COMMON UPPER EXTREMITY FRACTURES

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- I have received financial support for education from
  - Trimed
- I will not discuss off label drug use nor investigational use in my presentation

LEARNING OBJECTIVES

At the end of this session, participants will

1. Be familiar with the most common patterns and clinical presentation of upper extremity fractures
2. Know the typical physical exam findings of common UE fracture
3. Know the appropriate radiographic and imaging studies for diagnosing common UE fractures
4. Know when surgical or non-surgical treatment is appropriate for a given UE fracture

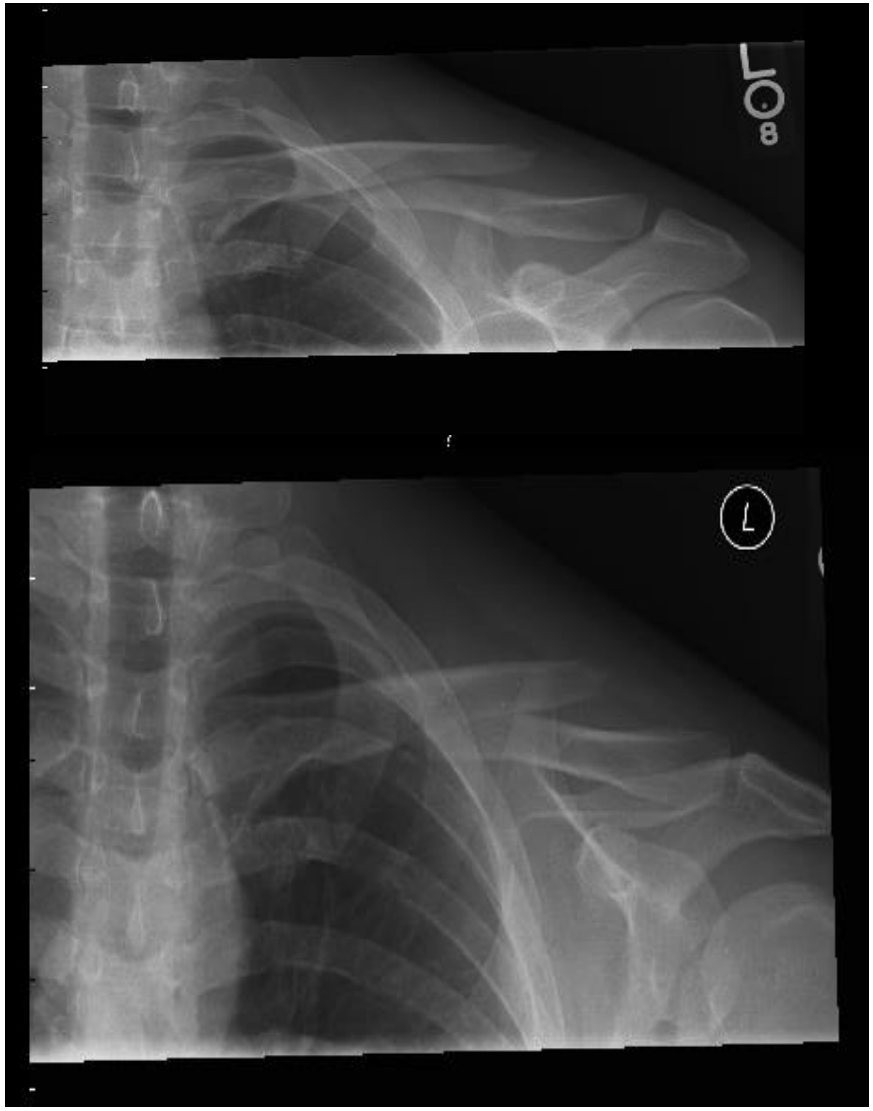
OVERVIEW OF UPPER EXTREMITY FRACTURES

- Clavicle
- Shoulder Dislocation
- Humerus
- Elbow
- Forearm
- Distal Radius
- Scaphoid

Clavicle Fractures

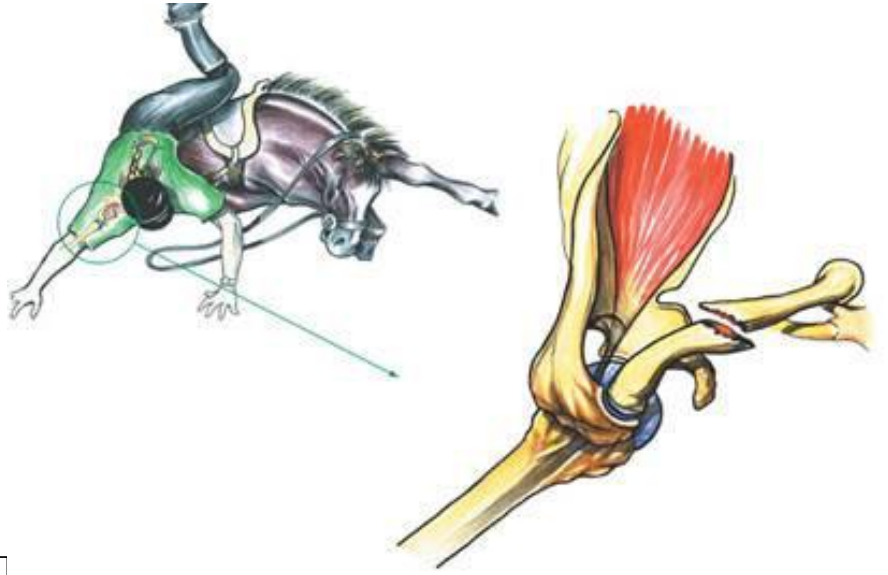
- Epidemiology
  - 2.6% - 12% of all fractures
  - 44% - 66% of fractures about the shoulder
  - 80% occur at middle 3rd of clavicle

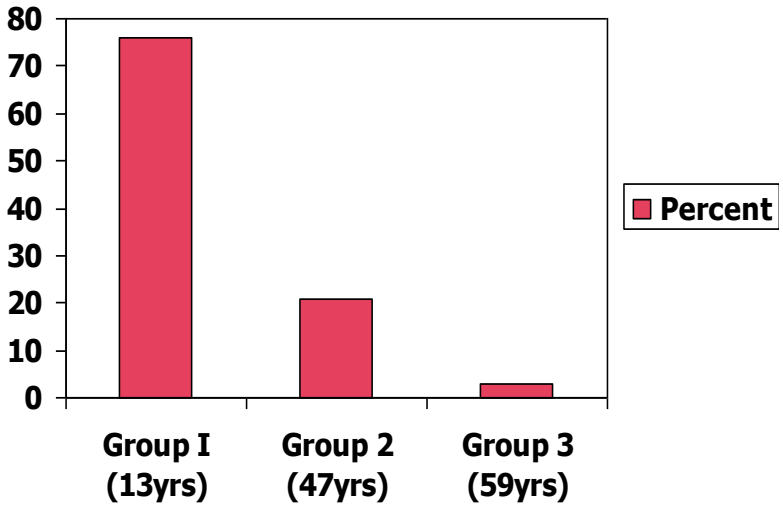
- Anatomy
  - Ossifies at 5th wk gestation, last to fuse at 22 – 25 years
  - Middle 3rd is transition area→vulnerable to fracture
  - Medial 3rd protects neurovascular structures and lung
  - Distal 3rd have attachments to the coracoclavicular ligaments



Clavicle Fractures

- Mechanism
  - Fall onto shoulder (87%)
  - Direct blow (7%)
  - Fall onto outstretched hand (6%)
- Trimodal distribution

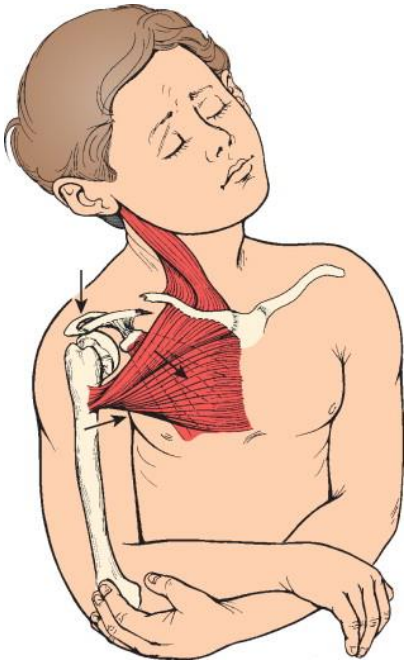


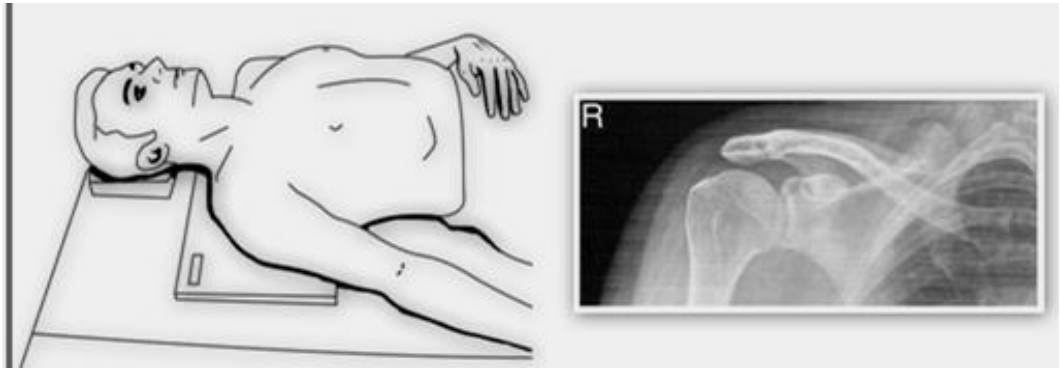


Clavicle Fractures

- Clinical Evaluation
  - Inspect and palpate for deformity/abnormal motion
  - Thorough neurovascular exam
  - Auscultate the chest for signs of lung injury/pneumothorax

- Radiographic Exam
  - AP chest radiographs.
  - Clavicular 45deg A/P oblique view
  - Traction views may be used as well





Clavicle Fractures

- Classification of Clavicle Fractures
  - Type I: Middle Third (80%)
  - Type II: Distal Third (15%)
  - Type III: Medial Third (5%)

