling have subsided**
  - *Indicated in*
    - **Distal third fracture**

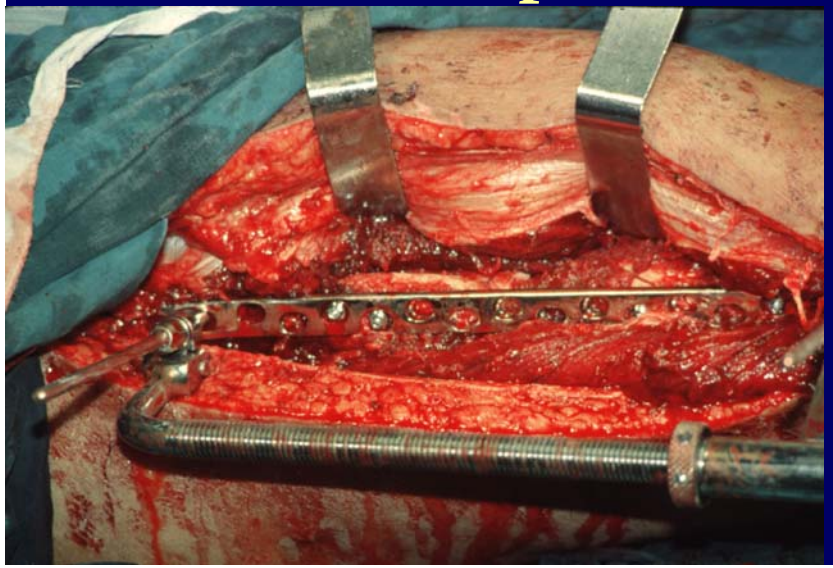


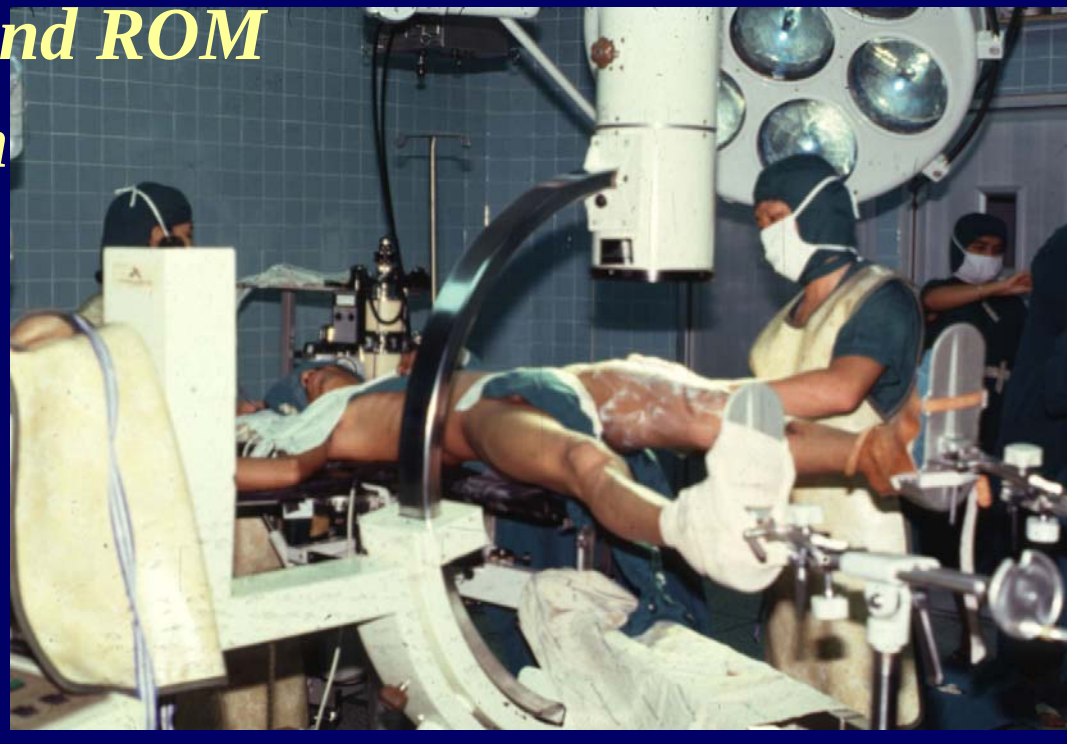
Fracture of the shaft of the femur

- *Cast brace*
  - *Disadvantages*
    - **Limb-length discrepancy**
    - **Varus angulation**
    - **Limb-length discrepancy**
    - **Limited area of usage**

Fracture of the shaft of the femur

- *Operative treatment*
  - *Immediate fracture stability*
  - *More anatomical reduction*
  - *Early ambulation and ROM*
  - *Less hospitalization*



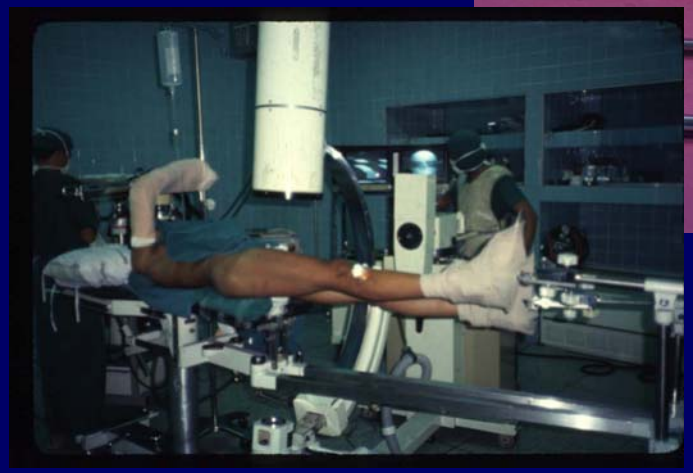


Fracture of the shaft of the femur

- *Plating*
  - *No need for special instruments*
  - *Favorable results*
  - *Ipsilateral neck-shaft fracture (same side)*
  - *Disadvantages*
    - **Extensive tissue exposure**
    - **Higher complications than nailing**

Fracture of the shaft of the femur

- *Intramedullary nailing*
  - *Treatment of choice*
  - *Load-sharing implant*
  - *Predictable shaft alignment*
  - *Early recovery*
  - *Type*
    - **Open nailing**
    - **Closed nailing**

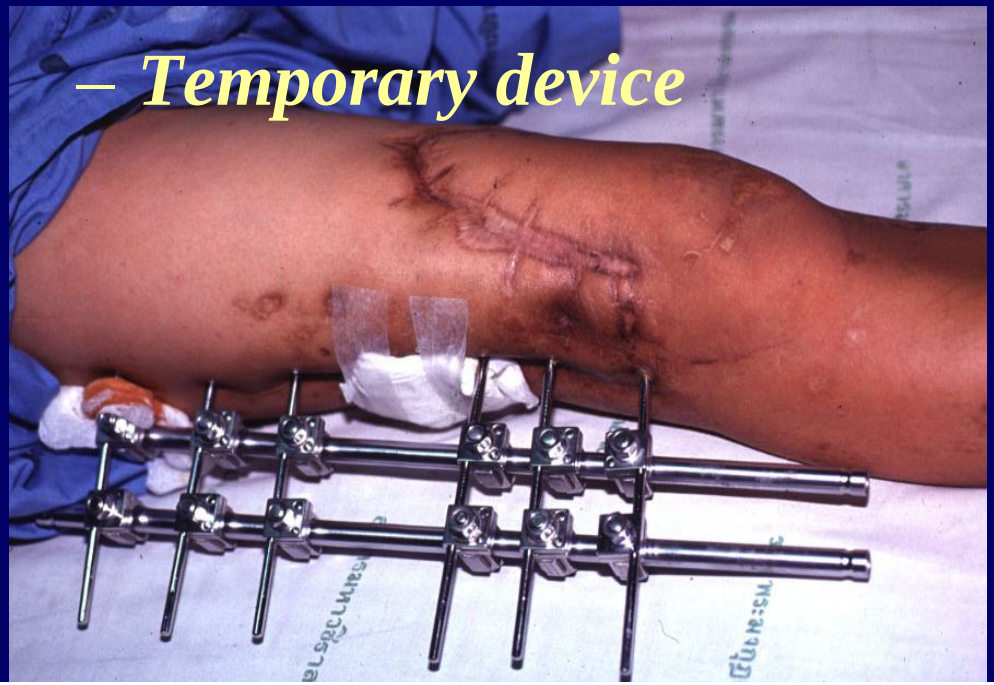


Fracture of the shaft of the femur

- *Intramedullary nailing*
  - *Closed nailing*
    - Interlocking nailing
    - Less invasive
    - Minimal surgical surgical scar
    - Rapid fracture healing

Fracture of the shaft of the femur

- *External fixator*
  - *Open fracture: need wound care*
  - *Severe comminution*
  - *Marked contaminated wound*
  - *Temporary device*

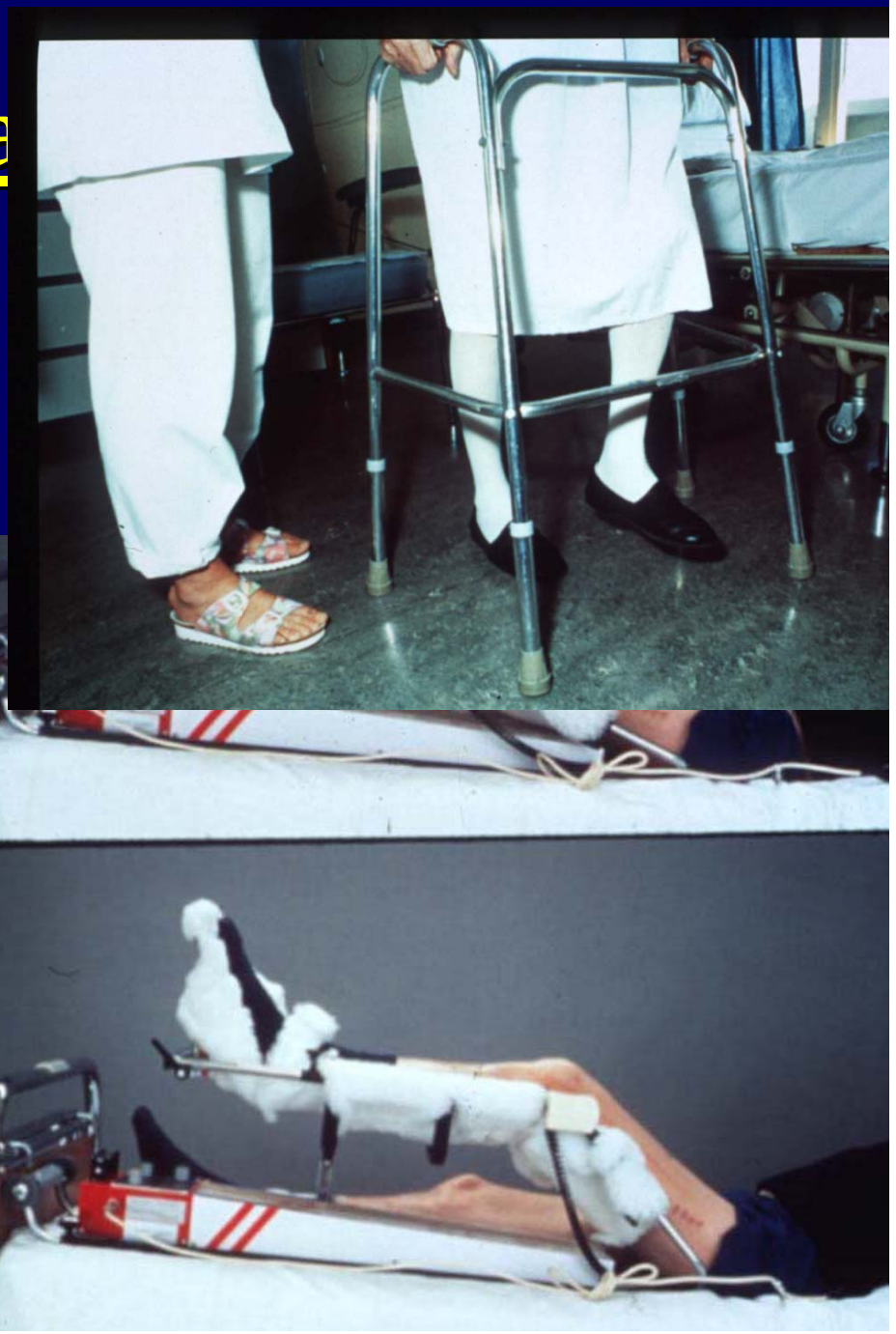


Fracture of the shaft of the femur

- *Disadvantages of operative treatment*
  - *Infection*
  - *Nonunion*
  - *Delayed union*
  - *Loss of fixation*
  - *Others surgical complications*

