Lower Extremity Trauma

- Hip Fractures / Dislocations
- Femur Fractures
- Patella Fractures
- Knee Dislocations
- Tibia Fractures
- Ankle Fractures

Hip Fractures

- Hip Dislocations
- Femoral Head Fractures
- Femoral Neck Fractures
- Intertrochanteric Fractures
- Subtrochanteric Fractures

Epidemiology

- 250,000 Hip fractures annually
  - Expected to double by 2050
- At risk populations
  - Elderly: poor balance & vision, osteoporosis, inactivity, medications, malnutrition
  - Young: high energy trauma

Hip Dislocations

- Significant trauma, usually MVA
- Posterior: Hip flexion, Hip Internally Rotated & Adducted
- Anterior: Limb in Flexion, External Rotation, Abduction

Hip Dislocations

- Emergent Treatment: Closed Reduction
  - Dislocated hip is an emergency
  - Goal is to reduce risk of Avascular Necrosis and Degenrative Joint Disease
  - Allows restoration of flow through occluded or compressed vessels
  - Literature supports decreased AVN with earlier reduction
  - Requires proper anesthesia
  - Requires "team" (i.e. more than one person)

Hip Dislocations

- Emergent Treatment: Closed Reduction
  - General anesthesia with muscle relaxation facilitates reduction, but is not necessary
  - Conscious sedation is acceptable
  - Attempts at reduction with inadequate analgesia/ sedation will cause unnecessary pain, cause muscle spasm, and make subsequent attempts at reduction more difficult

Hip Dislocations

- Emergent Treatment: Closed Reduction
- Allis Maneuver
  - Assistant stabilizes pelvis with pressure on Ant. Sup. Iliac Spine
  - Surgeon stands on stretcher and gently flexes hip to 90deg, applies progressively increasing traction to the extremity with gentle adduction and internal rotation
  - Reduction can often be seen and felt

Hip Dislocations

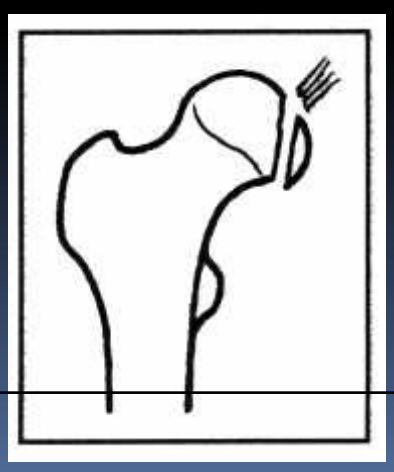
- Following Closed Reduction
  - Check stability of hip to 90deg flexion
  - Repeat X Ray Pelvis AP
  - Judet views of pelvis (if acetabulum fx)
  - CT scan with thin cuts through acetabulum
  - Remains of bony fragments within hip joint (indication for emergent OR trip to remove incarcerated fragment of bone)

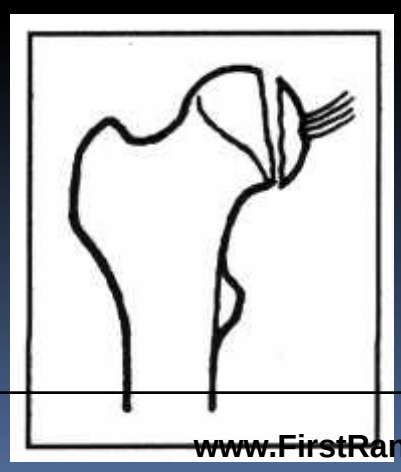
Femoral Head Fractures

- Concurrent with hip dislocation due to shear injury

Femoral Head Fractures

- Pipkin Classification
  - I: Fracture inferior to fovea
  - II: Fracture superior to fovea
  - III: Femoral head + acetabulum fracture
  - IV: Femoral head + femoral neck fracture



