



## Commonly Missed Injuries of the Extremities

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### Top 10 Missed Fractures

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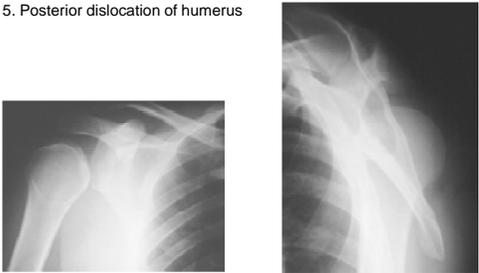
- 1. Base of skull
- 2. Odontoid process
- 3. Zygomatic arch and orbit
- 4. C7 Fracture dislocation
- 5. Posterior dislocation of humerus
- 6. Scaphoid, lunate and perilunar dislocation
- 7. Sacroiliac fractures
- 8. Undisplaced neck of femur
- 9. Dislocated hip with ipsilateral femoral fracture
- 10. Tibial plateau fractures

Fulde GWO (1994) Emergency Medicine

### Top 10 Missed Fractures

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5. Posterior dislocation of humerus



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### Top 10 Missed Fractures

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6. Scaphoid, lunate and perilunar dislocation

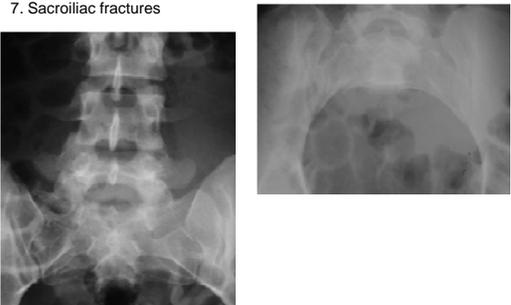


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### Top 10 Missed Fractures

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7. Sacroiliac fractures



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### Top 10 Missed Fractures

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8. Undisplaced neck of femur



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### Top 10 Missed Fractures

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9. Dislocated hip with ipsilateral femoral fracture



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### Top 10 Missed Fractures

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10. Tibial plateau fractures



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### Reasons for Misses Satisfaction of Search

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- Simple miss
- Satisfaction of Search
- Inadequate study
- Not what was expected
- Corner of film finding
- Inappropriate history
- Working conditions



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Talar neck fracture with subtalar dislocation

### Reasons for Misses Satisfaction of Search

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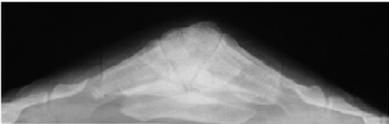
- One of the commonest reasons to miss injuries
- See most obvious injury
- Miss other (more significant) injury

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### Reasons for Misses Inadequate Study

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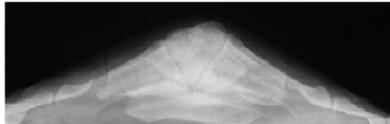
- Need two or more views to assess for fracture or dislocation
- Need appropriate study
- Insist on good quality studies
  - With empathy
- If equivocal, ask for more



### Reasons for Misses Inadequate Study

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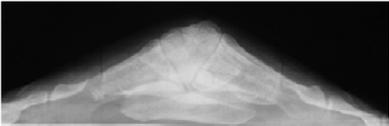
- All films need
  - Patients name
  - Patients number
  - Date and time of study
  - Side marker (lead, not added later)
  - Cone marks
  - Appropriate exposure



Reasons for Misses  
**Inadequate Study**

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- Department needs technologist CQI
  - Keywords
    - Reject markers
    - Reject technique
    - Reject patient details
    - Reject positioning



Reasons for Misses  
**Not what was expected**

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Dislocated right shoulder

**Ways to Avoid Missing Fractures**

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- Look for fracture patterns
- Look at regions that should align
- Look for secondary signs of fracture
- Look for the common sites of fractures

**Fracture Patterns**

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- Patterns help us know where to look
  - Transscapular / scaphoid fracture dislocation
  - Maisonneuve
  - Essex Lopresti
  - Galeazzi
  - Monteggia
  - Pelvic ring fractures
  - Waist of Scaphoid
  - Don Juan
  - Femoral shaft and neck

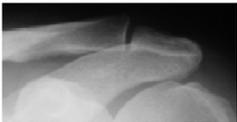


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**Alignment Rules**

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- These are helpful at various sites
  - ACJ
  - Lisfranc joint
  - Medial ends of clavicles
  - Elbow in children
  - Carpal bones
- Also check for rotation