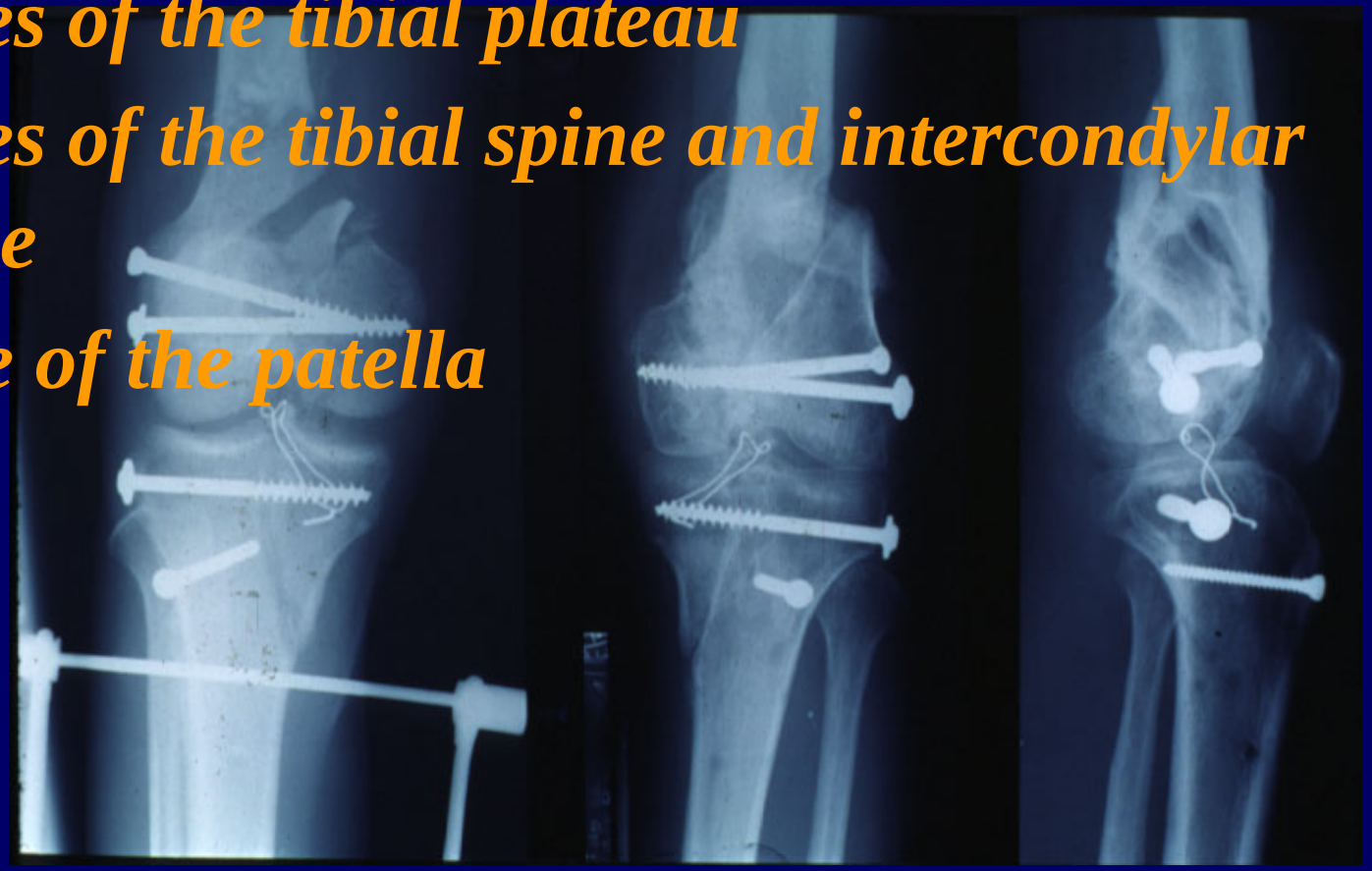
Fracture of the sha

- *Postoperative rehabilitation*
  - *Early mobilization*
  - *Muscle activity: following stability*
  - *Progressive weight bearing: stable*
  - *Delayed weight bearing: less stability, proximal or distal fracture*



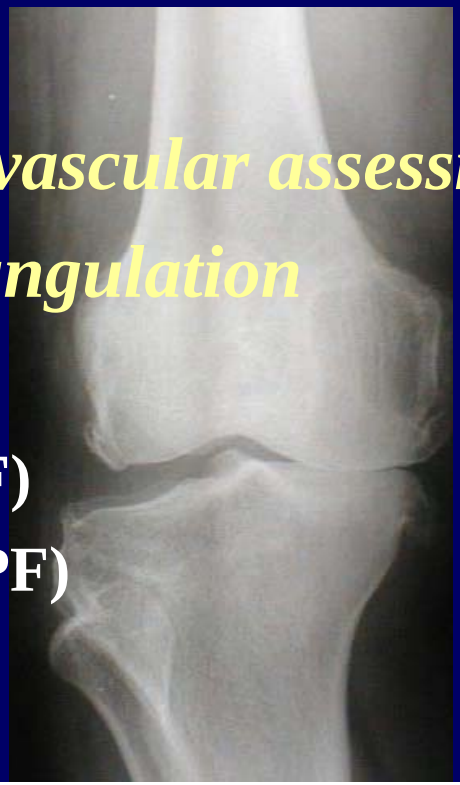
Fractures around the knee

- *Fracture of the distal femur*
- *Fractures of the tibial plateau*
- *Fractures of the tibial spine and intercondylar eminence*
- *Fracture of the patella*

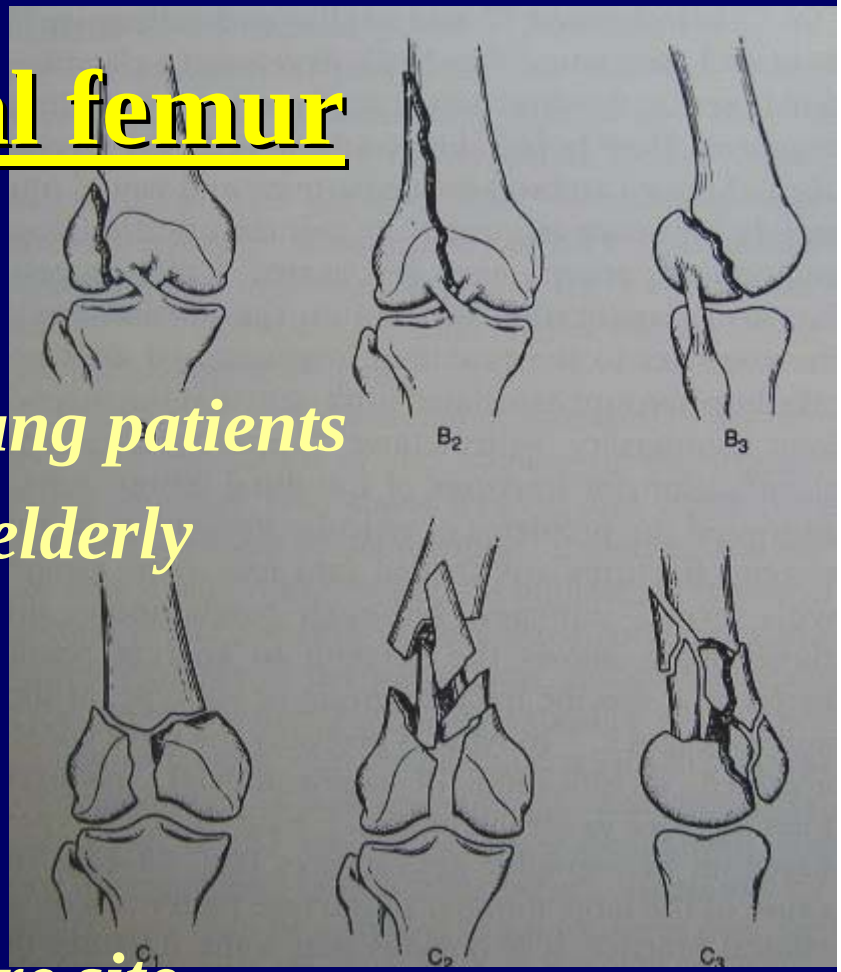


Fracture of the distal femur

- *General*
  - *Supracondylar area*
    - 5 cm above the flare of metaphysis
  - *Intercondylar area*
  - *Require careful neurovascular assessment*
  - *Distal part: posterior angulation*
  - *Joint*
    - Tibiofemoral joint (TF)
    - Patellofemoral joint (PF)