Clavicle Fracture

- Associated Injuries
  - Up to 9% of patients
  - Brachial Plexus Injuries
    - » Traction more common
    - » penetrating (rare)
  - Vascular Injury
  - Rib Fractures
  - Scapula Fractures
  - Pneumothorax

Clavicle Fracture

- Closed Treatment
  - Sling immobilization for usually 3-4 weeks with early ROM encouraged

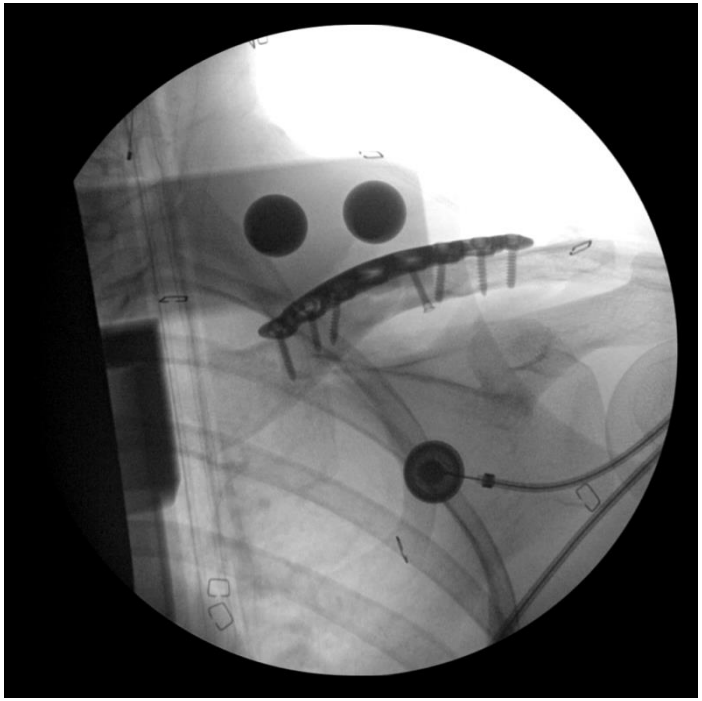
Clavicle Fracture

Operative intervention

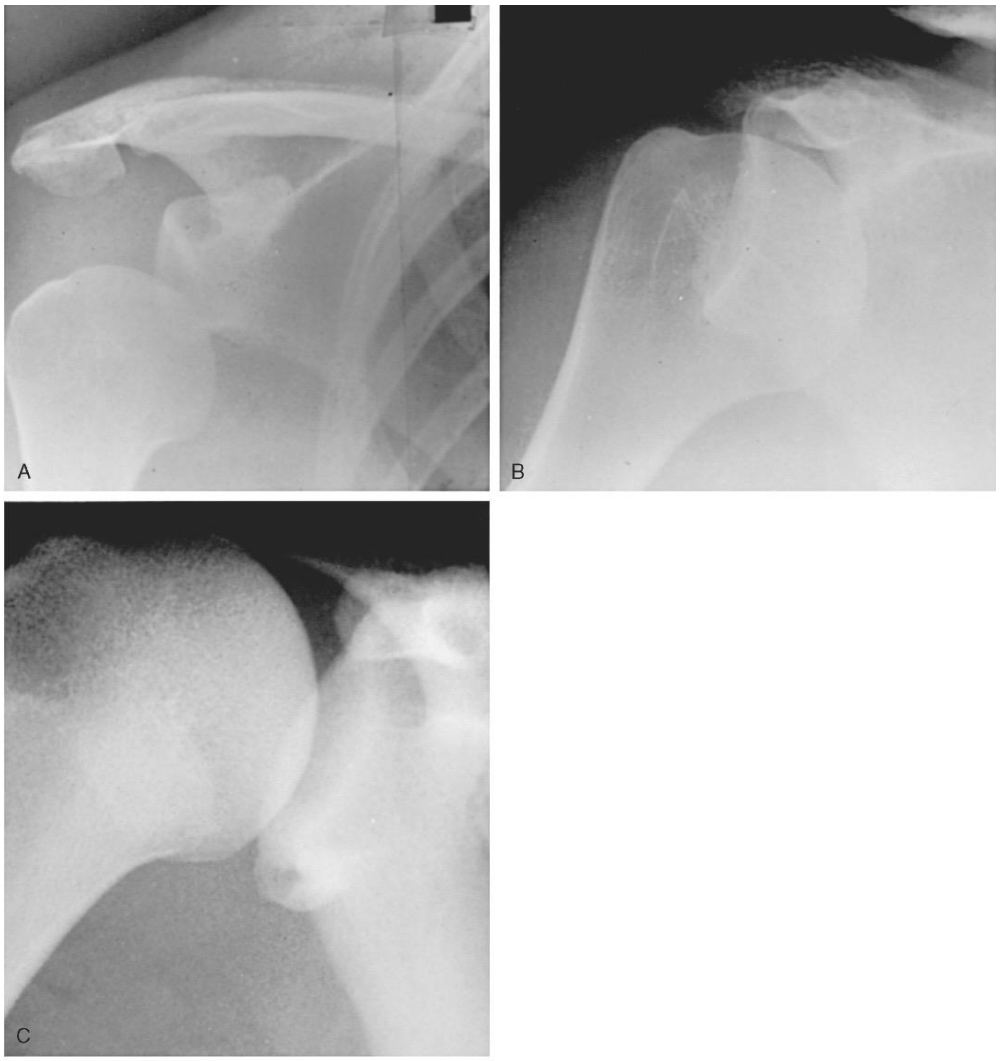
- Fractures with neurovascular injury
- Fractures with severe associated chest injuries
- Open fractures
- Group II, type II fractures
- Nonunion

Operative treatment Outcomes

- *Altamini, et al (J Bone Joint Surg-Am, 2008)*
- Multicenter, prospective RCT comparing ORIF (67 px) vs. non-surgical tx (65 px)
- Operative group had
  - Faster union
  - Less malunion
  - Better functional scores
  - Better satisfaction rating
  - Hardware related complications (9 px's)



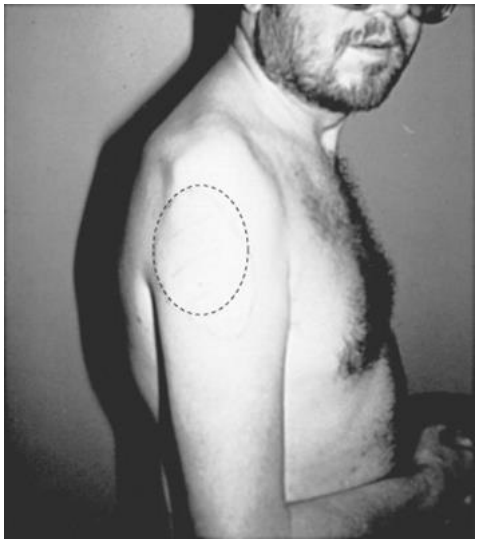
Shoulder Dislocations



Shoulder Dislocations

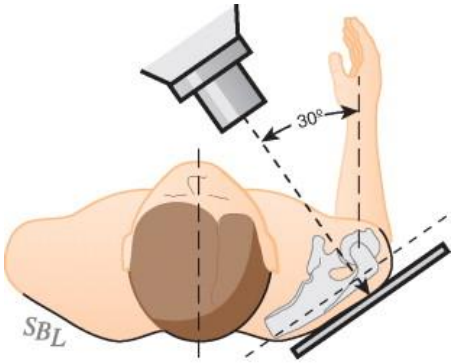
- Epidemiology
  - Anterior: Most common
  - Posterior:
    - » May be unrecognized due to absence of obvious deformity
    - » Uncommon, 10%,
    - » May occur in Electrocutions & Seizures
  - Inferior (Luxatio Erecta): Rare, hyperabduction injury

- Clinical Evaluation
  - Examine Axillary nerve (deltoid function, no sensation over lateral shoulder)
  - Examine Musculocutaneous nerve (biceps function and anterolateral forearm sensation)



Shoulder Dislocations

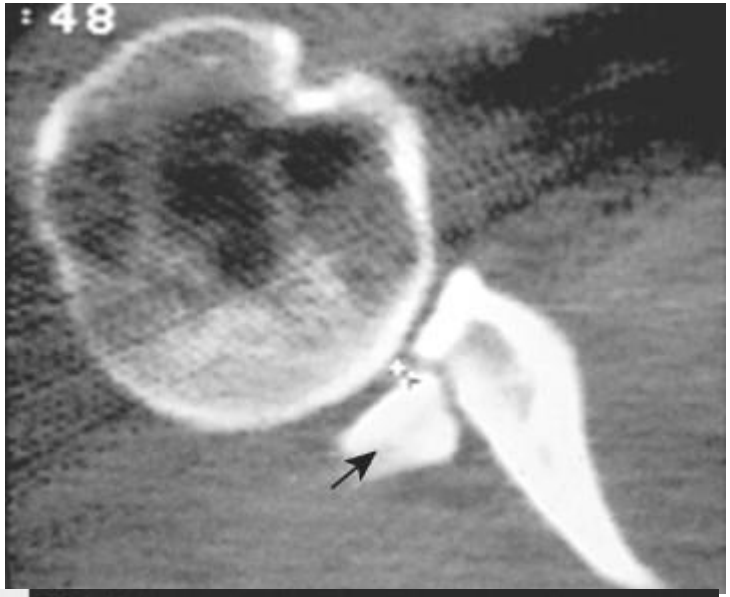
- Radiographic Evaluation
  - True AP shoulder
  - Axillary Lateral
  - Scapular Y
  - Stryker Notch View (Bony Bankart)



