The Language of Fractures and Dislocations: How to Describe an X-ray to an Orthopedic Surgeon Over the Phone

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Goals and Objectives

**Goal 1:** Improve participant understanding of and ability to read basic fractures and dislocations on plain film x-rays.

- **Objectives:** At the end of this lecture, participants should able able to:
  - Determine and accurately name the fractured bone and / or dislocated joint
  - Identify the specific location of the fracture and / or dislocation.
  - Describe the basic characteristics of the fracture and / or dislocation.

**Goal 2:** Augment participant’s communication with orthopedic colleagues regarding radiographic findings, to enhance diagnostic accuracy and improve overall patient outcomes.

- **Objectives:** At the end of this lecture, participants should able able to:
  - Succinctly describe several radiographic examples of basic fractures and / or dislocations.
  - Correctly answer 2-3 questions pertaining to the description of fractures and/or dislocation(s) as noted on plain radiographs.
Disclosures

The presenter has no relevant financial relationships to be discussed, directly or indirectly, referred to or illustrated with or without recognition within this presentation.

Relevance

- Important to know how to describe fractures for:
  - Documentation
  - Communication with other physicians
    - Colleagues
    - Specialists
  - Ortho-speak
Pre-reading Musculoskeletal Radiographs

- **1:** Name, date, old films for comparison
- **2:** Identify type of view(s)
- **3:** Identify bone(s) & joint(s) demonstrated
- **4:** Skeletal maturity
  (physis: growth plate)
- **5:** Soft tissue reactions/swelling
- **6:** Bone & joint injury
  (fractures & dislocations)

What is a (bony) fracture?

- Disruption of a bone's normal structure or continuity
- Crack, break, or rupture in a bone
- There are many how & why is to bony fractures
  - Terms used to describe each are related
Appropriate Imaging

- “One view is no view”. Need orthogonal imaging (at least 2) to appropriately read & interpret x-rays. These views may differ per joint / bone being imaged.
  - Shoulder: (AP, true AP, scapular Y, axillary)
  - Knee: (AP, lat, oblique, merchant)
  - Ankle (AP, lat, mortise)
  - Wrist (AP, lat, oblique, carpal tunnel, scaphoid)
  - Elbow (AP, lat, oblique, radial head / Greenspan)

- Image joint above and below injury.

Classification

- In 1958 Swiss surgeons founded the AO (Arbeitsgemeinschaft für Osteosynthesefragen/Association for the Study of Internal Fixation) in order to the care for musculoskeletal injuries.

- Müller AO Classification of fracture published in 1987 by the AO Foundation.
  - Classifies fractures by location, type, and provides relative prognosis of severity.
  - Very complicated and cumbersome

- General rule is to describe what you see utilizing common verbiage and terminology.
Mnemonic for identifying and describing fractures: OLD ACID

- O: Open vs. closed
- L: Location
- D: Degree (complete vs. incomplete)
- A: Articular extension
- C: Comminution / Pattern
- I: Intrinsic bone quality
- D: Displacement, angulation, rotation

O: Open vs. Closed

- Open fracture
  - AKA: [Compound fracture]
  - A fracture in which bone penetrates through skin; [Open to air]
  - Some define this as a fracture with any open wound or soft tissue laceration near the bony fracture, i.e. if skin is compromised by fracture assume open

- Closed fracture
  - Fracture with intact overlying skin barrier
L: Location
- Which bone?
- Break into thirds (long bones)
  - Proximal, middle, distal third
- Anatomic orientation
  - E.g. proximal, distal, medial, lateral, anterior, posterior
- Anatomic landmarks
  - E.g. head, neck, body / shaft, base, condyle
- Segment (long bones)
  - Epiphysis, physis, metaphysis, diaphysis

D: Degree of Fracture
- Complete
  - Complete cortical circumference involved
  - Fragments are completely separated
- Incomplete
  - Cortex is not completely compromised
  - Only one cortex involved
  - E.g. Greenstick fracture

Diagrams showing anatomic locations such as epiphysis, physis, metaphysis, and diaphysis, as well as examples of transverse and greenstick fractures.
A: Articular Extension / Involvement

- Intra-articular fractures
- Involves the articular surface
- Dislocation
  - Loss of joint surface / articular congruity
- Fracture-dislocation