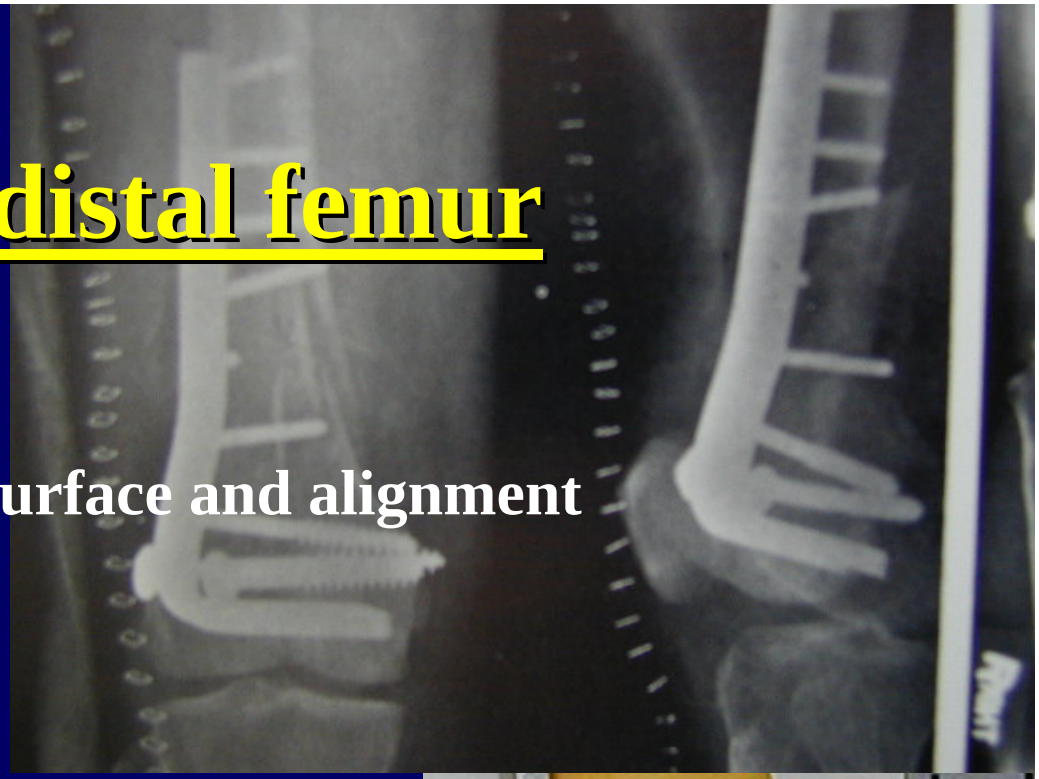


Fracture of the distal femur

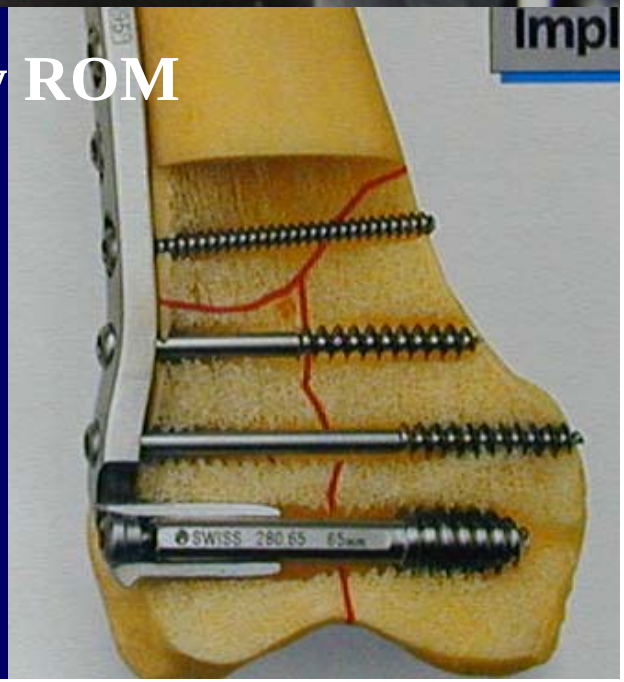


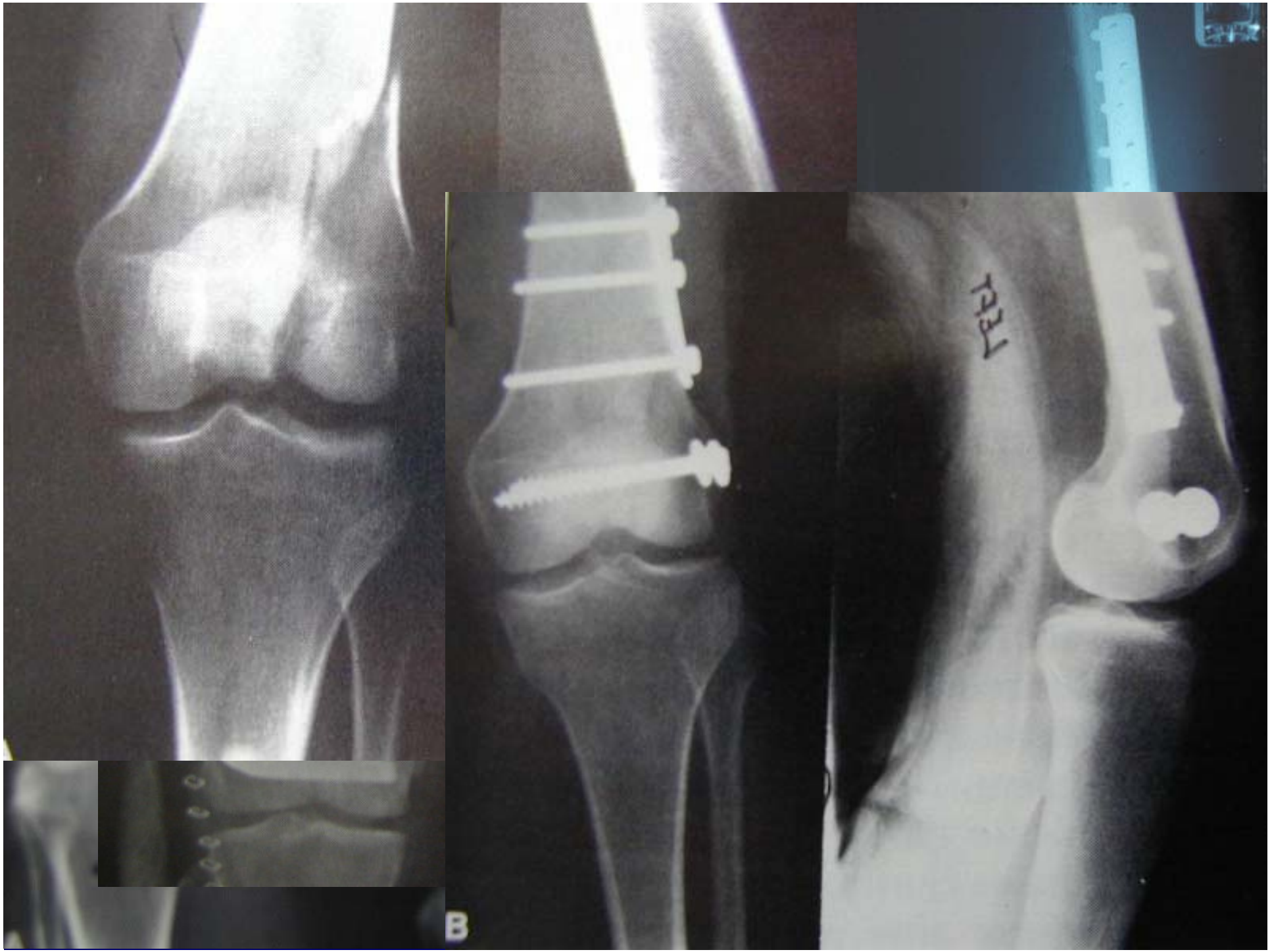
- *Mechanisms of injuries*
  - *High energy trauma in young patients*
  - *Low energy trauma in the elderly*
- *Symptoms and signs*
  - *Pain around the knee*
  - *Swelling around the knee*
  - *Tenderness over the fracture site*
- *Radiographic evaluation*
  - *Usually standard x-ray views*

Fracture of the distal femur



- *Treatment*
  - Goal: restore joint surface and alignment
  - *Nonoperative*
    - Nondisplaced
      - Traction 4-6 wk
      - Cast brace with NWB and early ROM
  - *Operative*
    - Significant displaced
    - Implant
      - Condylar blade plate
      - Condylar sliding nail-plate
      - Intramedullary nail

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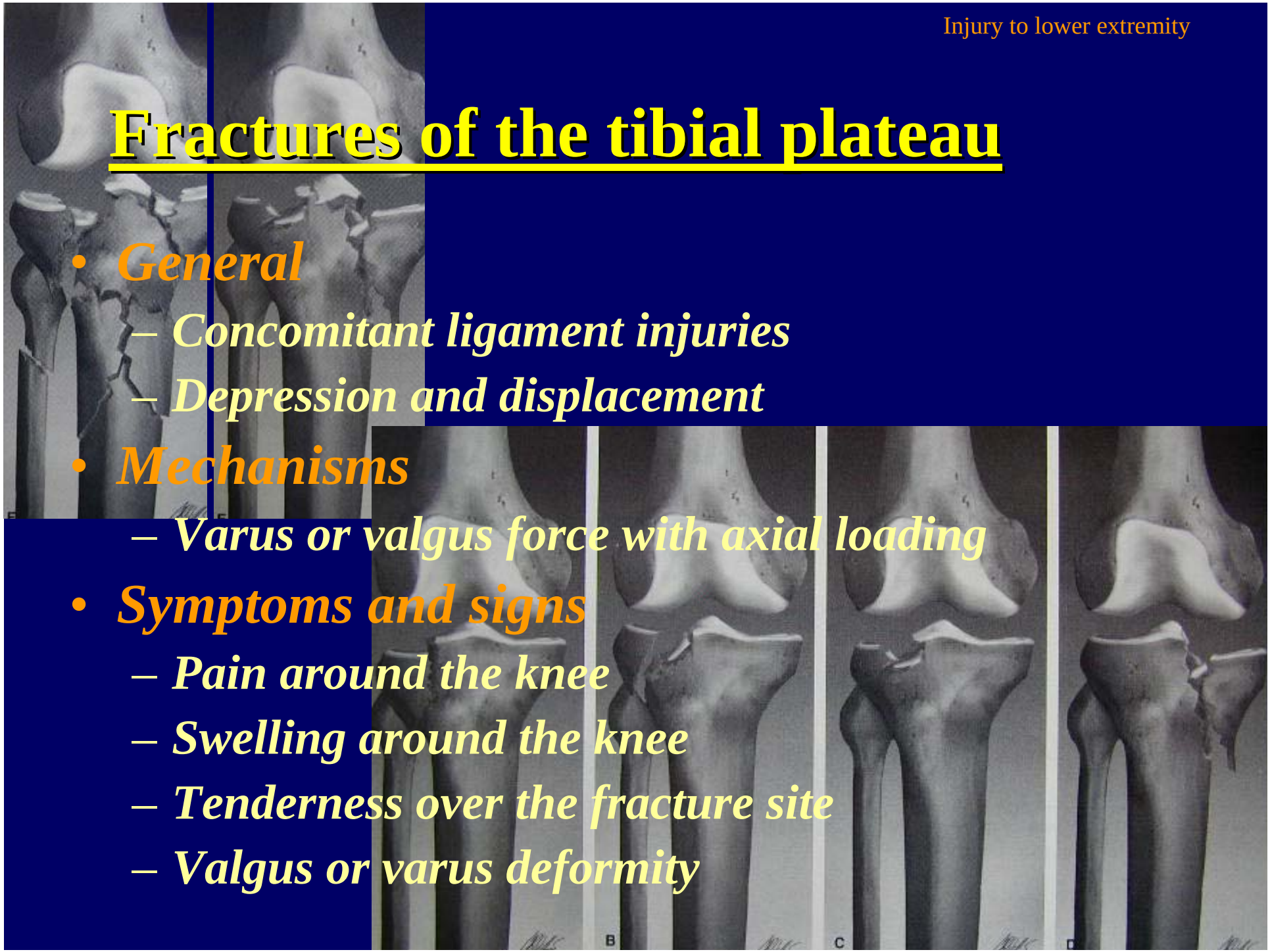
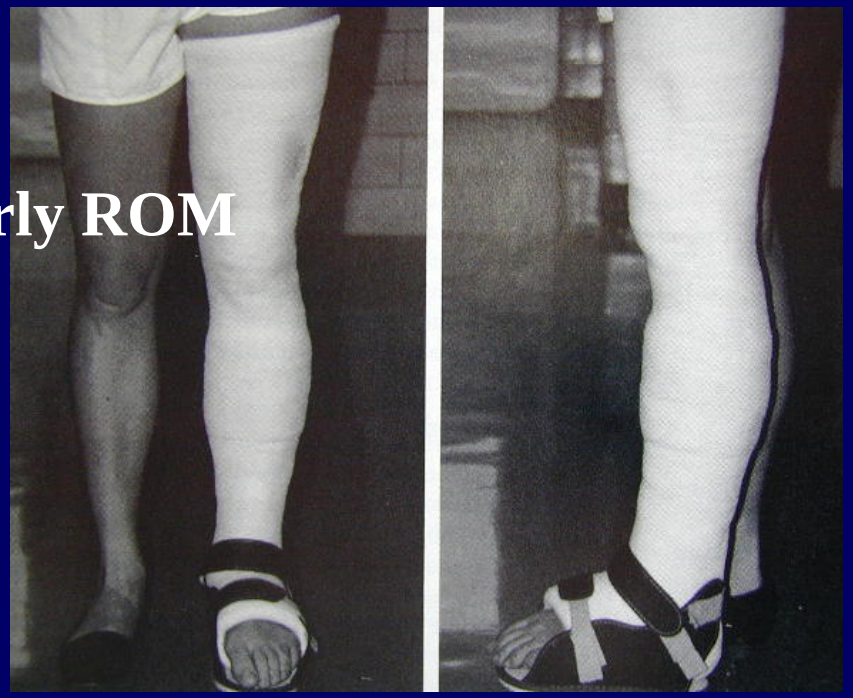
Fractures of the tibial plateau