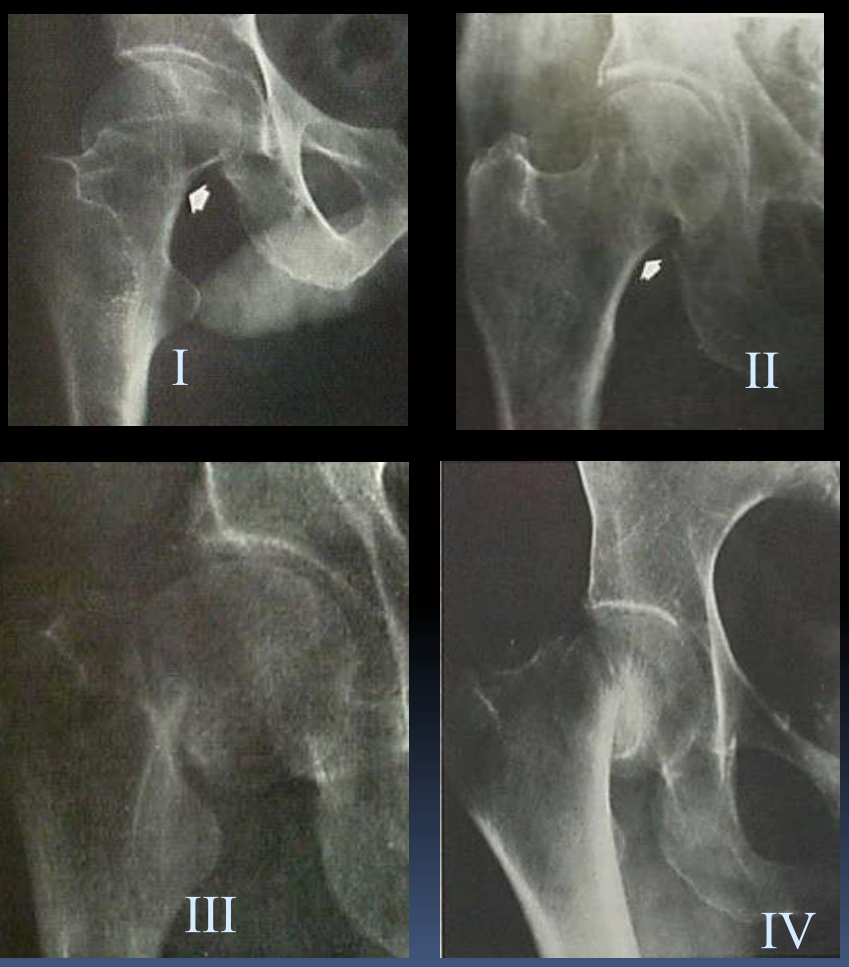


Femoral Head Fractures

- Treatment Options
  - Type I
    - Nonoperative: non-displaced
    - ORIF if displaced
  - Type II: ORIF
  - Type III: ORIF of both fractures
  - Type IV: ORIF vs. hemiarthroplasty

Femoral Neck Fractures

- Garden Classification
  - I Valgus impacted
  - II Non-displaced
  - III Complete: Partially Displaced
  - IV Complete: Fully Displaced
- Functional Classification
  - Stable (I/II)
  - Unstable (III/IV)



Femoral Neck Fractures

- Treatment Options
  - Non-operative
    - Very limited role
    - Activity modification
    - Skeletal traction
  - Operative
    - ORIF
    - Hemiarthroplasty (Endoprosthesis)
    - Total Hip Replacement

ORIF

Hemi

THR

Femoral Neck Fractures

- Young Patients
  - Urgent ORIF (<6hrs)
- Elderly Patients
  - ORIF possible (higher risk AVN, non-union, and failure of fixation)
  - Hemiarthroplasty
  - Total Hip Replacement

Intertrochanteric Hip Fx

- Intertrochanteric Femur Fracture
  - Extra-capsular femoral neck
  - To inferior border of the lesser trochanter

Intertrochanteric Hip Fx

- Intertrochanteric Femur Fracture
  - Physical Findings: Shortened / ER Posture
  - Obtain Xrays: AP Pelvis, Cross table lateral

Intertrochanteric Hip Fx

- Classification
  - # of parts: Head/Neck, GT, LT, Shaft
  - **Stable**
    - Resists medial & compressive Loads after fixation
  - **Unstable**
    - Collapses into varus or shaft medializes despite anatomic reduction with fixation
  - **Reverse Obliquity**