Shoulder Dislocations

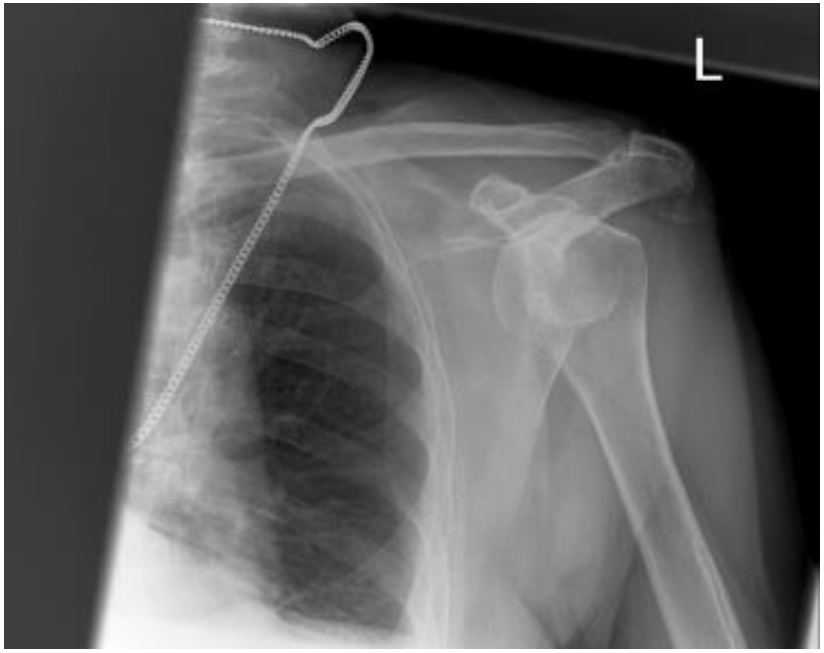
- Anterior Dislocation Recurrence Rate
  - Age 20: 80-92%
  - Age 30: 60%
  - > Age 40: 10-15%

- Look for Concomitant Injuries
  - **Bony:** Bankart, Hill-Sachs Lesion, Glenoid Fracture, Greater Tuberosity Fracture
  - **Soft Tissue:** Subscapularis Tear, Rotator Cuff Tear (older pts with dislocation)
  - **Vascular:** Axillary artery injury (older pts with atherosclerosis)
  - **Nerve:** Axillary nerve, Brachial plexus



Shoulder Dislocations

- Anterior Dislocation
  - Traumatic
  - Atraumatic
    (Congenital Laxity)
  - Acquired
    (Repeated Microtrauma)

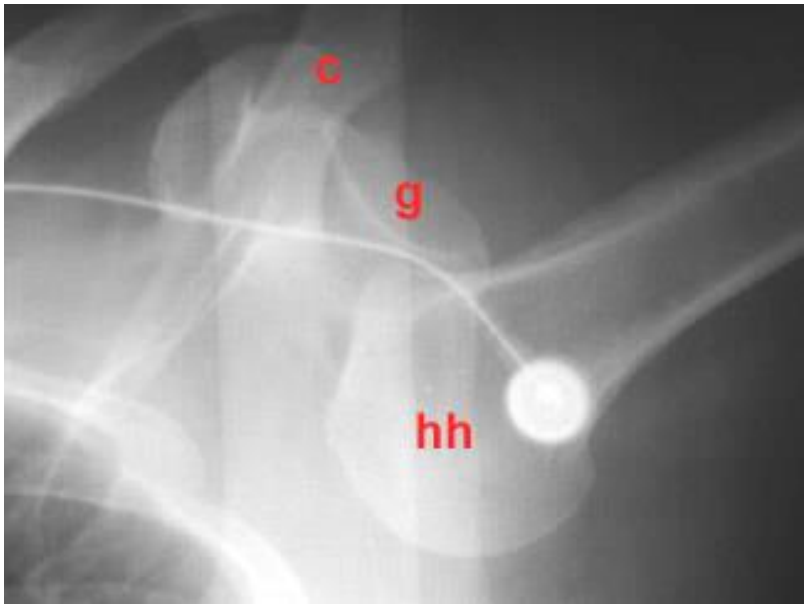


Shoulder Dislocations

- Posterior Dislocation
  - Adduction/Flexion/IR at time of injury
  - Electrocution and Seizures cause overpull of subscapularis and latissimus dorsi
  - Reduce with traction and gentle anterior translation

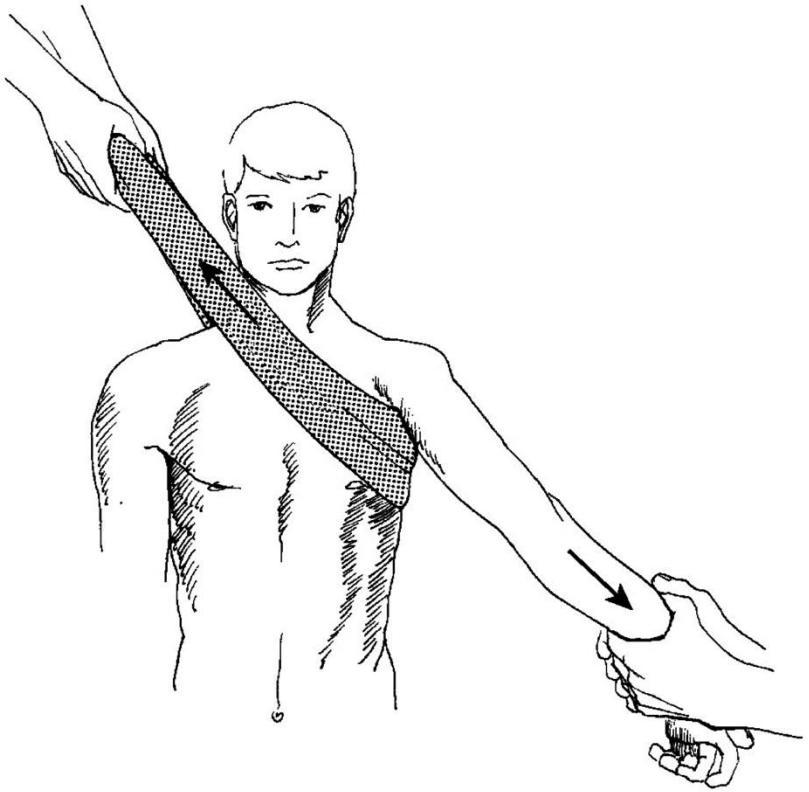
Shoulder Dislocations

- Inferior Dislocations
  Luxatio Erecta
  - Hyperabduction injury
  - Arm presents in a flexed posture
  - High rate of nerve and vascular injury
  - Reduce with in-line traction and gentle adduction



Shoulder Dislocation

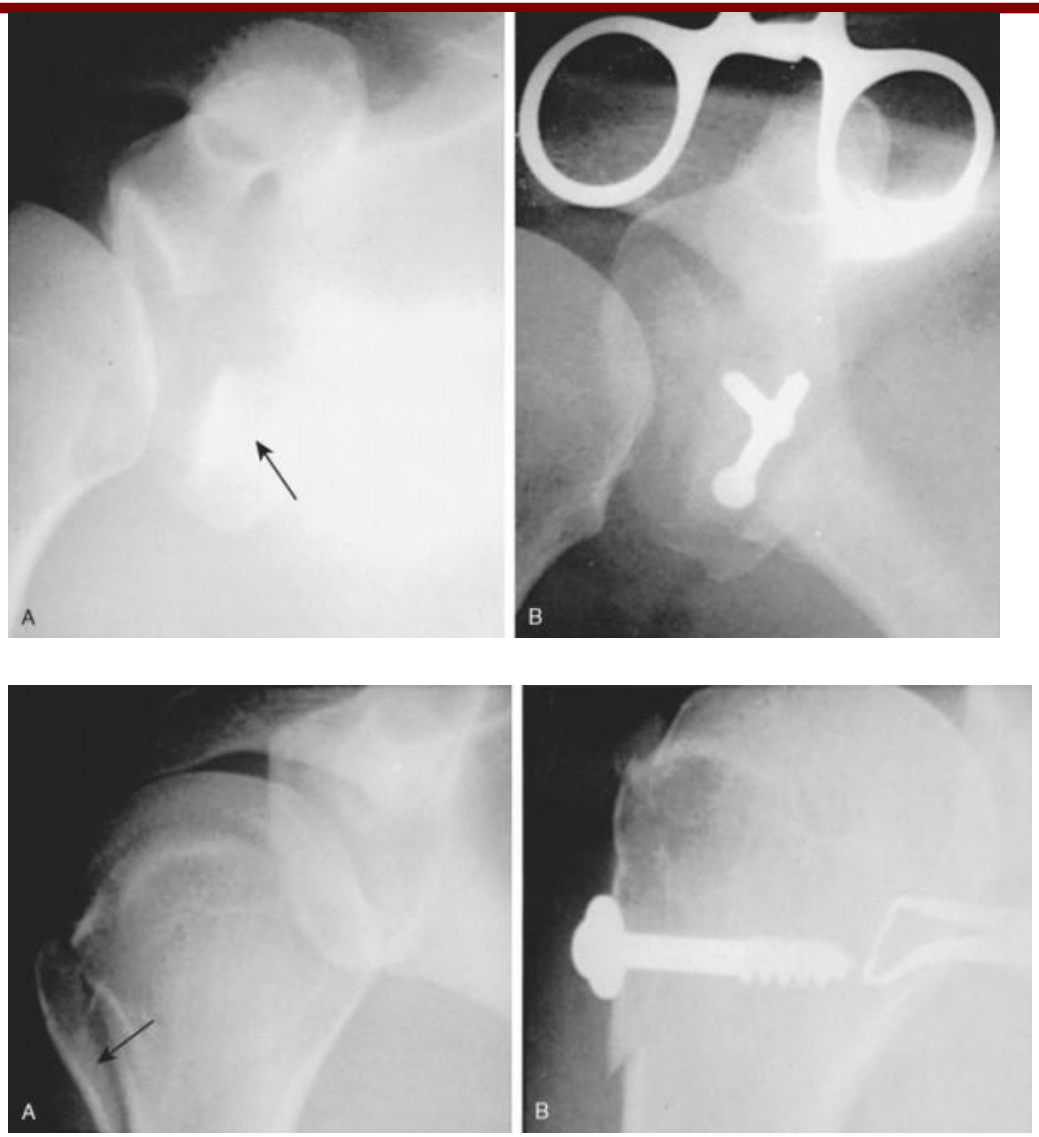
- Treatment
  - Nonoperative treatment
    - » Closed reduction should be performed after adequate clinical evaluation and appropriate sedation
  - Reduction Techniques:
    - » Traction/countertraction
    - » Hippocratic technique
    - » Stimson technique
    - » Milch Technique
    - » Scapular manipulation



Shoulder Dislocations

- Postreduction
  - Post reduction films are a must to confirm the position of the humeral head
  - Pain control
  - Immobilization for 7-10 days then begin progressive ROM

- Operative Indications
  - Irreducible shoulder (soft tissue interposition)
  - Displaced greater tuberosity fractures
  - Glenoid rim fractures bigger than 5 mm
  - Elective repair for younger patients