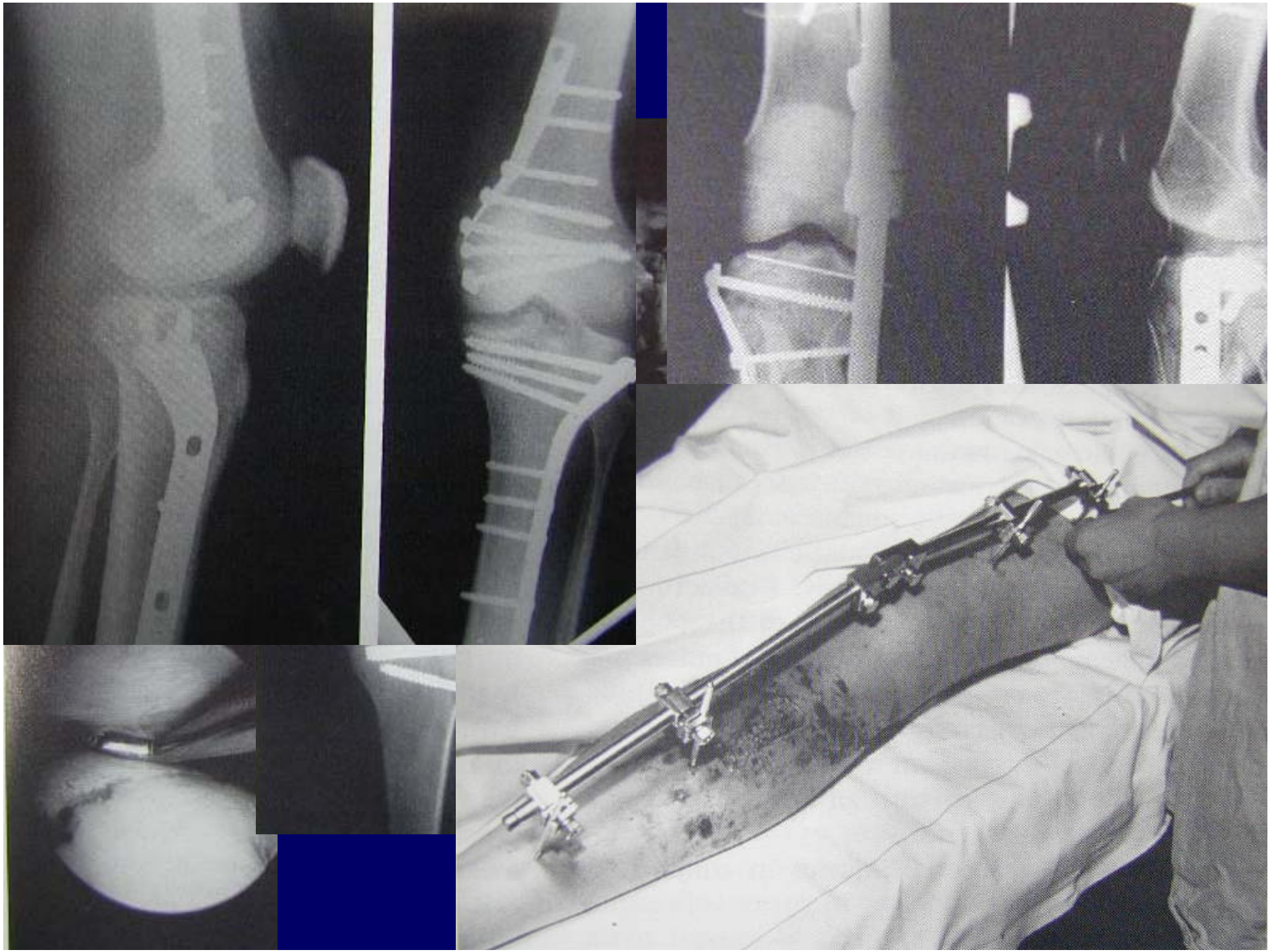


- *General*
  - *Concomitant ligament injuries*
  - *Depression and displacement*
- *Mechanisms*
  - *Varus or valgus force with axial loading*
- *Symptoms and signs*
  - *Pain around the knee*
  - *Swelling around the knee*
  - *Tenderness over the fracture site*
  - *Valgus or varus deformity*

Fractures of the tibial plateau

- *Nonoperative*
  - Long leg cast (LLC)
  - Brace with NWB and early ROM
  - Traction
- *Operative*
  - Screw or pin
  - Plate and screws
- *Rehabilitation*
  - Non weight bearing 6-8 weeks
  - Partial weight bearing until 12 weeks
  - Full weight bearing after 12 weeks



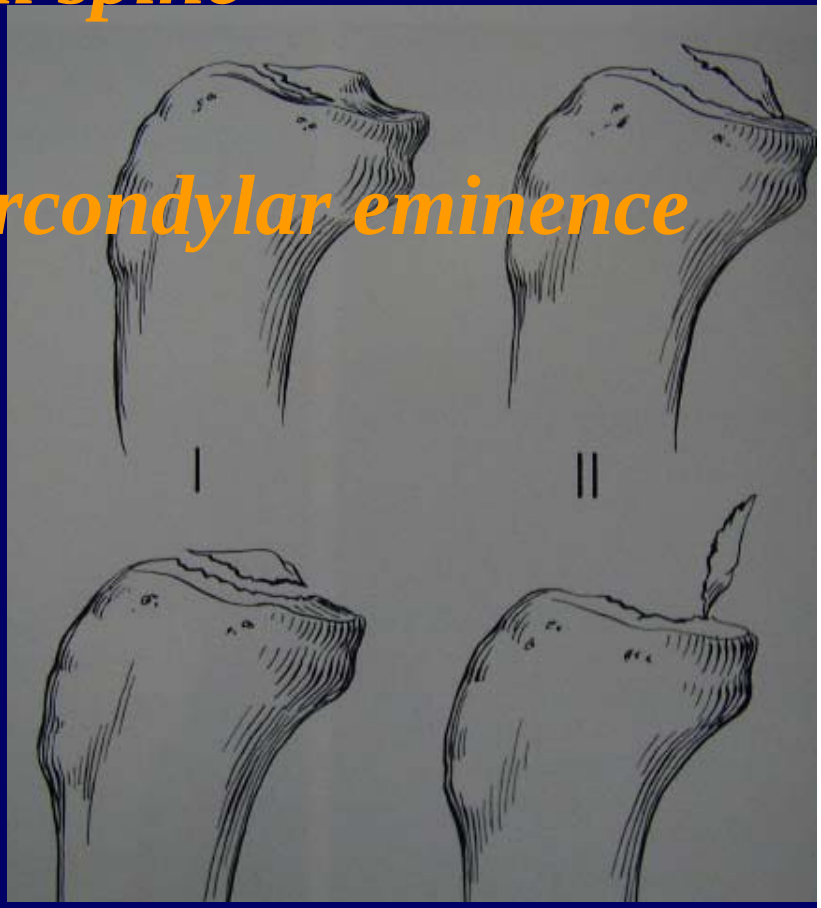


Fractures of the tibial plateau

- *Complications*
  - *Common Fx complications*
  - *Peroneal nerve injury*
  - *Popliteal artery injury*
  - *Compartment syndrome*
- *Associate injuries*
  - *Meniscal injury 15%*
  - *Cruciate ligament and collateral ligament injuries 22%*

Fractures of the tibial spine and intercondylar eminence

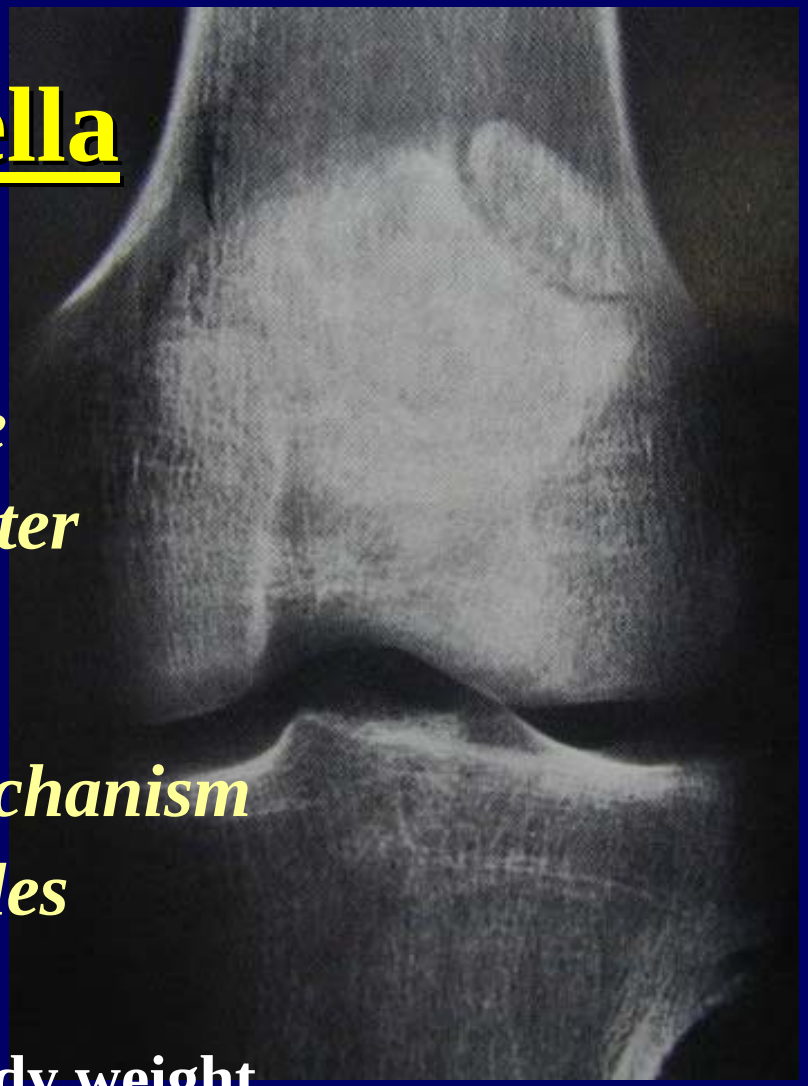
- *Mechanism of injury: tibial spine*
  - *Knee twisting*
- *Mechanism of injury: intercondylar eminence*
  - *Hyperflexion*
  - *Hyperextension*
  - *Valgus-varus force*



Fractures of the t l intercondylar emi

- *Symptoms and signs*
  - *Pain and swelling of the kn*
  - *A block to full extension*
- *Treatment*
  - *Nonoperative*
    - **Most fractures**
    - **Long leg cast in full extension 4-6 wk**
  - *Operative*
    - **Arthrotomy and screw fixation**
    - **Arthroscopy and screw fixation**
  - *Complication*
    - **Fragment becomes a loose body**

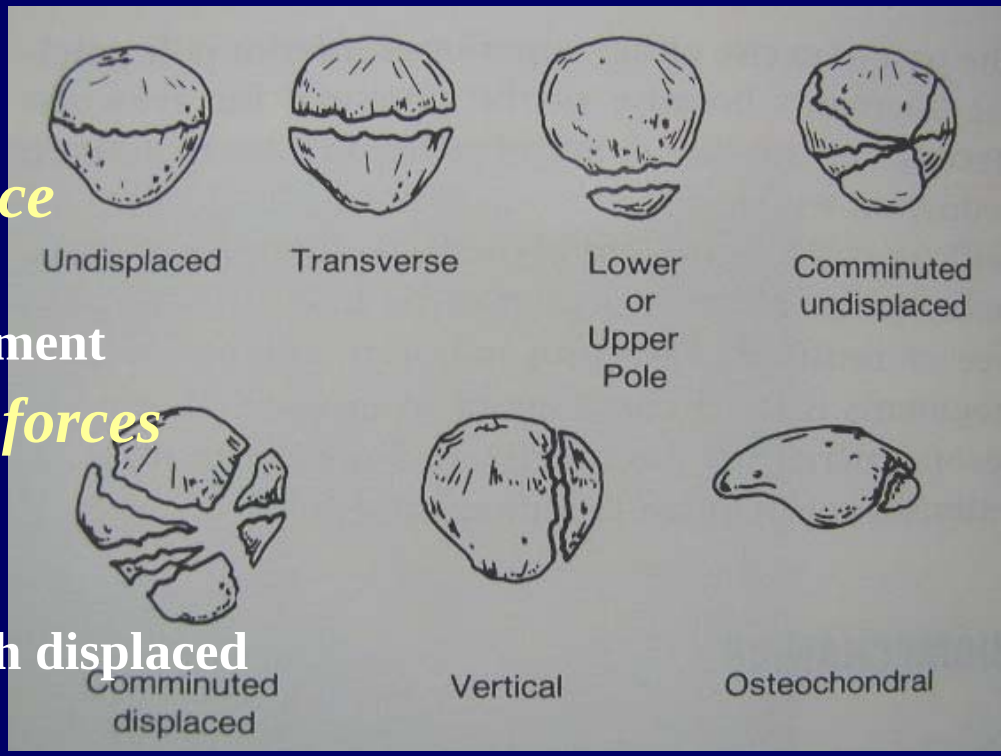
Fracture of the patella



- *General*
  - *The largest sesamoid bone*
  - *Accessory ossification center*
    - **Superolateral corner**
    - **Named “bipatite patetta”**
  - *Increases the extensor mechanism*
  - *Protect the femoral condyles*
  - *Forces across PF joint*
    - **Daily activity: >3 times body weight**
    - **Stair climbing and deep squatting: >7 times body weight**

