

Commonly Missed Injuries of the Extremities

Top 10 Missed Fractures

- 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

Reasons for Misses

- Satisfaction of Search
- Inadequate study
- Not what was expected
- Inappropriate history
- Working conditions

Reasons for Misses

Satisfaction of Search

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

Inadequate Study

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

Fracture Patterns

- Patterns help us know where to look
 - Transtriquetral/scaphoid perilunate fracture dislocation
 - Maisonneuve
 - Galeazzi
 - Monteggia
 - Waist of Scaphoid

Alignment Rules

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

Secondary Signs

Joint Effusion

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

Problem solving

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

Elderly

- Fractures often hard to see
- Degenerative changes obscure fractures
- Fractures more often fatal
- If alters management, low threshold for MRI

Childhood Fractures

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

Imaging Techniques

Plain Film V's CT V's MRI

- 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

Medial end of Clavicle

- Dislocations
 - Infrequent
 - <25Y
 - Anterior more common
 - Clavicle elevated
 - Posterior more serious
 - Clavicle depressed
 - Difficult to see
 - Serendipity view 40 cephalic
- Fractures
 - Epiphyseal separation
- CT optimal

Clavicle

- Common in children
 - Greenstick
 - Plastic bowing
 - Undisplaced
- AP and 15 degrees cephalic angulation
- 80% in adults – mid third

Acromioclavicular Joint

- FOOSH 15-40Y
- Normal 3-8mm wide
 - <2mm difference
- Smooth undersurface
- CC distance 11-13mm
 - <4mm difference
- Stress views 10-20 lbs
- Boomerang filter
- Zanca view - ST 10deg ceph

Scapula Fractures

- 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

Glenohumeral Joint

- Anterior 95%
- Posterior 4%
 - Initially unrecognized in 50%
 - Insist on ER view
 - Light bulb sign
 - Vacant glenoid cavity > 6mm
 - Loss of parallelism
 - Trough line
 - Reverse Bankart
 - Lesser tuberosity avulsion
 - Subscapularis tear

Greater Tuberosity of Humerus

- One of the most commonly missed fractures

Coronoid Fracture of Ulna

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

Radial Head Fracture

- Use fat pad signs
 - Sail sign
 - Posterior fat pad
- FOOSH + Effusion + Pain + Fx not seen
 - = radial head fracture

Monteggia Fracture Dislocation

- Common compared to individual components
 - proximal fracture of the ulna
 - radial head dislocation

Essex-Lopresti Injury

- Need to see both joints
- Distal ulna dislocation
- Proximal radial fracture
- Injury to interosseous ligament
- Poor outcome

Galeazzi Fracture Dislocation

- Galeazzi fractures occur more commonly than isolated DRUJ dislocations
- Radial fracture more proximal than usual

Longitudinal Distal Radius

- Fine longitudinal fracture line
- Often difficult to see
- Often ignored because unexpected

Torus Fracture

- Look for the cortical bump in children

DRUJ subluxation

- Ulna styloid lines up within 5mm of triquetrum on all views
- CT pronation and supination

Scaphoid Fractures

- Common
- Easily missed
- Full carpal series
 - AP
 - Lat
 - Ulnar deviation
 - Radial deviation
 - Ulnar deviation 20 deg cephalic angulation.

Scaphoid Fractures

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

Scaphoid Fractures

- 5% non union
 - > displaced
- OA
- AVN
 - Proximal > Distal
- Malunion
 - CT
- SNAC

Scaphoid Tubercle

- Younger age group

Perilunate Dislocation

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

Transscaphoid Perilunate fracture-dislocation

- Common form of greater arc injury

Bennett V's Rolando

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

Sacral Fractures

- In trauma, rarely isolated
- Add 15 deg cranial view
- Inlet view good for displacement

Sacral Insufficiency Fractures

- Difficult to see due to osteopenia
- Use CT, MRI or scintigraphy
- Look for accompanying pelvic fractures

Pelvic Insufficiency Fractures

- Pubic body and rami common
- Horizontal supraacetabular
- Vertical para sacroiliac

Femoral Head Fracture

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

Slipped Upper Femoral Epiphysis

- Must obtain frog leg lateral
- Head goes
Posteromedioinferior

Neck of Femur Fracture

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

Inferior Pole of Patella

- 70% transverse
- Longitudinal if direct blow
- Bipartite superolateral
- Inferior pole most often missed

Lipohemarthrosis of Knee

- Intraarticular fracture
- SH3 injury in children
- ACL tear

Lateral Tibial Plateau

- 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

- 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

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

Ankle Injury Check List

- Malleoli
- Lateral process of Talus
- Anterior process of Calcaneus
- Base of 5th metatarsal
- Jones fracture
- Does ankle fracture suggest Maisonneuve
- Dorsal chip fractures

Calcaneal Fractures

- Most common tarsal fracture
- 10% bilateral
- 10% Spinal fracture
- Anterior process missed
- Harris Beath view useful
- CT for pre op planning

Lisfranc Fracture Dislocations

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