**Secondary Signs  
Joint Effusion**

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- Secondary signs
  - Joint effusion
  - Lipothorax
  - Gas in joint
  - ST swelling
  - Obliteration of fat planes
  - Fat in joint on CT
  - Bone edema on CT
  - Intraosseous Vacuum
  - Delayed resorption
  - Delayed sclerosis



### Elderly

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- Fractures often hard to see
- Degenerative changes obscure fractures
- Fatty marrow makes bone edema useful sign
- Fractures more often fatal
- If alters management, low threshold for MRI

### Childhood Fractures

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- Tendons stronger than bone
  - Apophyseal avulsion
- Fracture patterns different
  - Salter Harris
- Incomplete fractures more common
  - Plastic bowing
  - Torus / Buckle
  - Greenstick
- Remember NAI

### Problem solving

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- Repeat
- Oblique views
  - Tibial plateau
  - Radial head
- Dedicated views
  - Scaphoid
  - Radial head
- Single emulsion
  - Periphery
- Tomography, CT, MRI, Scintigraphy

Imaging Techniques

### DEXA

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- Has been used to assess for stress fractures



Imaging Techniques

### Plain Film V's CT V's MRI

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- As CT and MRI continue to improve, only rarely now are fractures only seen on X-ray
- X-ray still mainstay
- CT and MRI complimentary
- CT good for defining complexity of fracture
- MRI good for presence of fracture and ST injury

### Scapula Fractures

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- Body
  - Significant force
  - Ass. Life-threatening injuries
- Acromial
  - Direct blow
  - Os acromiale
- Coracoid
  - GHJ dislocation
  - Direct blow
    - Trap shooters
  - Avulsion
    - Athletes
  - Best on axillary view



### Greater Tuberosity of Humerus

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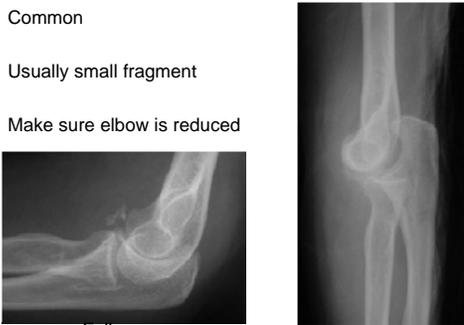
- One of the most commonly missed fractures



### Coronoid Fracture of Ulna

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- Common
- Usually small fragment
- Make sure elbow is reduced

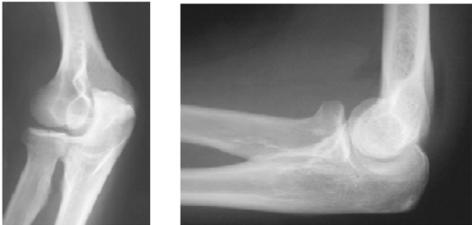


Follow up

### Radial Head Fracture

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- Use fat pad signs
- FOOSH + Pain + Effusion = radial head fracture



### Torus Fracture

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- Look for the cortical bump in children



### Scaphoid Fractures

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- Negative x-ray
  - MRI better than bone scan
  - Immobilize x-ray 10-14/7



J Hand Surg [Br] 1993;18:403-6.

### Perilunate Dislocation

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- Classic missed injury
- Often present again too late for repair
- 3x commoner than lunate dislocations



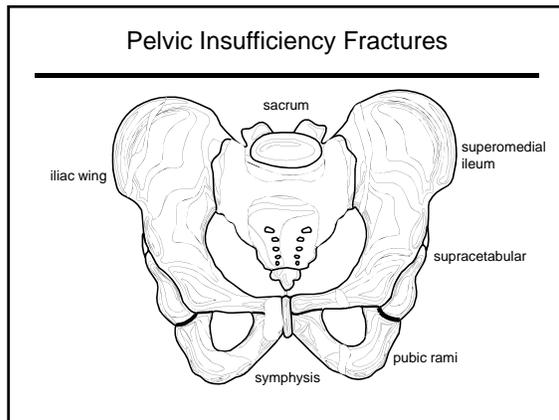
### Bennett V's Rolando

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- Both intraarticular
- Rolando – comminuted
- Both unstable
- Separate from extraarticular



Rolando
Bennett's



### Femoral Head Fracture

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- Usually occurs with hip dislocation
- Must be sought
- Requires fixation



### Slipped Upper Femoral Epiphysis

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- Must obtain frog leg lateral
- Head goes Posteromedioinferior