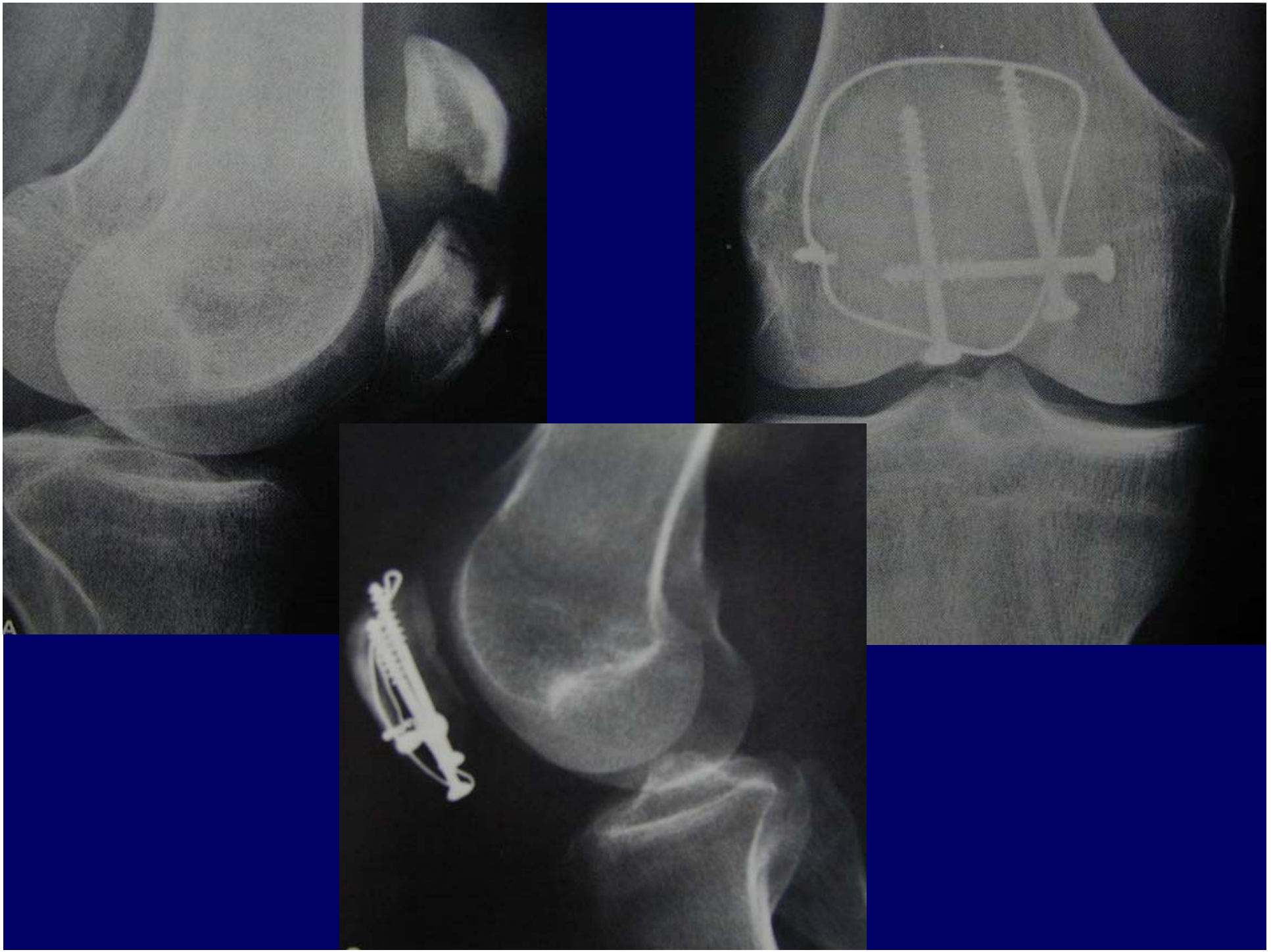
Fracture of the patella

- *Mechanisms of injury*
  - *Direct injuries: direct force*
    - **Pattern:Comminuted**
    - **Usually minimal displacement**
  - *Indirect injuries: muscle forces*
    - **Pattern:Transverse**
  - *Combined injuries*
    - **Pattern:Comminuted with displaced**
- *Symptoms and signs*
  - *Pain and tenderness at the anterior of the knee*
  - *Skin contusion: direct injuries*
  - *Ability to extend the knee*
    - **Depends on the continuity of the extensor mechanism**

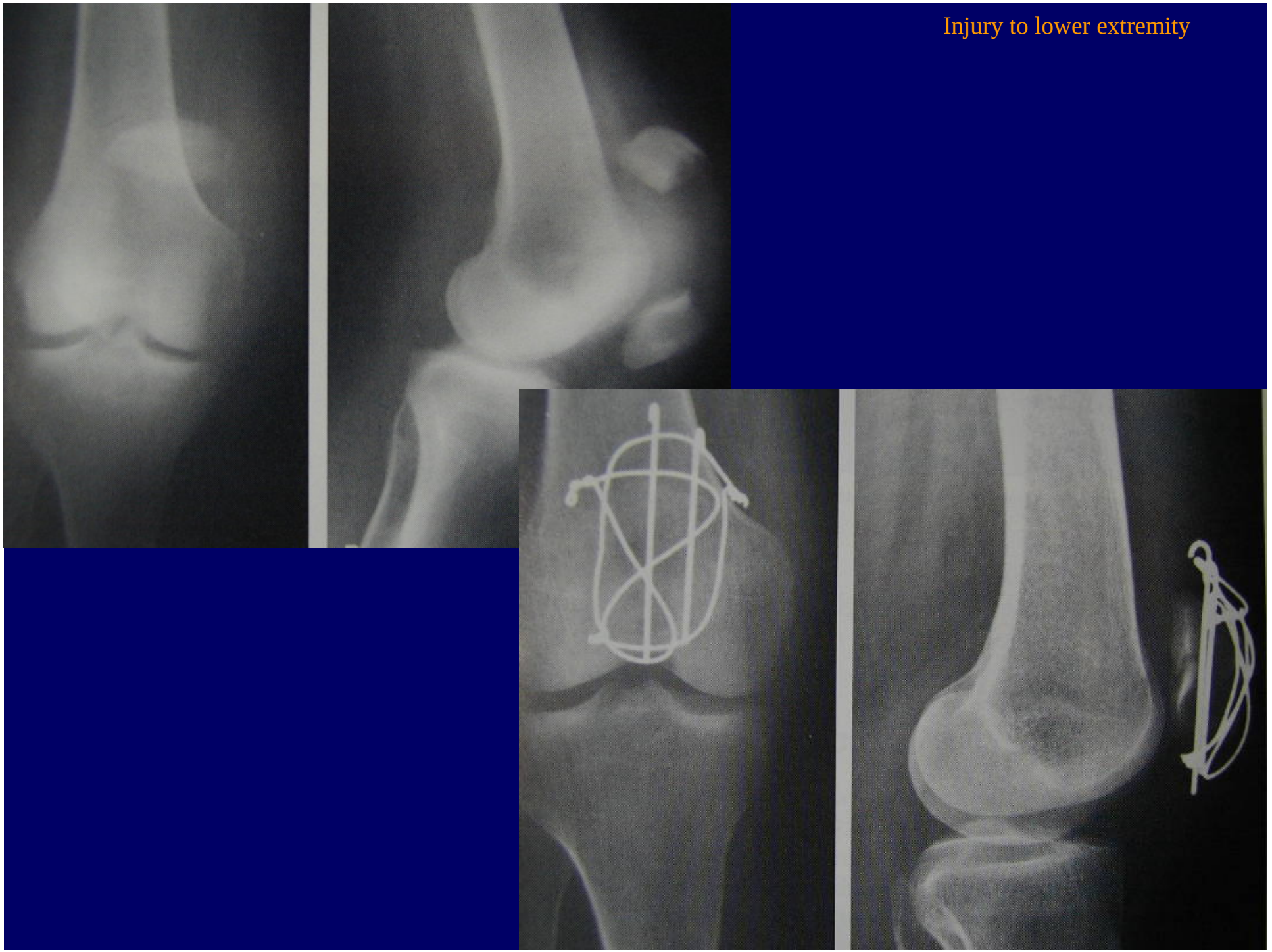


Fracture of the patella

- *Treatment*
  - *Nonoperative*
    - Within 2-3 mm displacement or stepping
    - Cylinder cast for 4-6 wk
  - *Operative*
    - More than 2-3 mm displacement or stepping
    - ORIF
      - Circlage wiring
      - Tension band wiring
    - Patellectomy



Injury to lower extremity

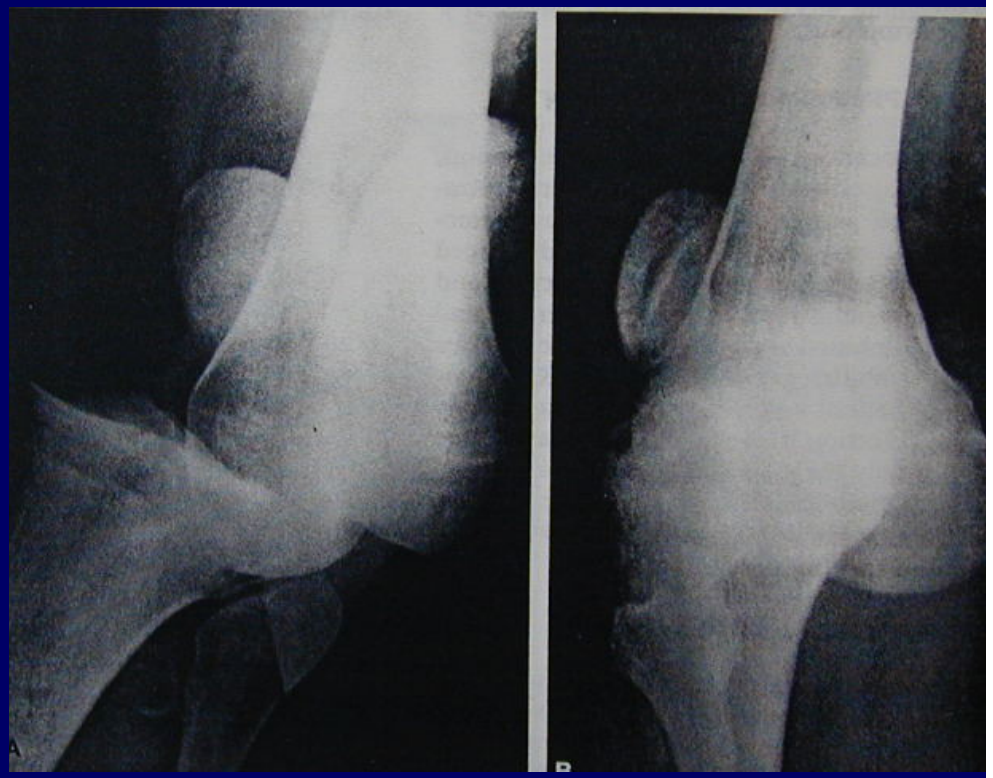


Fracture of the patella

- *Complications*
  - *Common Fx complications*
  - *Results after treatment*
    - **Late OA change of the PF joint**
    - **Painful retained hardware**

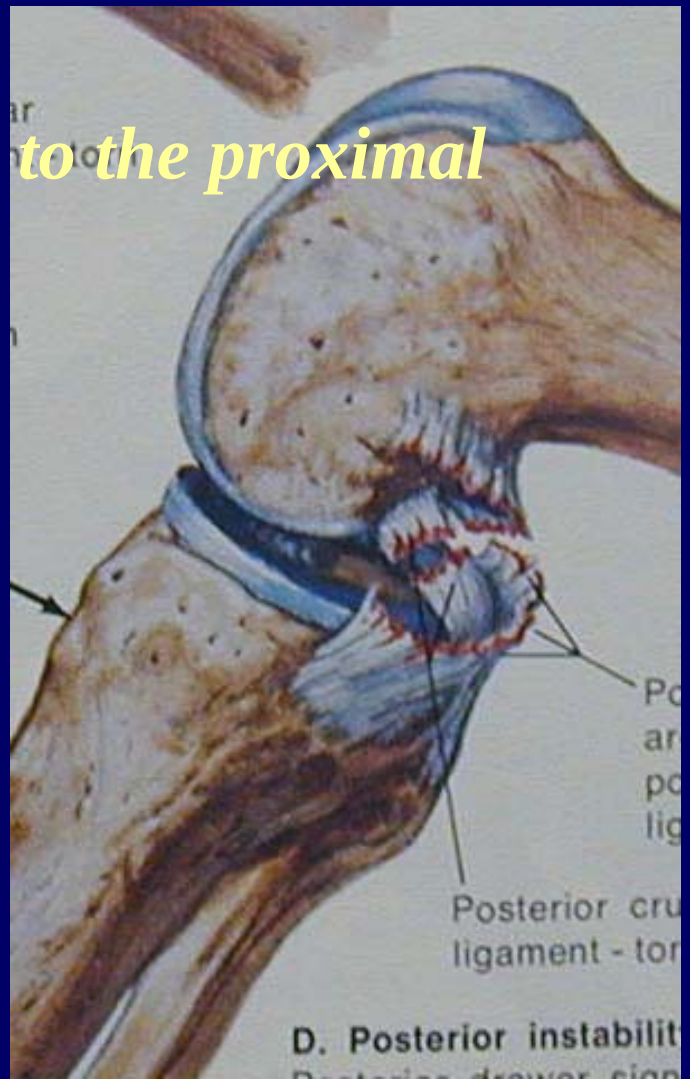
Knee dislocation and fracture dislocation