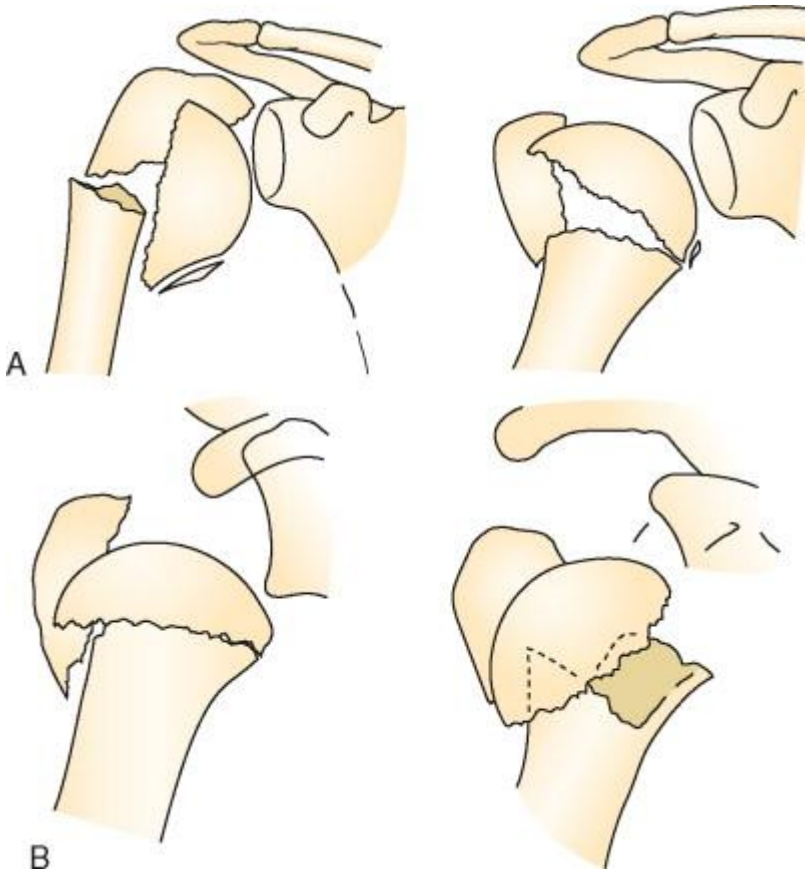


Proximal Humerus Fractures

Proximal Humerus Fractures

- Epidemiology
  - Most common fracture of the humerus
  - Higher incidence in the elderly, thought to be related to osteoporosis
  - Females 2:1 greater incidence than males

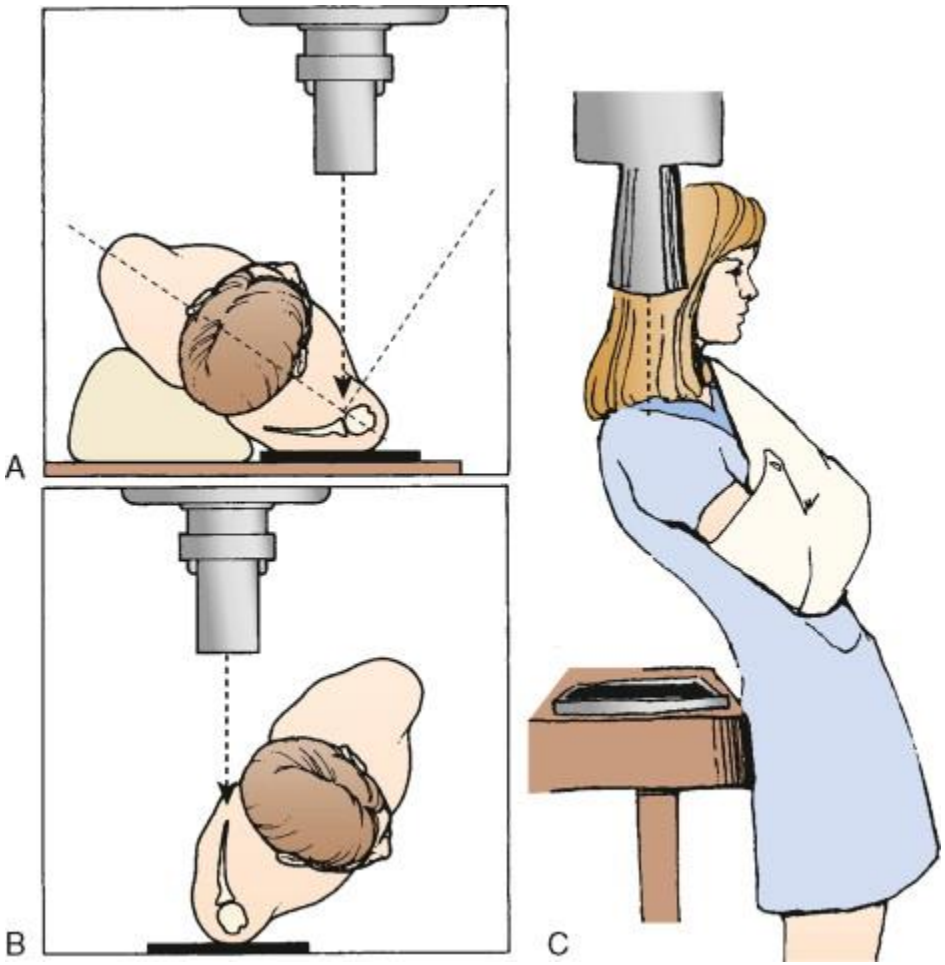
- Mechanism of Injury
  - Most commonly a fall onto an outstretched arm from standing height
  - Younger patient typically present after high energy trauma such as MVA



Proximal Humerus Fractures

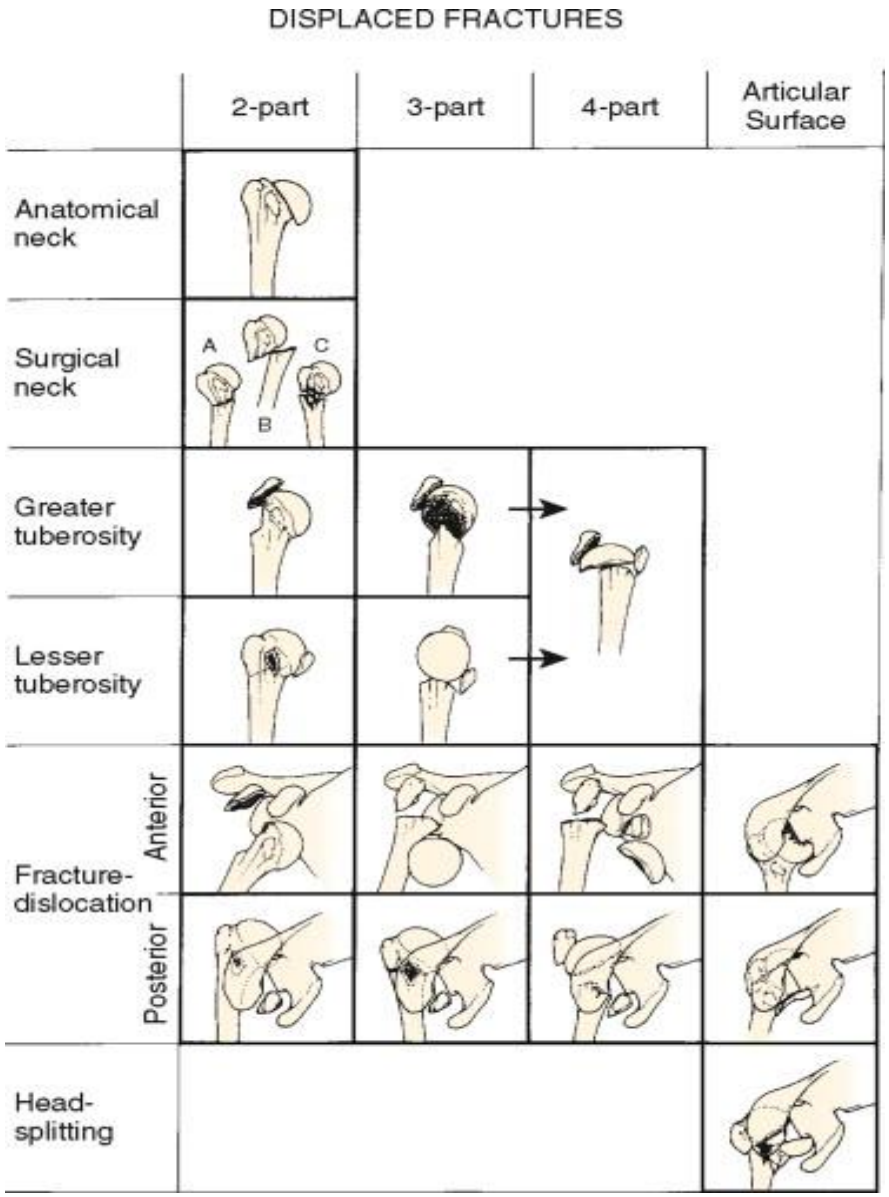
- Clinical Evaluation
  - Patients typically present with arm held close to chest by contralateral hand
  - Pain and crepitus elicited on palpation
  - Careful neuro exam focusing on Axillary Nerve