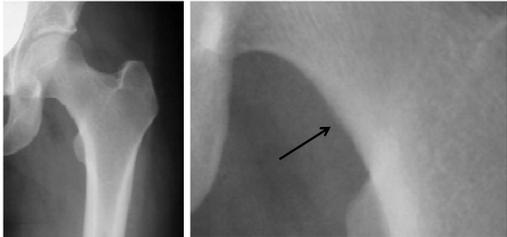
### Neck of Femur Fracture

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- AP internal rotation
- Angle beam medially
- Widened joint suggests entrapped fragment
- Impacted, undisplaced or incomplete may be invisible radiographically
- CT
  - Bone edema, intraosseous gas or IA fat
- MRI
  - Limited Cor T1 and T2FS

### Femoral Neck Stress Fracture

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### Femoral Condyle Fractures

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Can be difficult to see

Hoffa fracture

### ACL Avulsion

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### Tibial Plateau Fracture

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- Fall with twist
- Ped V's MVA
- 50% > 50Y
- 80% lateral due to valgus
- Obliques useful
- MRI for diagnosis
- CT to stage
- Schatzker classification

### Segond Fracture

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Segond fracture suggests the presence of significant pathology  
 A small, vertically oriented, avulsed bony fragment  
 Involves the lateral aspect of the proximal lateral tibia  
 Nearly always associated with a tear of the anterior cruciate ligament in the older population  
 Alternatively, an avulsion of the tibial spines is seen in younger patients

### Proximal Fibula Fractures

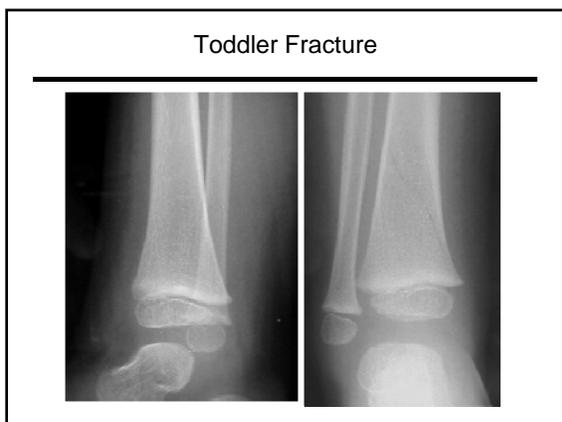
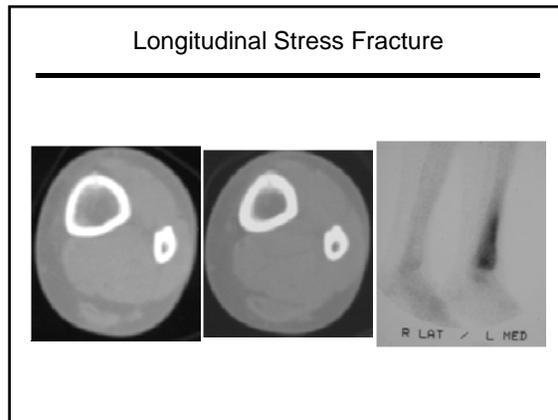
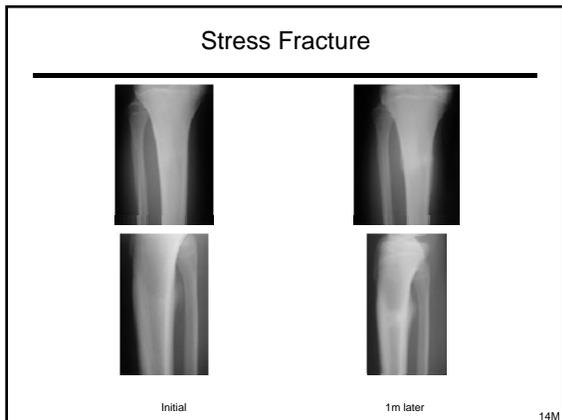
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- Can indicate an unstable posterolateral corner
- Ass. ACL injury

### Maisonneuve Fracture

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### Ankle Injury - Check List

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- Malleoli
- Lateral process of Talus
- Talar dome
- Anterior process of Calcaneus
- EDB avulsion
- Base of 5<sup>th</sup> metatarsal
- Jones fracture
- Does ankle fracture suggest Maisonneuve
- Dorsal chip fractures

### Lisfranc Fracture Dislocations

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- Often subtle
- Must be looked for
- Line up
  - Lateral margin of 1<sup>st</sup> on AP
  - Medial margin of 2<sup>nd</sup> on AP
  - Medial margin of 4<sup>th</sup> on Oblique
  - Medial margin of 5<sup>th</sup> on Oblique
  - Look for dorsal displacement on Lateral