- *Knee dislocation*
- *Patella dislocation*
- *Fracture dislocation*



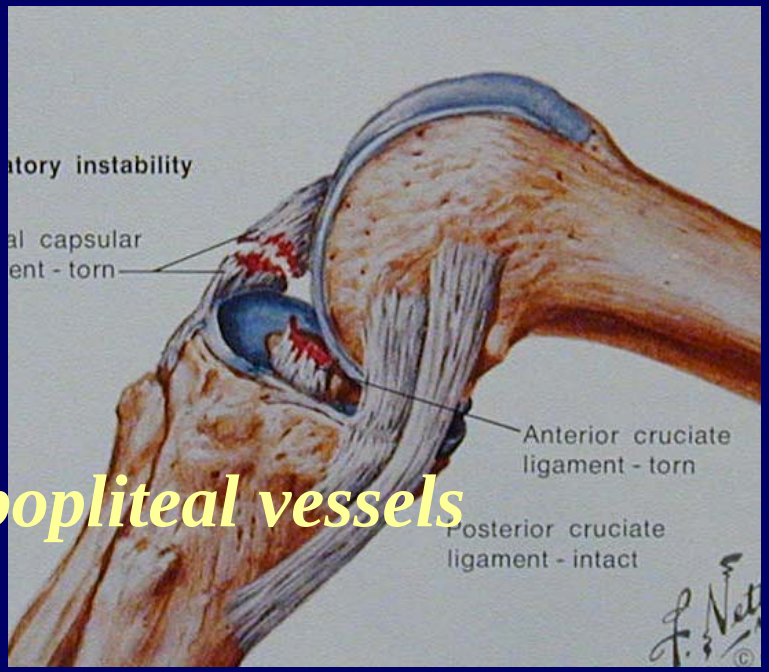
Knee dislocation

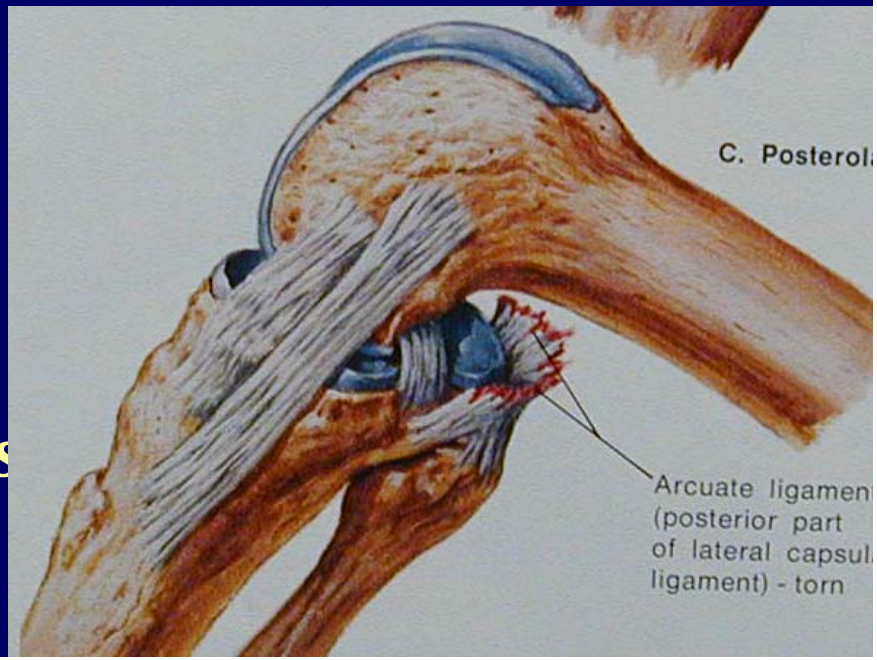
- *Description*
  - *Position of the distal relates to the proximal*
- *Type of dislocation*
  - *Anterior*
  - *Posterior*
  - *Medial*
  - *Lateral*
  - *Rotatory*



Knee dislocation

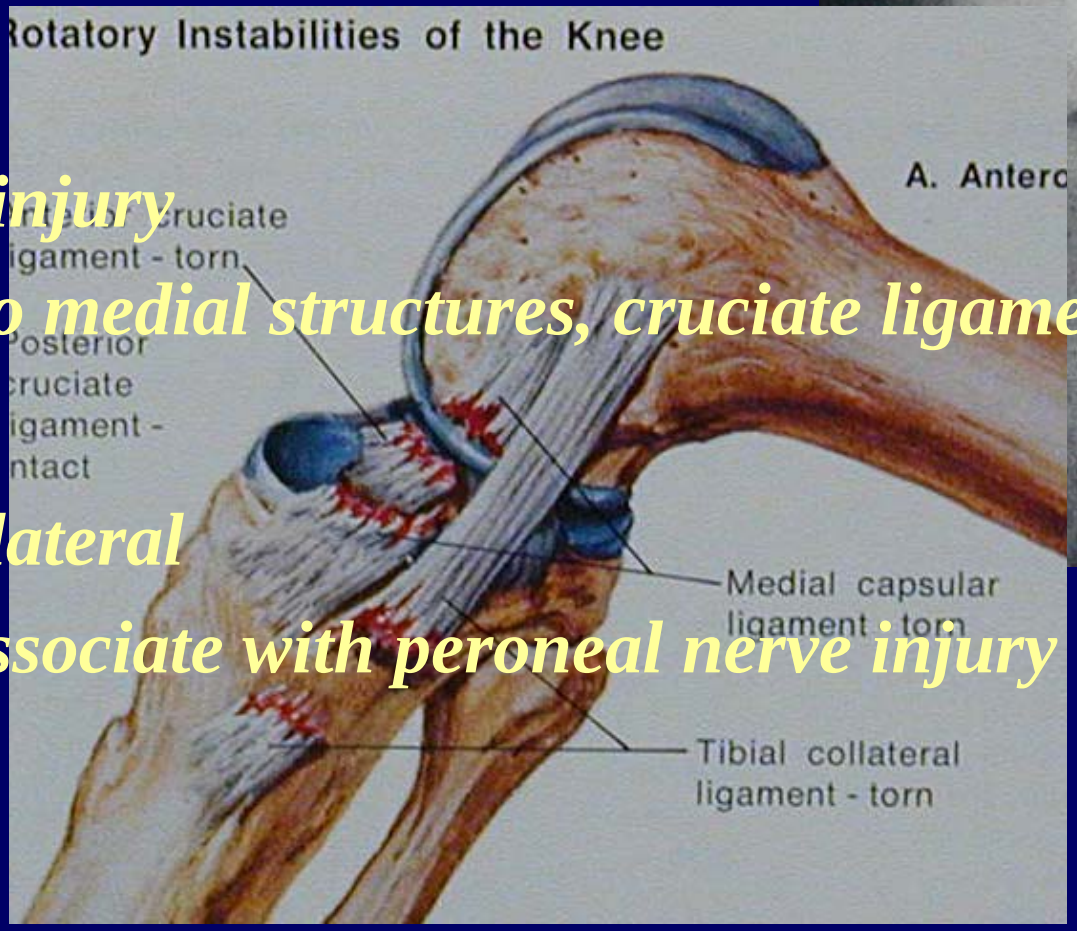
- *Anterior*
  - *Hyperextension injury*
  - *Injury to PCL, ACL and popliteal vessels*
  - *Common*
- *Posterior*
  - *Common*
- *Medial*
  - *Varus injury*
  - *Injury to lateral structures*





Knee dislocation

- *Lateral*
  - *Valgus injury*
  - *Injury to medial structures, cruciate ligaments*
- *Rotatory*
  - *Posterolateral*
  - *Often associate with peroneal nerve injury*



Knee dislocation

- ***Symptoms and signs***
  - ***Gross distortion of the knee***
  - ***Instability after reduction***
  - ***May have neurological deficit (35% of cases)***
    - **Most common: common peroneal nerve**
  - ***May have vascular compromise***
    - **Most common: popliteal artery**

Knee dislocation

- *Treatment*
  - *Principle*
    - **Operative better than conservative**
  - *Emergency vascular assessment*
    - **Torn; vascular repair or graft**
  - *Repairs ligament if possible*
  - *Nerve assessment*
    - **Torn: repair**

Knee dislocation

- *Postoperative care*
  - *Establishes ROM as early as possible*
  - *At 4-6 wk: begins muscle strengthening*
- *Prognosis*
  - *Depends on the extent of neurovascular injury*

Patellar dislocation

- *General*
  - *Common in female*
- *Symptoms and signs*
  - *Pain*
  - *Distorted knee anatomy*
  - *Limited ROM in flexed position*
- *Treatment*
  - *Closed reduction (CR)*
  - *Cylinder cast 4-6 wk*
  - *Vastus medialis strengthening*

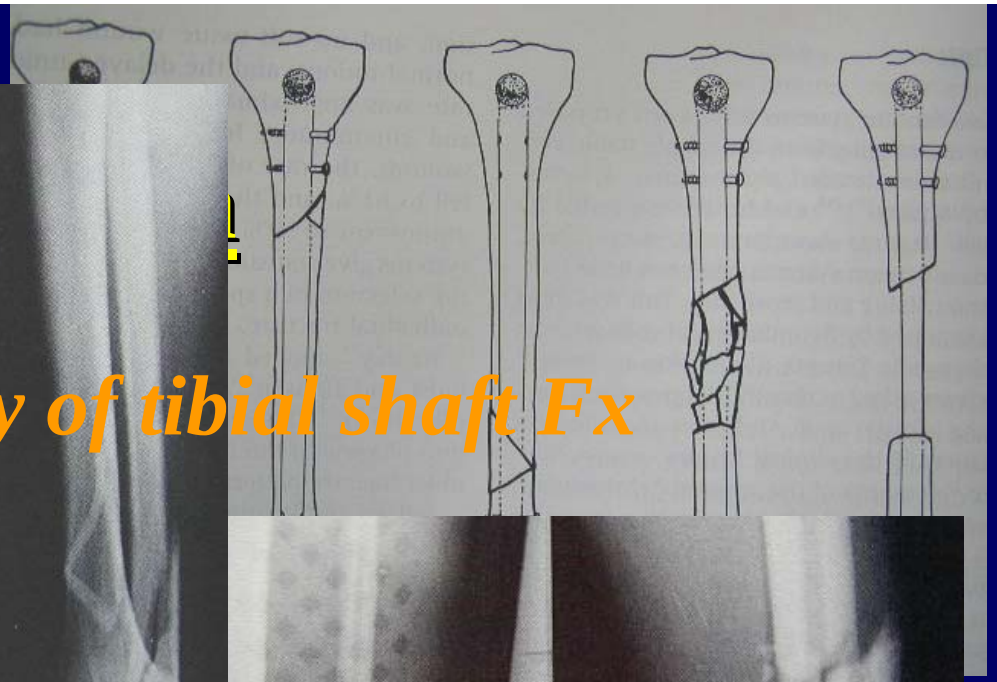
Fracture dislocation around the knee

- *General*
  - *Combination of fractures and dislocation*
- *Symptoms and signs*
  - *The same as major fracture around the knee*
  - *Distorted knee anatomy*
- *Treatment*
  - *immediate CR and immobilization*
  - *Definite fracture treatment*