- Radiographs
  - May need Shoulder focused and Full Humerus views



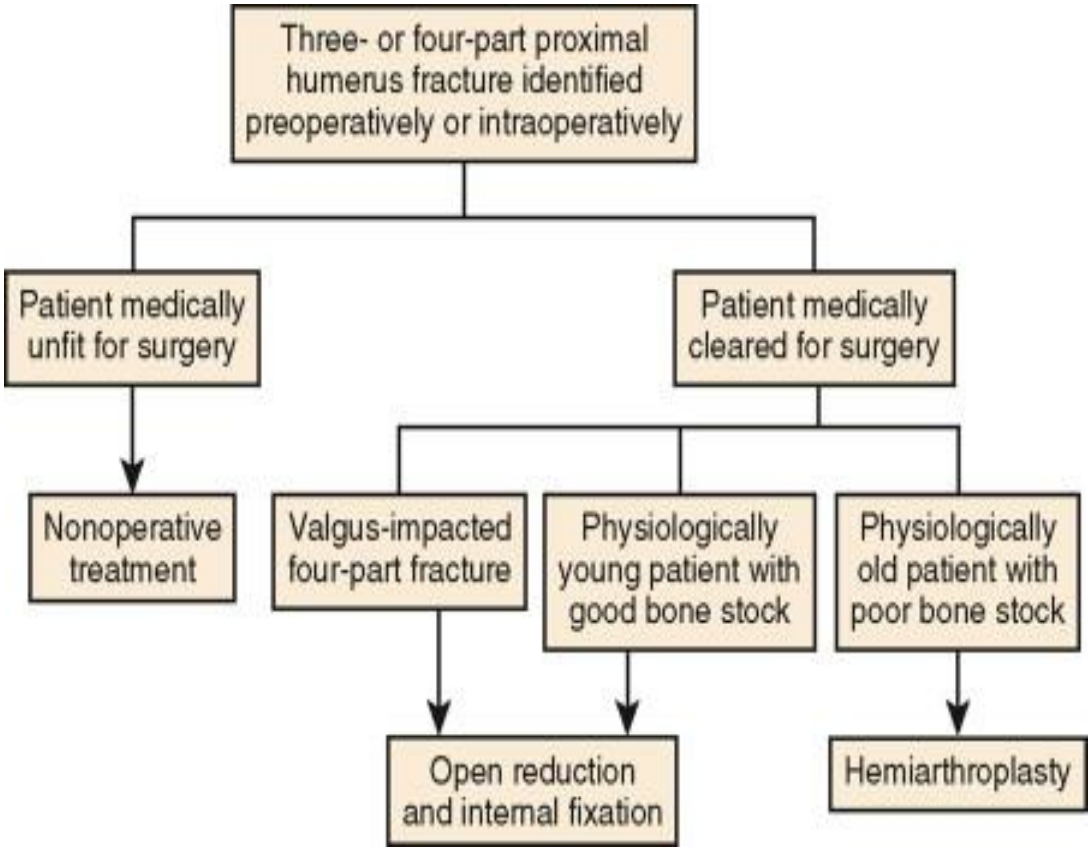
Proximal Humerus Fractures

- Neer Classification
  - Four parts
    - » Greater and lesser tuberosities,
    - » Humeral shaft
    - » Humeral head
  - A part is displaced if >1 cm displacement or >45 degrees of angulation is seen

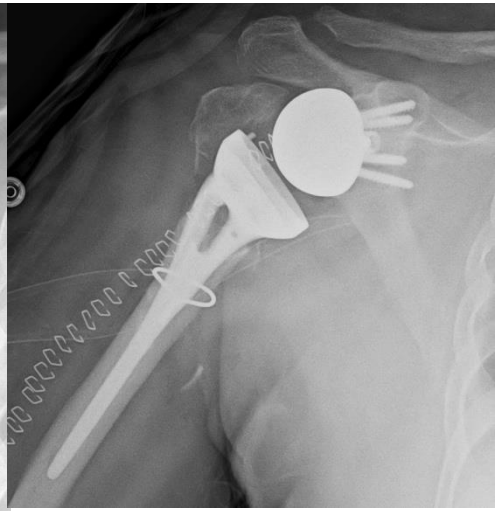


Proximal Humerus Fractures

- Treatment
  - Minimally displaced fractures- Sling immobilization, early motion
  - Two-part fractures-
    - » Anatomic neck fractures likely require ORIF. High incidence of osteonecrosis
    - » Surgical neck fractures that are minimally displaced can be treated conservatively. Displacement usually requires ORIF
  - Three-part fractures
    - » Due to opposing muscle forces, these are unstable so closed treatment is difficult.
    - » Displaced fx → ORIF
  - Four-part fractures
    - » Displaced or unstable→ ORIF or hemiarthroplasty
    - » High rate of Avascular Necrosis (13-34%)



Proximal Humerus Fractures

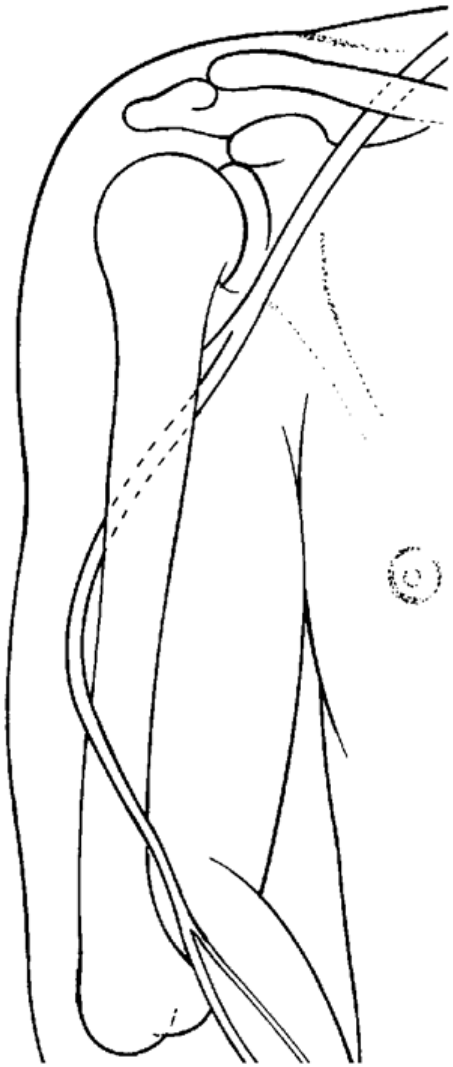


Humeral Shaft Fractures

- Mechanism of Injury
  - Direct trauma - MVA
  - Indirect trauma - fall on an outstretched hand
  - Fracture pattern depends on stress applied
    - » Compressive- proximal or distal humerus
    - » Bending- transverse shaft
    - » Torsional- spiral shaft
    - » Torsion and bending- oblique with a butterfly fragment

Humeral Shaft Fractures

- Clinical evaluation
  - History and PE
  - Presentation: Pain, Swelling, Deformity, Limitation of Motion
  - Neurovascular evaluation- Radial Nerve

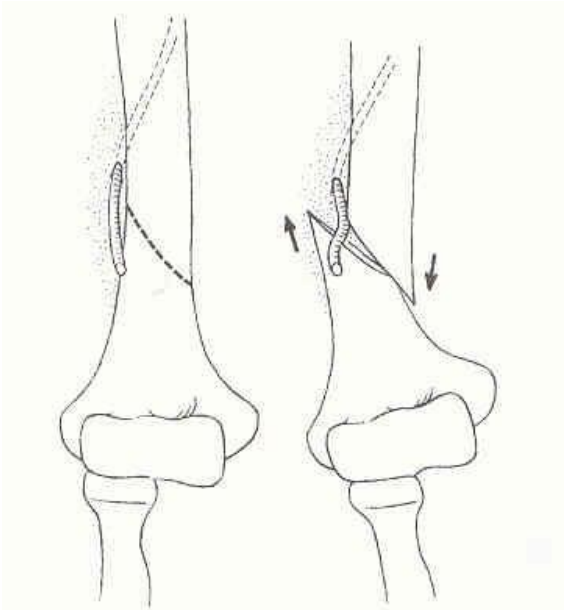


Humeral Shaft Fractures

- Radiographic evaluation
  - AP and lateral views of the humerus
  - Traction radiographs - for hard to classify secondary to severe displacement or a lot of comminution

Humeral Shaft Fractures

- Holstein-Lewis Fractures
  - Distal 1/3 fractures
  - May entrap or lacerate radial nerve as the fracture passes through the intermuscular septum



Holstein-Lewis fracture.
Reproduced by permission from A Holstein and GB Lewis, *Journal of Bone and Joint Surgery* 45A:1382, 1963.

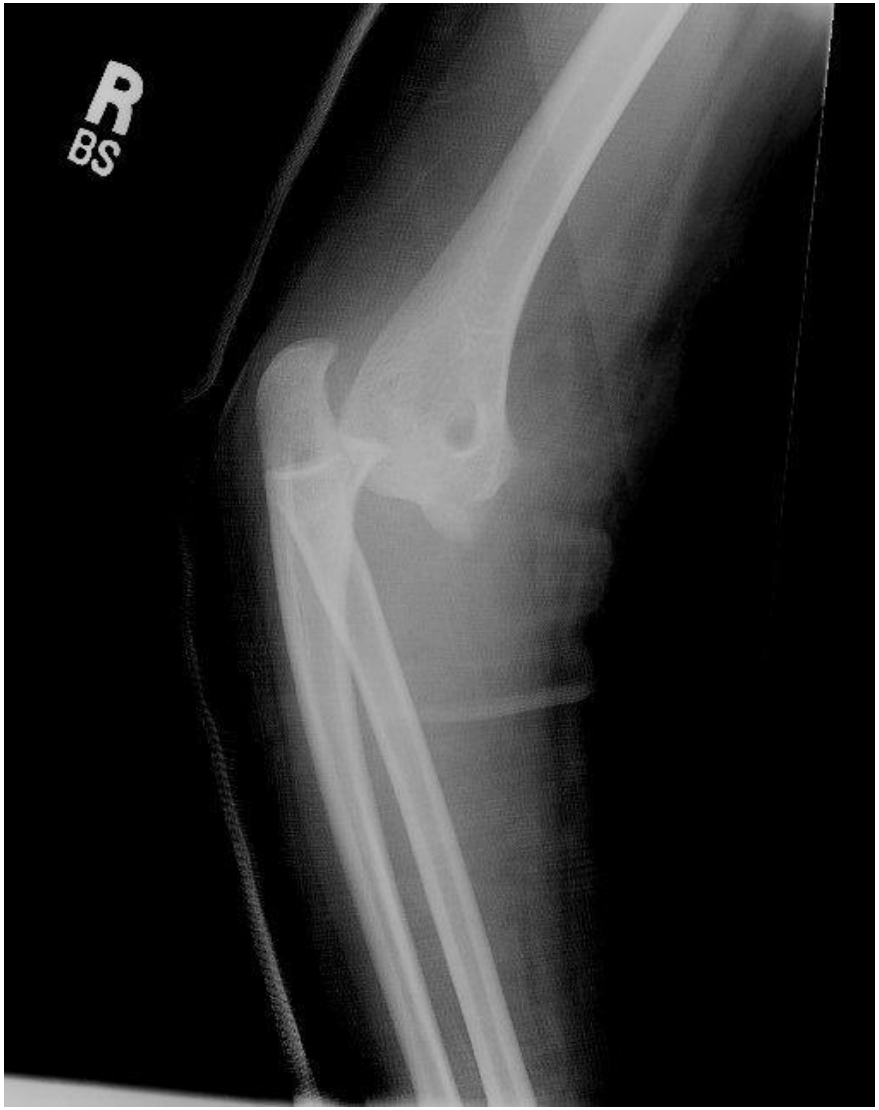
Humeral Shaft Fractures

- Conservative Treatment
  - Establish union with acceptable alignment
  - >90% of humeral shaft fractures heal with nonsurgical management
  - Acceptable alignment
    - » 20 - 45 degrees of anterior angulation, 30 degrees of varus angulation
      3 - 5 cm of shortening
  - May use coaptation splint, functional brace or hanging arm cast
  - Periodic follow up xrays to monitor alignment