Intertrochanteric Hip Fx

Stable

Unstable

Reverse Obliquity

Intertrochanteric Hip Fx

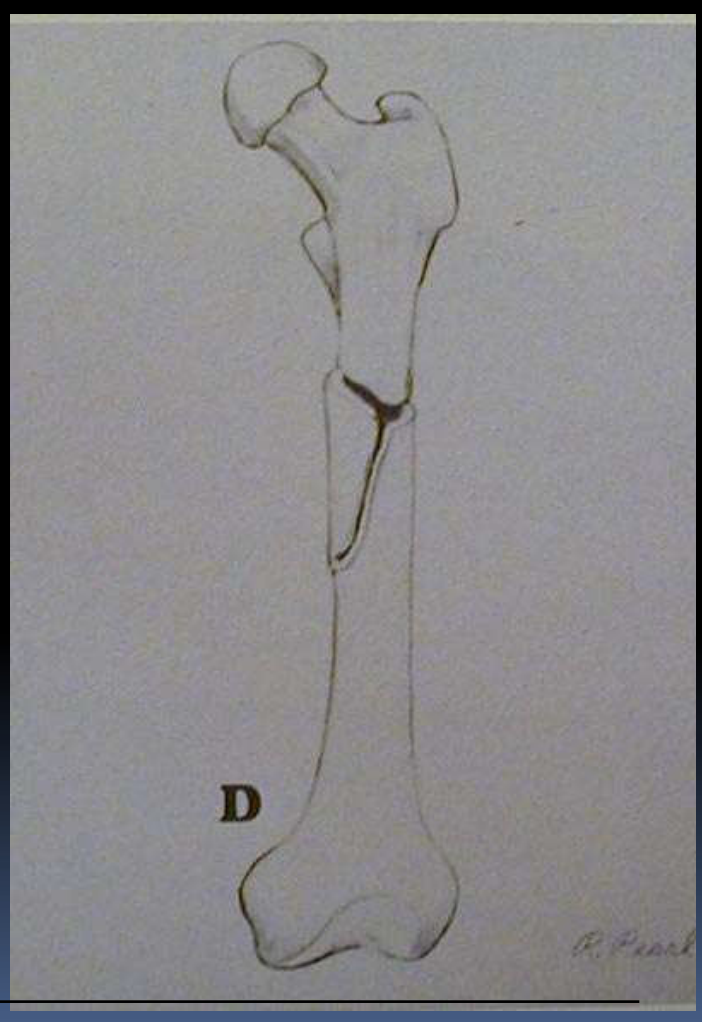
- Treatment Options
  - Stable: Dynamic Hip Screw (2-hole)
  - Unstable/Reverse: Intra Medullary Recon Nail

Subtrochanteric Femur Fx

- Classification
  - Located from LT to 5cm distal into shaft
  - Intact Piriformis Fossa?
- Treatment
  - IM Nail
  - Cephalomedullary IM Nail
  - ORIF

Femoral Shaft Fx

- Type 0 - No comminution
- Type 1 - Insignificant butterfly fragment with transverse or short oblique fracture
- Type 2 - Large butterfly of less than 50% of the bony width, > 50% of cortex intact
- Type 3 - Larger butterfly leaving less than 50% of the cortex in contact
- Type 4 - Segmental comminution
  - Winquist and Hansen 66A, 1984

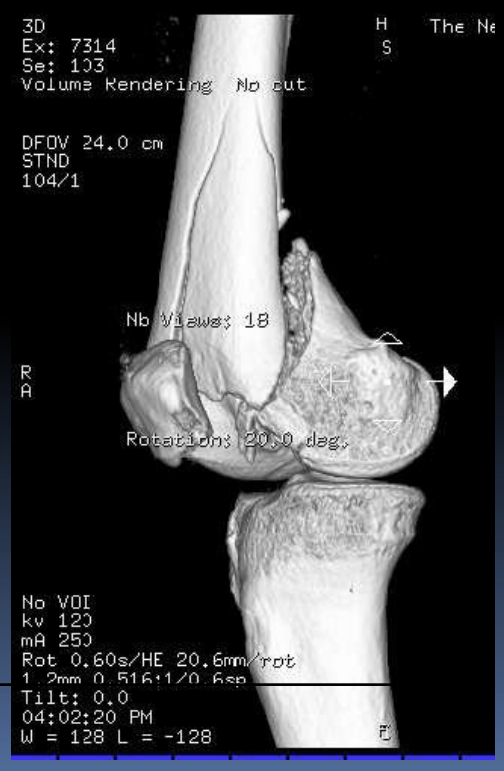


Femoral Shaft Fx

- Treatment Options
  - IM Nail with locking screws
  - ORIF with plate/screw construct
  - External fixation
  - Consider traction pin if prolonged delay to surgery