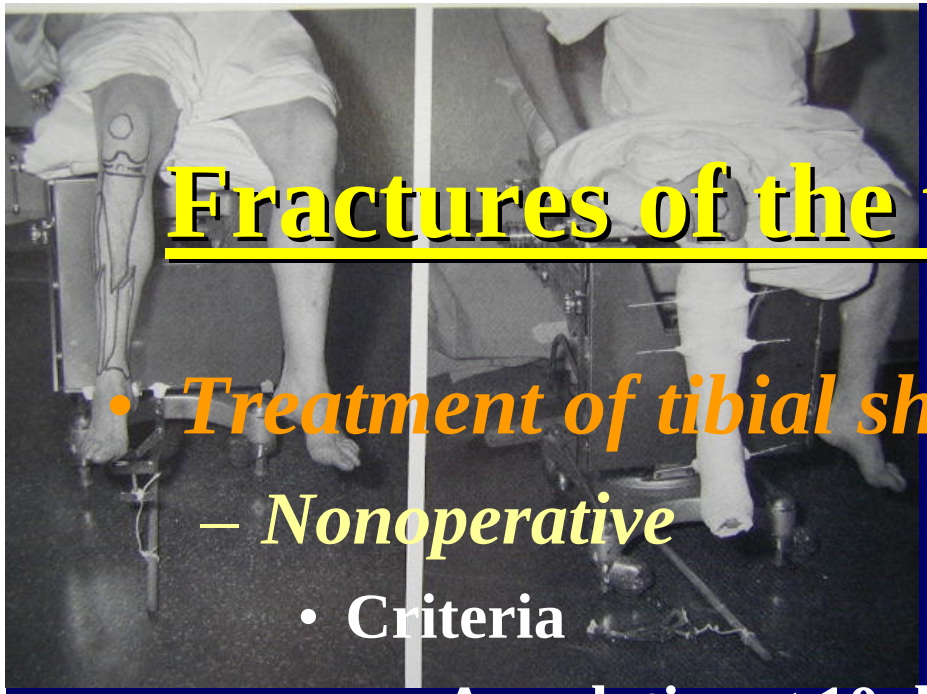
Fractures of tibia and fibular

- *General*
  - *Anterior compartment*
    - Ankle and foot dorsiflexion
    - Deep peroneal N
  - *Lateral compartment*
    - Foot plantaflexion and eversion
    - Sup peroneal N
  - *Superficial posterior compartment*
    - Foot plantaflexion
  - *Deep posterior compartment*
    - Foot plantaflexion and inversion
    - Posterior tibial N
    - Posterior tibial vessels

Fract

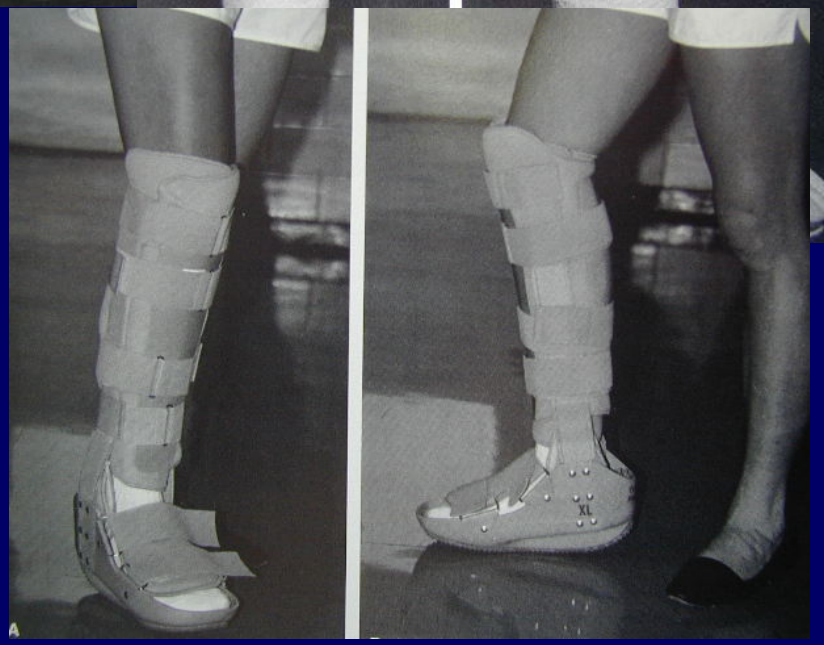


- *Mechanism of injury of tibial shaft Fx*
  - *Direct*
  - *Indirect*
  - *Penetrating*
- *Symptoms and signs of tibial shaft Fx*
  - *Usually obvious deformed leg*
  - *Pain*
  - *Swelling*
  - *Associated neurovascular injuries*



Fractures of the tibia

- *Treatment of tibial shaft Fx*
  - *Nonoperative*
    - Criteria
      - Angulation < 10 deg
      - Rotation < 10 deg
      - Shortening <1 cm
      - Apposition 50%
    - Closed reduction
    - Long leg cast
    - At 4 wk: progressive WB
    - At12 wk: full WB




C
D
B

Fractures of the tib

- *Complications*
  - *Common Fx complicatio*
  - *Vascular injury*
    - **Compartment syndrome**
  - *Nerve injury*

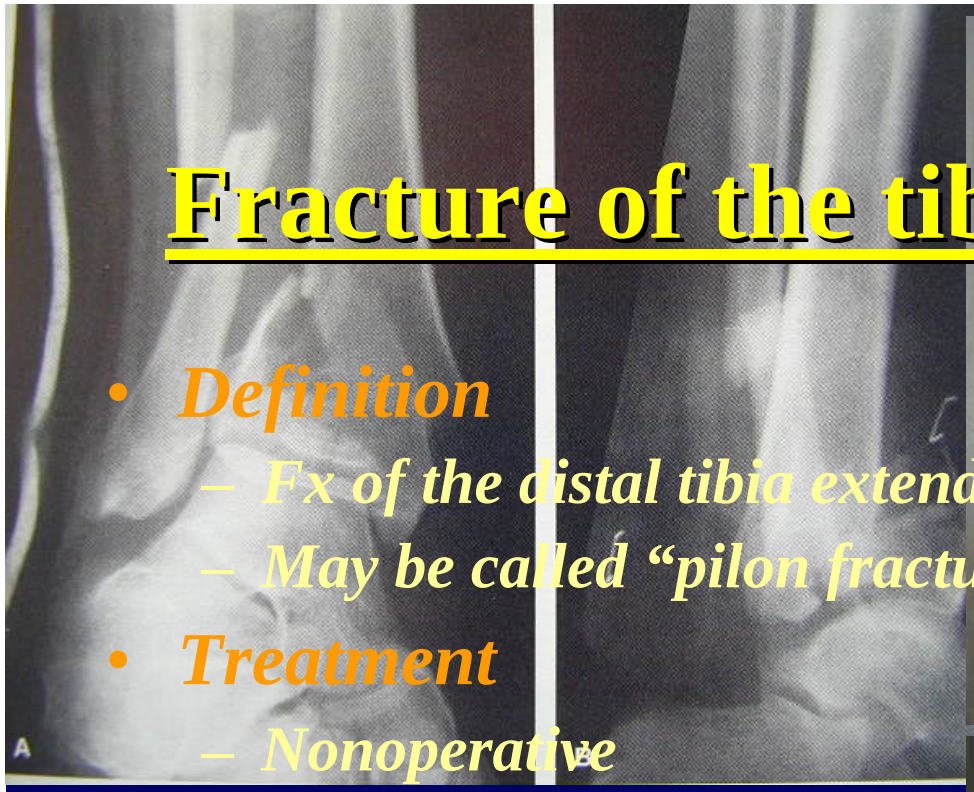
Fractures of the fibular

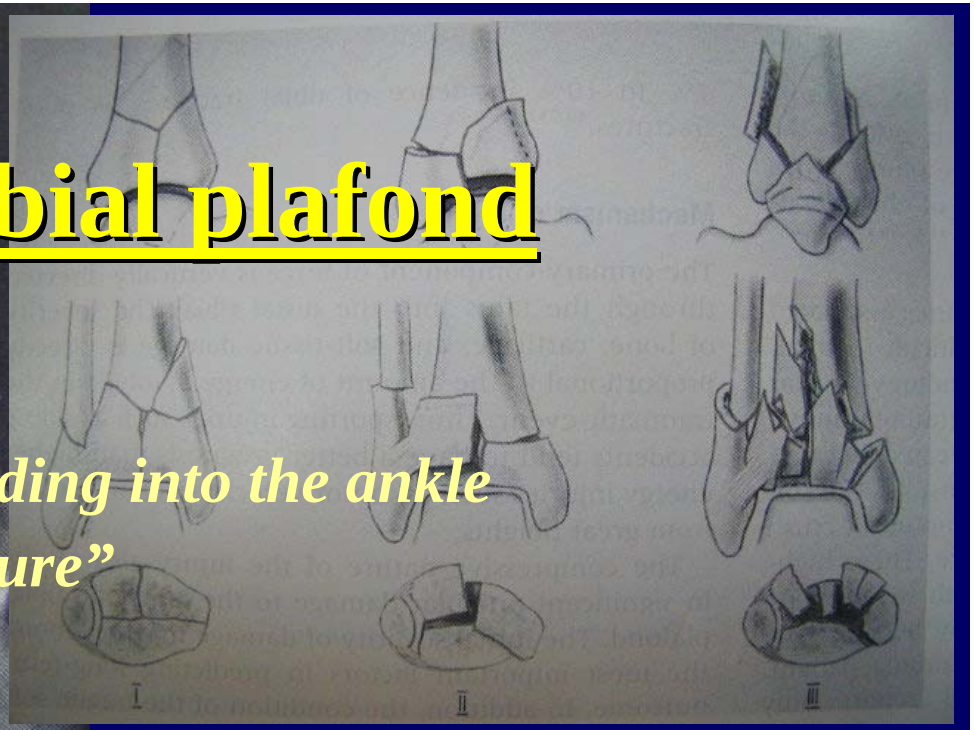
- *General*
  - *Most are associated with fx of the tibia*
  - *Isolate fx results from direct injury*
  - *Local signs and symptoms*
  - *Difficulty in walking*
- *Treatment*
  - *Mild: elastic bandage support*
  - *Mod to sev: SLC or brace for pain relief*
- *Ambulation*
  - *Progressive weight bearing as possible*
  - *Remove cast within 6 wk*

Fractures around the ankle

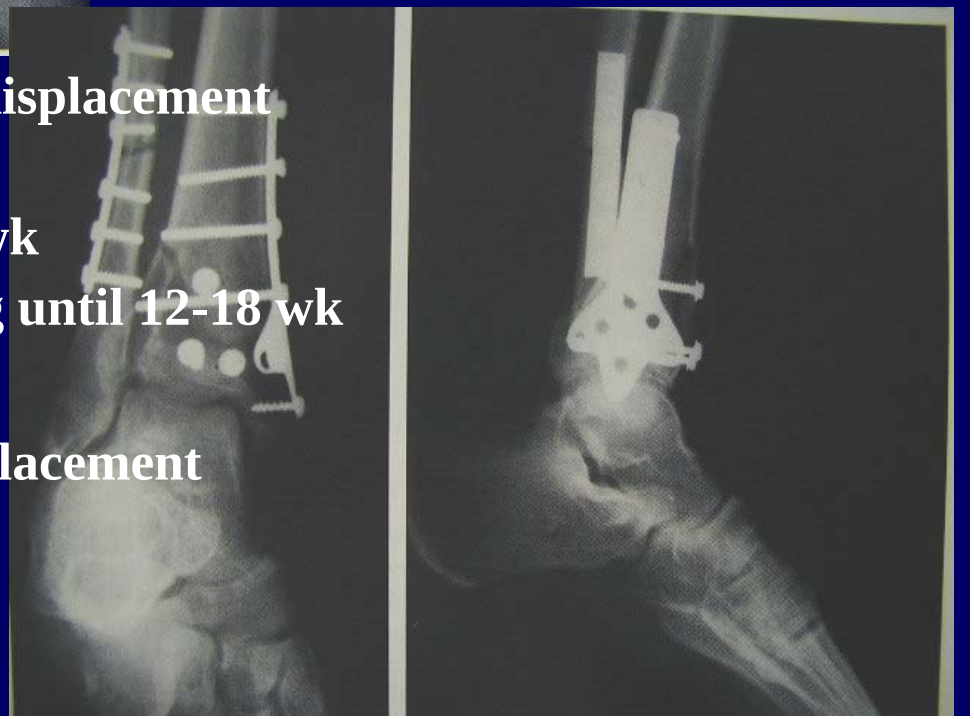
- *Fracture of the tibial plafond*
- *Ankle fractures*
- *Ankle dislocation and fracture dislocation*