Humeral Shaft Fractures

- Treatment
  - Operative Treatment
    - » Indications
      - inadequate reduction
      - nonunion,
      - associated injuries
      - open fractures,
      - segmental fractures,
      - associated vascular
      - nerve injuries
    - » Implants used
      - Plates and screws
      - Intramedullary nails
      - External fixators

Elbow Fracture/Dislocations



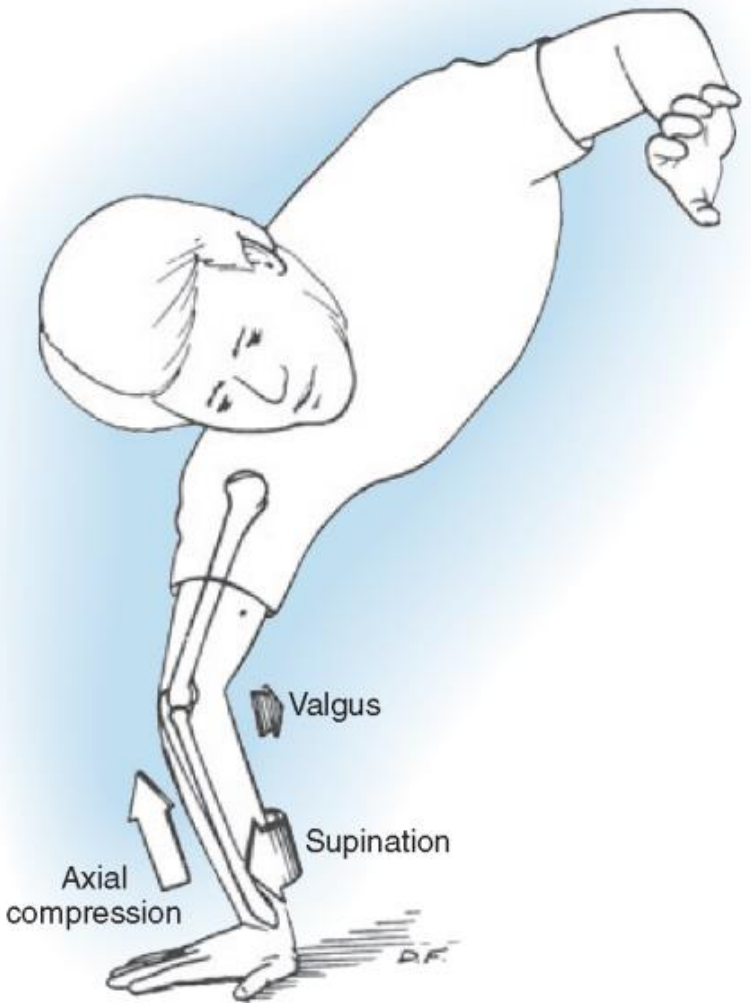
Elbow Dislocations

- Epidemiology
  - 11% - 28% of injuries to the elbow
  - Posterior dislocations most common
  - Highest incidence in the young 10-20 years and usually sports injuries

- Mechanism of injury
  - Fall on outstretched hand or elbow resulting in force to unlock the olecranon from the trochlea

  - Posterior dislocation following hyperextension, valgus stress, arm abduction, and forearm supination

  - Anterior dislocation from direct force to the posterior forearm with elbow flexed

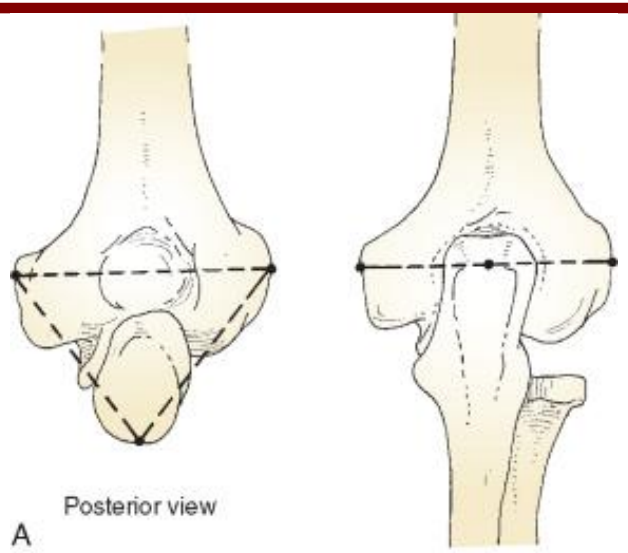


(Redrawn from O'Driscoll, S. W., Morrey, B. F., and Korinek, S., and An, K. N.: Elbow subluxation and dislocation: A spectrum of instability. Clin. Orthop. Relat. Res. 280:186, 1992.)

Elbow Dislocations

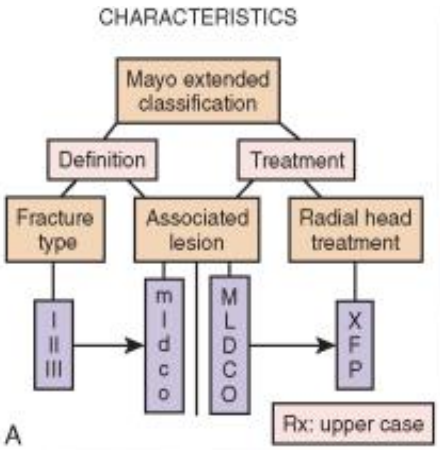
- Clinical Evaluation
  - Patients typically present guarding the injured extremity
  - Usually has gross deformity and swelling
  - Careful NV exam in important and should be done prior to radiographs or manipulation
  - Repeat after reduction

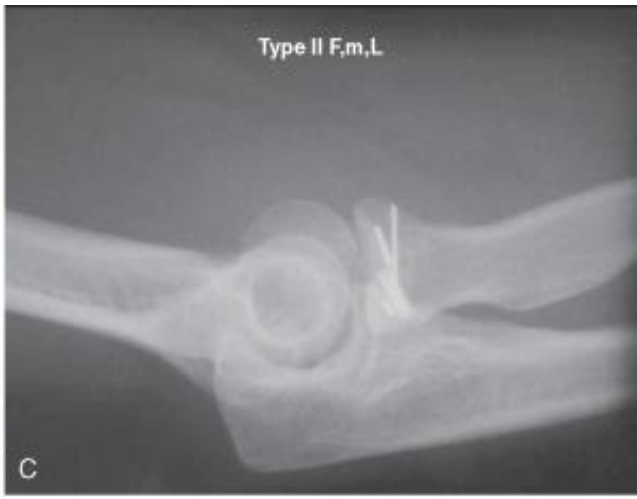
- Radiographic Evaluation
  - AP and lateral elbow films should be obtained both pre and post reduction
  - Careful examination for associated fractures



Elbow Dislocations

- Associated injuries
  - Radial head fx (5-11%)
  - Treatment
    - » Type I- Conservative
    - » Type II/III- Attempt ORIF vs radial head replacement





A suffix m is used if a medial collateral ligament injury is suspected or proven, but this has questionable impact on elbow stability. A capital M is used if there is an impact on stability, enough to warrant treatment. For lateral ligament injuries, l and L is used respectively. The same is done to document associated fractures to the ulna (U, u) or humerus (H, h). The suffix P is used to indicate that some sort of procedure was performed (Fig. 24-7); x for excision and F for ORIF.

Elbow Dislocations

- Associated injuries
  - Coronoid process fractures (5-10%)

Elbow Dislocations

- Associated injuries
  - Medial or lateral epicondylar fx (12-34%)

Elbow Fracture/Dislocations

- Treatment
  - Posterior Dislocation
    - » Closed reduction under sedation
    - » Reduction should be performed with the elbow flexed while providing distal traction
    - » Post reduction management includes a posterior splint with the elbow at 90 degrees
    - » Open reduction for severe soft tissue injuries or bony entrapment
  - Anterior Dislocation
    - » Closed reduction under sedation
    - » Distal traction to the flexed forearm followed by dorsally direct pressure on the volar forearm with anterior pressure on the humerus

Forearm Fractures

Forearm Fractures

- Epidemiology
  - Highest ratio of open to closed than any other fracture except the tibia
  - More common in males than females, most likely secondary mva, contact sports, altercations, and falls

- Mechanism of Injury
  - Commonly associated with direct trauma, missile projectiles, bending or torsion force

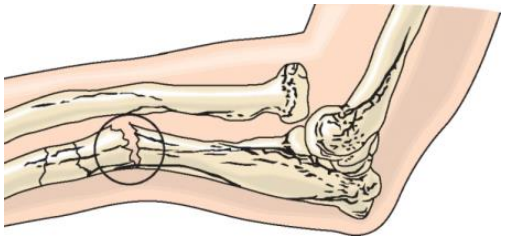
Forearm Fractures

- Clinical Evaluation
  - Patients come in with gross deformity pain, swelling, and loss of function at the hand/wrist
  - Evaluate radial, median, ulnar nerve functions
  - Evaluate radial, ulnar nerve pulses
  - Tense compartments, unrelenting pain, and pain with passive flexion/extension of digits →suspicion for compartment syndrome

- Radiographic Evaluation
  - AP and lateral radiographs of the forearm
  - Always evaluate the joint above and below

Forearm Fractures

- Ulna Fractures
  - These include nightstick and Monteggia fractures
  - Monteggia denotes a fracture of the proximal ulna with an associated radial head dislocation



