Commonly Missed Injuries of the Extremities

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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. Displaced neck of femur
9. Dislocated hip with ipsilateral femoral fracture
10. Tibial plateau fractures

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Top 10 Missed Fractures

9. Dislocated hip with ipsilateral femoral fracture

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Top 10 Missed Fractures

10. Tibial plateau fractures

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Reasons for Misses

Satisfaction of Search

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

Talar neck fracture with subtalar dislocation

Reasons for Misses

Satisfaction of Search

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

Reasons for Misses

Inadequate Study

• 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

• All films need
  • Patients name
  • Patients number
  • Date and time of study
  • Slide marker (lead, not added later)
  • Cone marks
  • Appropriate exposure
Reasons for Misses

Inadequate Study

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

Not what was expected

Ways to Avoid Missing Fractures

- 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

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

Alignment Rules

- 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

- Secondary signs
  - Joint effusion
  - Lipohemarthrosis
  - 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

- 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

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

Problem solving

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

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

- 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
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
• FOOSH + Pain + Effusion = radial head fracture

Torus Fracture

• Look for the cortical bump in children

Scaphoid Fractures

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

Perilunate Dislocation

• Classic missed injury
• Often present again too late for repair
• 3x commoner than lunate dislocations
Bennett V’s Rolando

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

Pelvic Insufficiency Fractures

- sacrum
- superomedial ilium
- superacetabular
- symphysis
- pubic rami

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, intraosseous gas or IA fat
- MRI
  - Limited Cor T1 and T2FS

Femoral Neck Stress Fracture
Femoral Condyle Fractures

Can be difficult to see

ACL Avulsion

Tibial Plateau Fracture

- 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 spine is seen in younger patients

Proximal Fibula Fractures

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

Maisonneuve Fracture
Stress Fracture

Longitudinal Stress Fracture

Toddler Fracture

Ankle Injury - Check List

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

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

Metatarsal Stress Fractures