Fracture of the tibial plafond



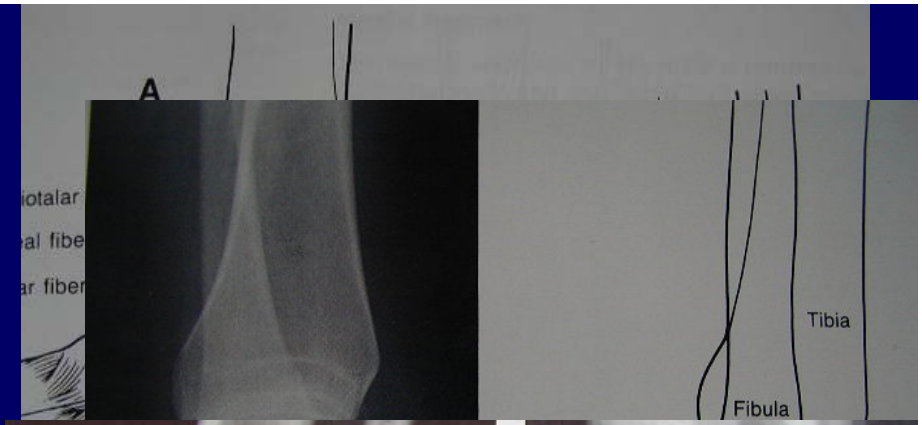


- *Definition*
  - *Fx of the distal tibia extending into the ankle*
  - *May be called "pilon fracture"*
- *Treatment*
  - *Nonoperative*
    - **No signification articular displacement**
    - **Closed reduction and LLC**
    - **Non weight bearing for 6 wk**
    - **Progressive weight bearing until 12-18 wk**
  - *Operative*
    - **Signification articular displacement**
    - **Plate and screws**
    - **Distraction ring**



Ankle fractures

- *General*
  - *Deltoid ligament*
    - Between med malleolus and talus
  - *Posterior tibial lip*
    - Posterior part of tibia
    - The third malleolus
  - *Distal tibiofibular syndesmosis*
    - Maintains ankle stability
- *Symptoms and signs*
  - *Pain*
  - *Swelling*
  - *Deformity*
  - *Difficult or unable weight bear*



Ankle fractures

- *investigation*
  - *X-ray standard AP and lateral*
  - *X-ray mortise view*
- *Treatment*
  - *Nonoperative*
    - **Minimal displaced**
    - **CR and short leg cast 6-8 wk**
  - *Operative*
    - **Displaced**
    - **Internal fixation**
      - **Plating**
      - **Screws**
      - **Tension band wiring**

Ankle dislocation and fracture dislocation

- *General*
  - *Combination of fractures around the ankle and dislocation*
  - *Associated fractures*
    - **Malleoli**
    - **Talus**
    - **Distal tibia**
  - *Require neurovascular assessment*

Ankle dislocation and fracture dislocation

- *Symptoms and signs*
  - *Common symptoms and signs of fracture*
  - *Distorted ankle anatomy*
  - *May associated neurovascular deficits*
- *Treatment*
  - *immediate CR and immobilization*
  - *Definite fracture treatment*

Fractures of the foot and fracture dislocations

- *Stress and neuropathic fractures*
- *Fracture of the talus*
- *Dislocation around the talus*
- *Fracture of the calcaneus*
- *Fractures of the tarsals and joint injuries*
- *Fractures of the metatarsals and phalanges*

Stress fractures

- *Excessive, repetitive stress applied to bone*
- *Most common: 2nd metatarsal, calcaneus*
- *Mild to moderate pain ing*
- *Diagnosis*
  - *X-ray: from 2 wk*
  - *Bone scan: from 2 day*
- *Treatment*
  - *Nonoperative: SLC 4-6 wk*

Neuropathic fractures

- *"Charcot joint"*
- *Associated with DM, peripheral nerve diseases*
- *Initiating event is fracture around the joint*
- *Rapid joint destruction without pain*
- *Usually,patients present late*
- *Treatment*
  - **Nonoperative: SLC with non weight bearing until heal**

Fracture of the talus

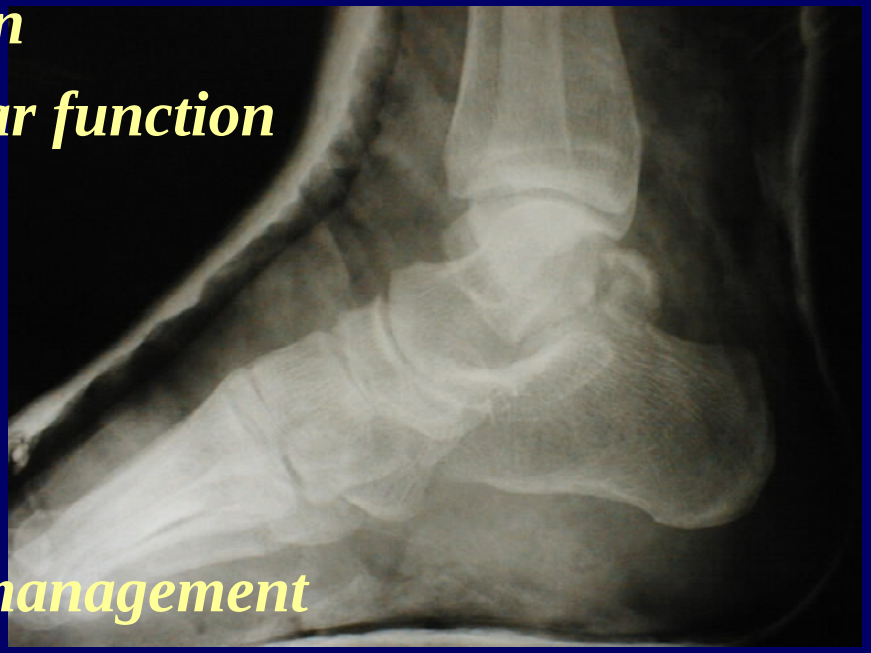
- *Neck, head, body and process*
- *Fracture of the talar neck*
  - Hyperdorsiflexion injury
  - May associated dislocation
    - Subtalar joint
    - Ankle joint
    - Talonavicular joint
- *Treatment*
  - Nonoperative
  - Operative

Frcacture of the talus

- *Treatment*
  - *Nonoerative*
    - No displacement, no dislocation
      - Short leg cast (SLC) 8-12 wk
    - Displaced and/or dislocation
      - CR and SLC 8-12 wk
  - *Operative*
    - Screws or K-wires fixation and cast
  - *Complications*
    - Common Fx complications
    - Avascular necrosis (AVN)
    - Skin necrosis
    - Posttraumatic OA

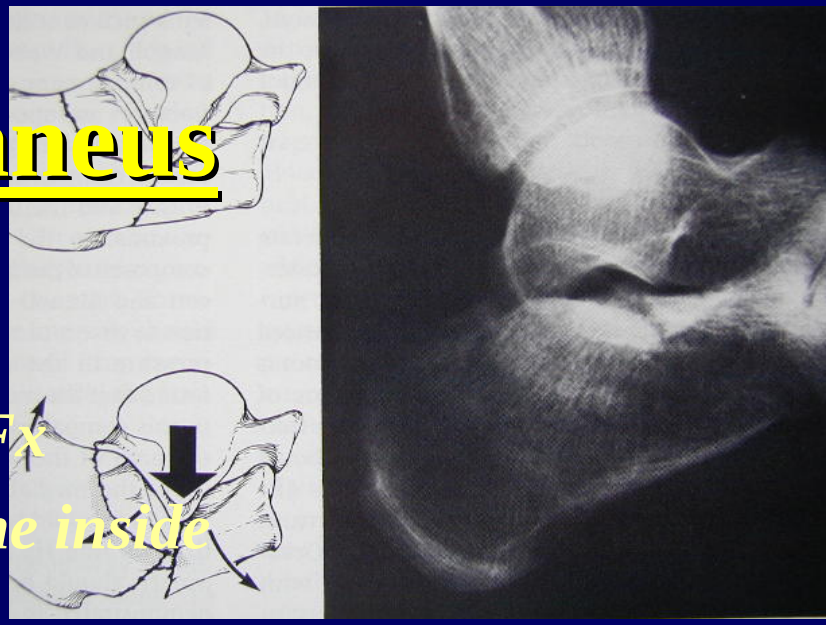
Dislocation around the talus

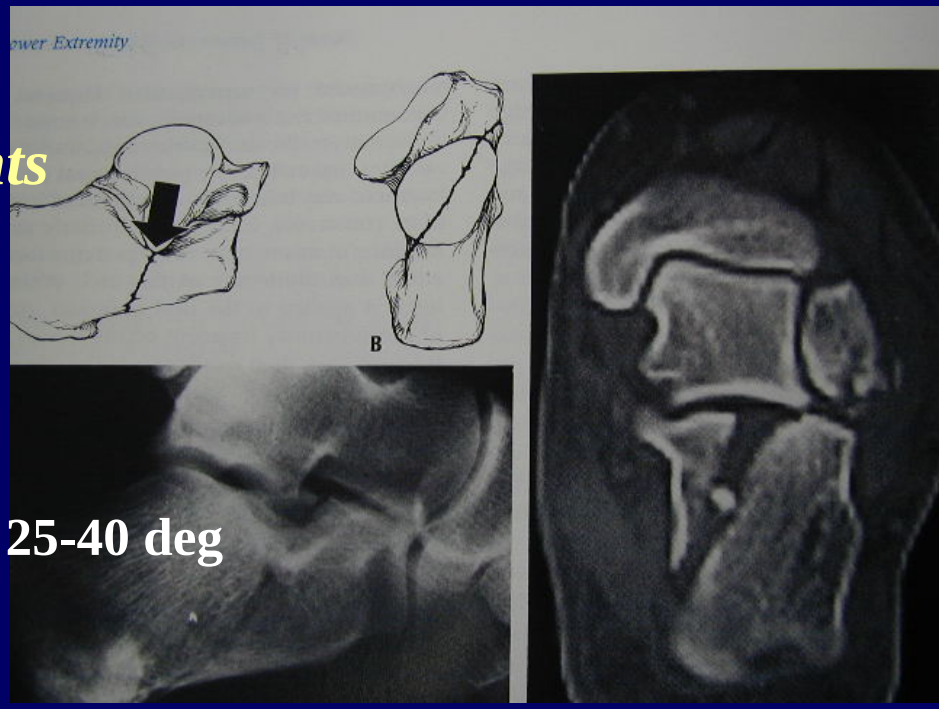
- *Subtalar dislocation*
  - *Inversion & eversion injuries to the foot*
  - *Common S&S of dislocation*
  - *Compromised neurovascular function*
  - *CR if failed open reduction*
  - *SLC 4 wk*
- *Talar dislocation*
  - *Most are open injuries*
  - *Reduction with soft tissue management*
  - *SLC (may be with pins) 6 wk*
  - *Results in AVN*



Fracture of the calcaneus

- *General*
  - *The most common tarsal bone Fx*
  - *Thin cortex with cancellous bone inside*
  - *Support the body weight*
- *Mechanisms of injury*
  - *Most are falling from heights*
  - *Associated spinal injury*
- *Radiographic findings*
  - *Standard AP, lateral*
    - **Bohler's angle (tuber angle) 25-40 deg**
  - *Calcaneal axial view*





Fracture of the calcaneus

- *Treatment*
  - *Nonoperative*
    - Non or minimal displaced
    - SLC 6-8 wk
  - *Operative*
    - Percutaneous pin and SLC
    - Open reduction and internal fixation (ORIF)
      - Plate
      - Screws
      - Staples

Fractures of the tarsals and joint injuries

- *General*
  - *Midfoot*
    - 3 cuneiforms
    - Navicular
      - Accessory navicular
    - Cuboid
  - Midtarsal joint (Chopart's joint)
    - *Talonavicular*
    - *Calcaneocuboid*
  - Tarsometatarsal joint (Linfranc's join

Fractures of the tarsals and joint injuries

- **Diagnosis**
  - **Usually overlooked**
  - **Less appreciated**
- **Treatment**
  - **Tarsal bones**
    - ***Usually nonoperative***
      - ***SLC 4-6 wk***
  - **Midtarsal joint**
    - ***CR and/or pin and SLC***
    - ***Arthrodesis in late case***
  - **Tarsometarsal joint**
    - ***Requires adequate Rx***
    - ***CR and pinning***
    - ***ORIF***

Fractures of the metatarsals and phalanges

- *General*
  - *Usually nonoperative treatment*
    - SLC 4-6 wk
  - *Some conditions*
    - Open Fx with problem of skin etc.
      - Posterior splint
  - *Operative treatment*
    - Soft tissue management
    - Displaced Fx
      - Longitudinal K-wire
      - Small screws

Fractures of the metatarsals and phalanges

- *Common Fx*
  - *Ballet dancer Fx*
    - Spiral Fx at distal of 5th metatarsal
    - Treatment: SLC 6 wk
  - *Jones Fx (Dancer Fx)*
    - Fx base of 5th metatarsal
    - Treatment: SLC 6 wk
  - *Phalanges Fx*
    - Posterior splint 4 wk