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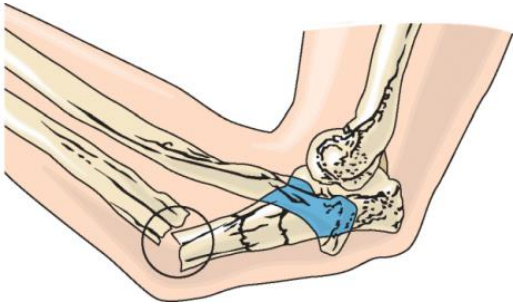

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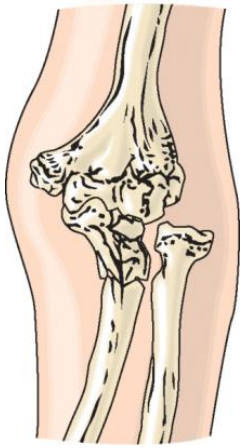

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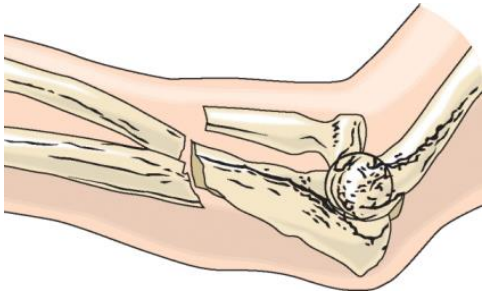


IV

Forearm Fractures

- Radial Diaphysis Fractures
  - Fractures of the proximal two-thirds can be considered truly isolated
  - Galeazzi fracture – distal radius fracture with distal radioulnar joint disruption
  - A reverse Galeazzi -fracture of the distal ulna with disruption of radioulnar joint

- Mechanism
  - Usually by direct or indirect trauma, such as fall onto outstretched hand
  - Galeazzi fractures -from direct trauma to the wrist or fall onto outstretched hand with pronation
  - Reverse Galeazzi results from fall with hand in supination

Forearm Fractures

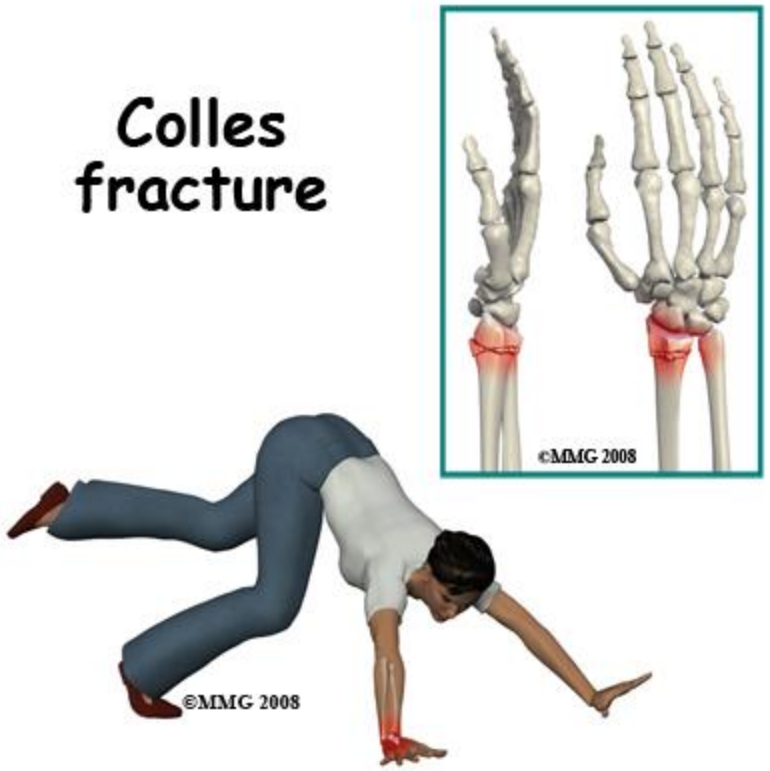
- Treatment
  - Nondisplaced Fractures
    - » May be treated with long arm cast
    - » Will require frequent follow up with xrays
  - Displaced Fractures
    - » Treatment of choice: ORIF with plates and screws

Distal Radius Fractures

Distal Radius Fractures

- Epidemiology
  - Most common fracture of the upper extremity
  - Common in younger and older patients
  - Result of direct trauma such as fall on out stretched hand
  - Increasing incidence due to aging population

- Mechanism of Injury
  - Most commonly a fall on an outstretched extremity with the wrist in dorsiflexion
  - High energy injuries may result in significantly displaced, highly unstable fractures

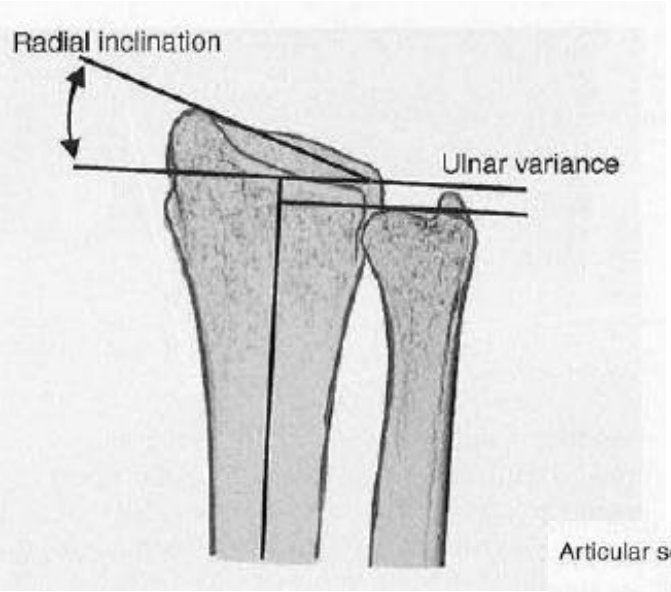


Distal Radius Fractures

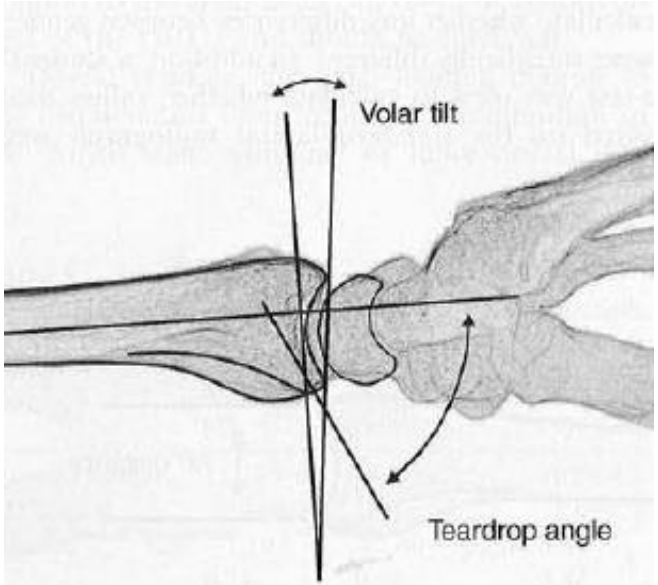
- Clinical Evaluation
  - Gross deformity of the wrist with variable displacement of the hand in relation to the wrist
  - Typically swollen with painful ROM
  - Ipsilateral shoulder and elbow must be examined
  - NV exam -median nerve for acute carpal tunnel compression syndrome

Distal Radius Fractures

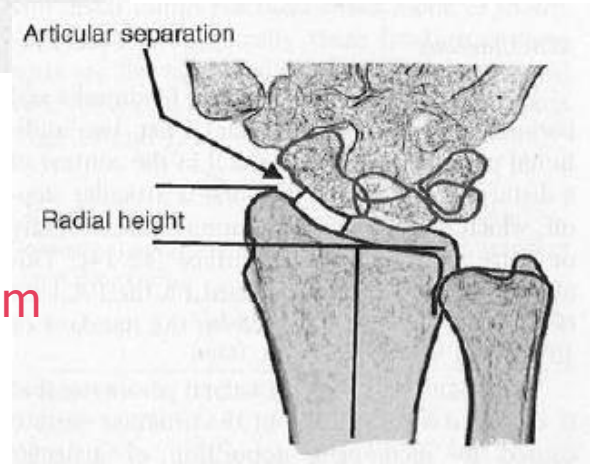
- Radiographic Evaluation
- 3 view of the wrist including AP, Lat, and Oblique



23 Deg



11 Deg



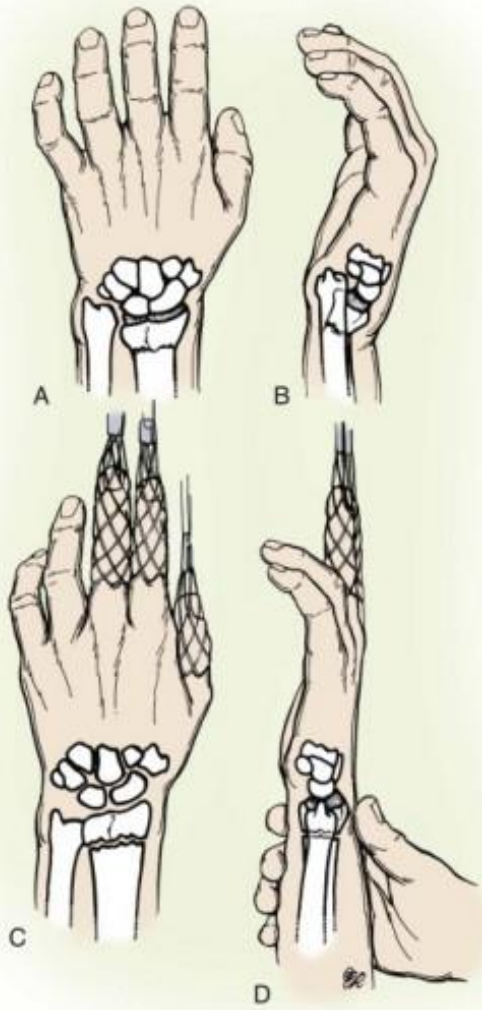
11 mm

Distal Radius Fractures

- Eponyms
  - Colles Fracture
    - » Combination of intra and extra articular fractures of the distal radius with dorsal angulation (apex volar), dorsal displacement, radial shift, and radial shortenting
    - » Most common distal radius fracture caused by fall on outstretched hand
  - Smith Fracture (Reverse Colles)
    - » Fracture with volar angulation (apex dorsal) from a fall on a flexed wrist
  - Barton Fracture
    - » Fracture with dorsal or volar rim displaced with the hand and carpus
  - Radial Styloid Fracture (Chauffeur Fracture)
    - » Avulsion fracture with extrinsic ligaments attached to the fragment
    - » Mechanism of injury is compression of the scaphoid against the styloid