Distal Femur Fractures

- Distal Metaphyseal Fractures
- Look for intra-articular involvement
- Plain films
- CT



Distal Femur Fractures

- Treatment:
  - Retrograde IM Nail
  - ORIF open vs. MIPO
  - Above depends on fracture type, bone quality, and fracture location

Knee Dislocations

- High association of injuries
  - Ligamentous Injury
    - ACL, PCL, Posterolateral Corner
    - LCL, MCL
  - Vascular Injury
    - Intimal tear vs. Disruption
    - Obtain ABI's → (+) → Arteriogram
    - Vascular surgery consult with repair within 8hrs
  - Peroneal >> Tibial N. injury

Patella Fractures

- History
  - MVA, fall onto knee, eccentric loading
- Physical Exam
  - Ability to perform straight leg raise against gravity (ie, extensor mechanism still intact?)
  - Pain, swelling, contusions, lacerations and/or abrasions at the site of injury
  - Palpable defect

Patella Fractures

- Radiographs
  - AP/Lateral/Sunrise views
- Treatment
  - ORIF if ext mechanism is incompetent
  - Non-operative treatment with brace if ext mechanism remains intact

Tibia Fractures

- Proximal Tibia Fractures (Tibial Plateau)
- Tibial Shaft Fractures
- Distal Tibia Fractures (Tibial Pilon/Plafond)

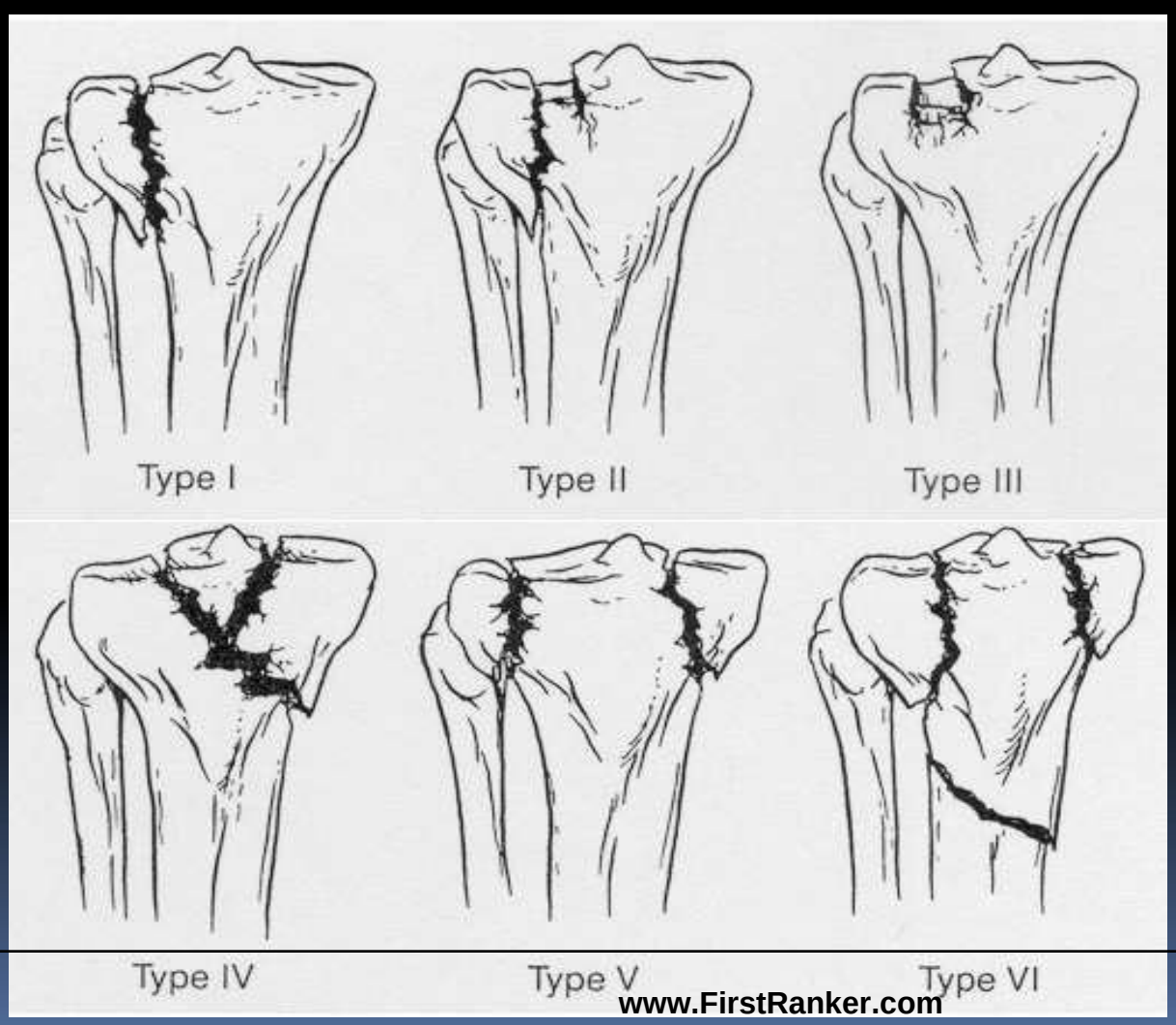
Tibial Plateau Fractures

- MVA, fall from height, sporting injuries
- Mechanism and energy of injury plays a major role in determining orthopedic care
- Examine soft tissues, neurologic exam (peroneal N.), vascular exam (esp with medial plateau injuries)
- Be aware for compartment syndrome
- Check for knee ligamentous instability

Tibial Plateau Fractures

- Xrays: AP/Lateral +/- traction films
- CT scan (after ex-fix if appropriate)

- Schatzker Classification of Plateau Fxs



Lower Energy

Higher Energy

Tibial Plateau Fractures

- Treatment
  - Spanning External Fixator may be appropriate for temporary stabilization and to allow for resolution of soft tissue injuries

Tibial Plateau Fractures

- Treatment
  - Definitive ORIF for patients with varus/valgus instability, >5mm articular stepoff
  - Non-operative in non-displaced stable fractures or patients with poor surgical risks

Tibial Shaft Fractures

- Mechanism of Injury
  - Can occur in lower energy, torsion type injury (e.g., skiing)
  - More common with higher energy direct force (e.g., car bumper)
  - Open fractures of the tibia are more common than in any other long bone

Tibial Shaft Fractures

- Open Tibia Fx
- Priorities
  - ABC'S
  - Associated Injuries
  - Tetanus
  - Antibiotics
  - Fixation

Tibial Shaft Fractures

- Management of Open Fx Soft Tissues
  - **ER**: initial evaluation → wound covered with sterile dressing and leg splinted, tetanus prophylaxis and appropriate antibiotics
  - **OR**: Thorough I&D undertaken within 6 hours with serial debridements as warranted followed by definitive soft tissue cover

Tibial Shaft Fractures

- Definitive Soft Tissue Coverage
  - Proximal third tibia fractures can be covered with gastrocnemius rotation flap
  - Middle third tibia fractures can be covered with soleus rotation flap
  - Distal third fractures usually require free flap for coverage

Tibial Shaft Fractures

- Treatment Options
  - IM Nail
  - ORIF with Plates
  - External Fixation
  - Cast

Tibial Shaft Fractures

- Advantages of IM nailing
  - Lower non-union rate
  - Smaller incisions
  - Earlier weightbearing and function
  - Single surgery

Tibial Shaft Fractures

- IM nailing of distal and proximal fx
  - Can be done but requires additional planning, special nails, and advanced techniques

Tibial Pilon Fractures

- Fractures involving distal tibia metaphysis and into the ankle joint
- Soft tissue management is key!
- Often occurs from fall from height or high energy injuries in MVA
- "Excellent" results are rare, "Fair to Good" is the norm outcome
- Multiple potential complications

Tibial Pilon Fractures

- Initial Evaluation
  - Plain films, CT scan
  - Spanning External Fixator
  - Delayed Definitive Care to protect soft tissues and allow for soft tissue swelling to resolve

Tibial Pilon Fractures

- Treatment Goals
  - Restore Articular Surface
  - Minimize Soft Tissue Injury
  - Establish Length
  - Avoid Varus Collapse
- Treatment Options
  - IM nail with limited ORIF
  - ORIF
  - External Fixator

Tibial Pilon Fractures

- Complications
  - Mal or Non-union (Varus)
  - Soft Tissue Complications
  - Infection
  - Potential Amputation