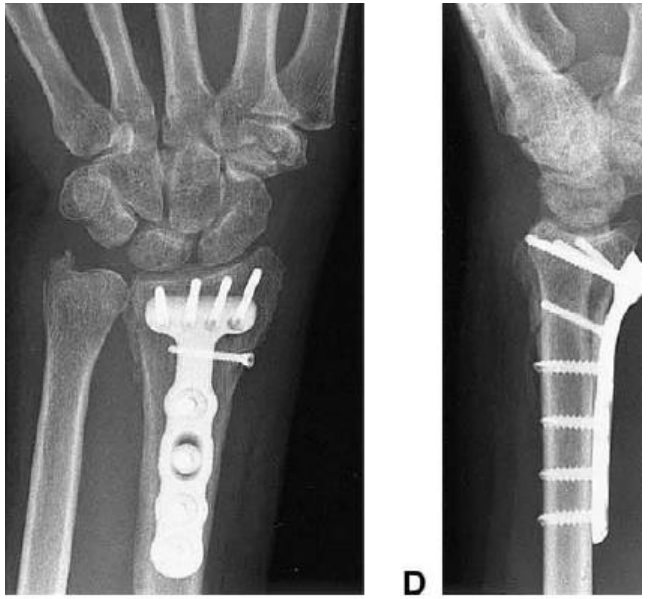
Distal Radius Fractures

- Treatment
  - Displaced fractures require an *attempt* at reduction.
    - » Hematoma block-10ccs of lidocaine or a mix of lidocaine and marcaine in the fracture site
    - » Apply traction to wrist in fingertraps with a traction weight
    - » Reproduce the fracture mechanism and reduce the fracture
    - » Place in sugar tong splint or a bivalved cast



Distal Radius Fractures

- Operative Management
  - » For the treatment of intraarticular, unstable, malreduced fractures
  - » Open fractures must go to the surgery for I&D and fixation



8 year old woman with an intra-articular, unstabl

Scaphoid Fractures

- Physical Exam Findings
  - Swelling
  - Limited Range of Motion
  - Tenderness over anatomic snuffbox
  - Pain on axial loading of the thumb

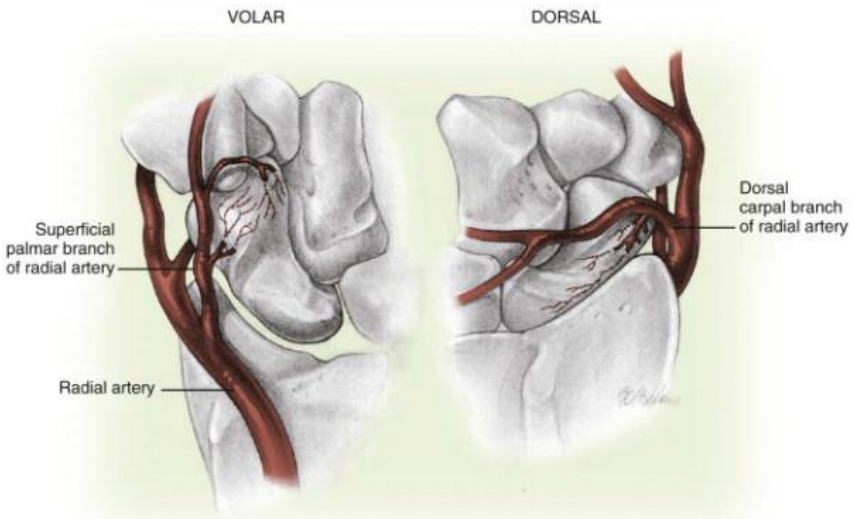
- Radiographic Evaluation
  - PA wrist view
  - PA wrist with clenched fist
  - Lateral
  - Radial oblique
  - Ulnar Oblique

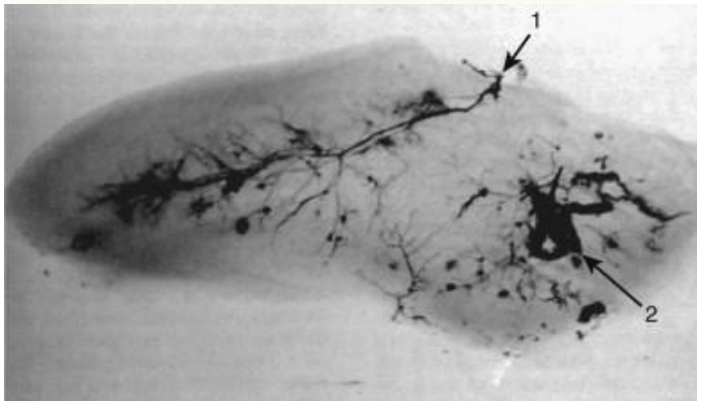
**Xrays may be negative intially and may need to be repeated in 1- 2 weeks to demostrate fracture

**MRI, CT, Technetium scan and Ultrasound may be used to diagnose occult fractures

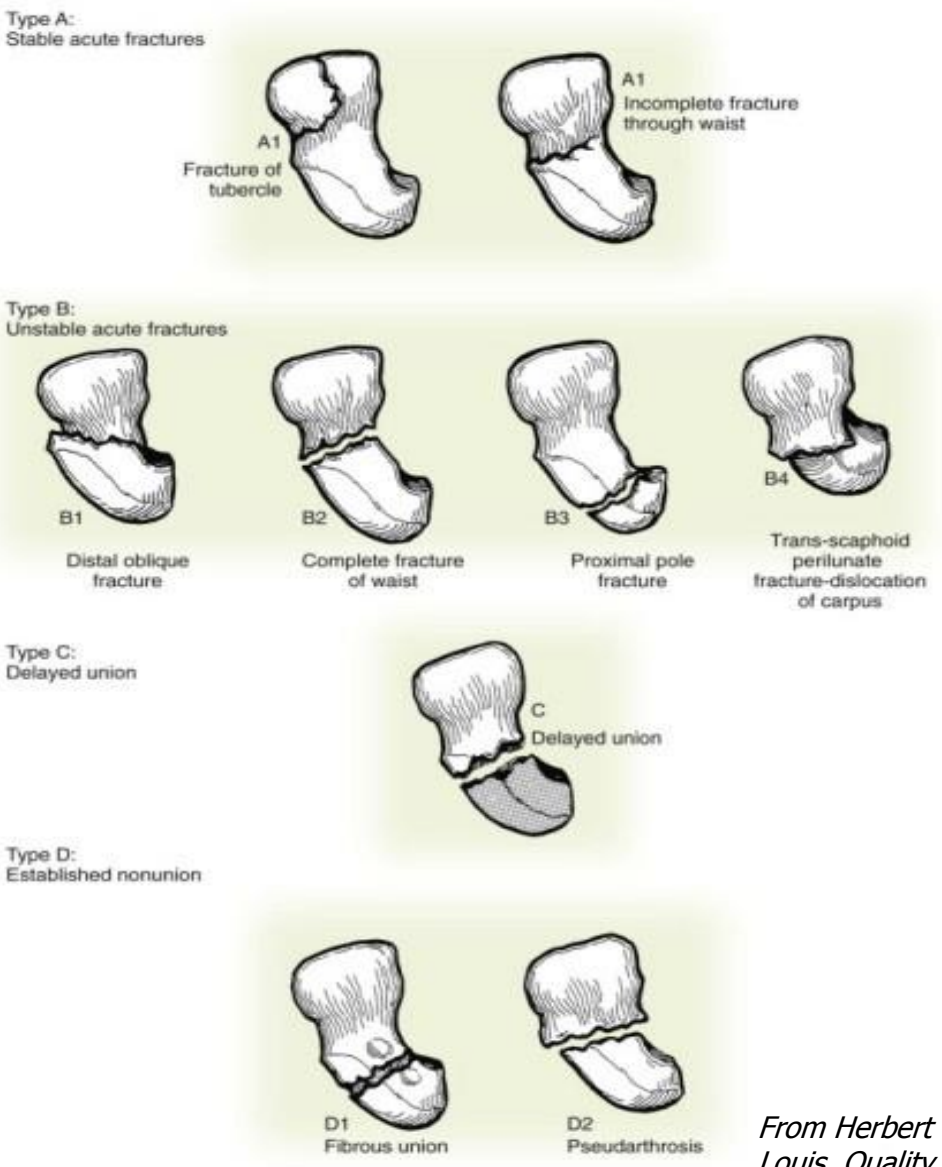
Scaphoid Fractures

- 50% - 80% of carpal injuries
- Anatomic Considerations
  - 80% covered with articular cartilage
  - 70% - 80% of blood supplied by scaphoid branches of the radial artery
  - Blood supply is retrograde (i.e. flow from distal to proximal direction)
- Mecahnism of Injury
  - Fall on outstretched hand (FOOSH)





Scaphoid Fractures



From Herbert TJ: The Fractured Scaphoid, St Louis, Quality Medical Publishing, 1990

Scaphoid Fractures

TYPE OF FRACTURE	TREATMENT
Stable Fractures, Nondisplaced	
Tubercle fracture	**Short arm cast for 6 to 8 weeks**
Distal third fracture/incomplete fracture	**Short arm cast for 6 to 8 week**
Waist fracture	**Long arm thumb spica cast for 6 weeks, short arm cast for 6 weeks or until CT confirmed healing, especially for Pediatric patients, Sedentary or low-demand patients, Preference for nonoperative treatment**
Waist fracture	**Percutaneous or open internal fixation, especially for Active, young, manual worker, Athlete, high-demand occupation Preference for early range of motion**
Proximal pole fracture, nondisplaced	**Percutaneous or open internal fixation**
Unstable Fractures	**Dorsal percutaneous/open screw fixation**
Displacement >1 mm	
Lateral intrascaphoid angle >35°	
Bone loss or comminution	
Perilunate fracture-dislocation	
Dorsal intercalated segmental instability alignment	

THANK YOU

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