C: Comminution / Pattern

- Transverse (Simple)
- Oblique (Simple)
- Spiral (Simple)
- Linear / longitudinal
- Segmental
- Comminuted
- Compression / impacted
  - Buckle / Torus
- Distraction / avulsion
Fracture Patterns

Atypical Fractures

- Greenstick
- Impacted
- Pathologic
- Stress
- Hairline
- Torus (buckle)
C: Comminution / Pattern

- Transverse (Simple)

- Oblique (Simple)
- Spiral (Simple)
  - Oblique in 2+ views
C: Comminution / Pattern

- Linear / longitudinal / split

C: Comminution / Pattern

- Segmental
  - Bone broken in 2+ separate places; Fx lines do not connect
C: Comminution / Pattern

- Comminuted
  - Broken, splintered, or crushed into >2 pieces

C: Comminution / Pattern

- Compression
  (Vertebral body)
- Depression
  (skull fracture)
- Impacted
  - (e.g. Buckle / Torus)
C: Comminution / Pattern

- Buckle / Torus

C: Comminution / Pattern

- Avulsion
- Shear
I: Intrinsic Bone Quality

- Normal
- Osteopenia
  - Decreased density

I: Intrinsic Bone Quality

- Normal
- Osteopetrosis
  - Increased density
I: Intrinsic Bone Quality

- Normal
- Osteopoikilosis
  - Focal areas of increased density

D: Displacement, Angulation, Rotation

- **Displacement**
  - Extent to which Fx fragments are not axially aligned
  - Fragments shifted in various directions relative to each other
  - Convention: describe displacement of distal fragment relative to proximal.

- Complete, oblique tibial shaft fracture between distal & middle thirds; laterally displaced
**D: Displacement, Angulation, Rotation**

- **Angulation**
  - Extent to which fracture fragments are not *anatomically* aligned
    - In an *angular* fashion
  - Convention: describe angulation as the direction the *apex* is pointing relative to anatomical long axis of the bone (e.g. apex medial, apex valgus), or direction of distal segment.

- **R tibial shaft fracture** between proximal & middle thirds, angulated *apex lateral* (varus angulated)

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**Valgus angulated**
- **Apex medial**

**Parallel**
- **No angulation**

**Varus angulated**
- **Apex lateral**
D: Displacement, Angulation, Rotation

**Rotation**
- Extent to which fracture fragments are rotated relative to each other

- Convention: describe which direction the *distal* fragment is rotated relative to the proximal portion of the bone
  ex: internal (towards midline) vs external (away from midline) rotation
Alternative Mnemonic: BLT LARD

- B: Identify Bone
- L: Location on bone
- T: Type of fracture
- L: Length changes
- A: Angulation
- R: Rotation
- D: Displacement

Salter-Harris Fractures

Pediatric fracture involving physis (growth plate)

Mnemonic: Straight Above beLow Through cRushed
Salter-Harris II
Fracture of Distal Femur

Salter-Harris III
fracture distal tibia

Salter-Harris IV
fracture distal tibia
Other signs of fractures

- Periosteal reaction
- Callus / Osteosclerosis

Other signs of fractures

- Fat pad sign / Sail sign

Anterior fat pad:
Shallow coronoid fossa.
Sensitive but not specific to fracture.

Posterior fat pad:
Deeper olecranon fossa,
less sensitive but > 70% specific for true fracture.
Common Fracture Names and Eponyms

<table>
<thead>
<tr>
<th>Fracture Name</th>
<th>Eponym</th>
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<tbody>
<tr>
<td>Jones’</td>
<td>Maisonneuve</td>
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<tr>
<td>Barton’s</td>
<td>Monteggia</td>
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<tr>
<td>Bankart</td>
<td>Segond</td>
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<td>Bennet</td>
<td>Pellegrini-stieda</td>
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<tr>
<td>Rolando</td>
<td>Smith’s</td>
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<td>Boxer’s</td>
<td>Tillaux</td>
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<td>Colles’</td>
<td>Lisfranc</td>
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<td>Galleazzi</td>
<td>Jefferson</td>
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<td>Essex-Lopresti</td>
<td>Chance</td>
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Joint Dislocations

Dislocation: Abnormal separation / discontinuity in a joint.

Subluxation: A partial / incomplete separation of a joint.

Same rules apply: Identify joint(s) involved in dislocation, determine direction of dislocation, and any associated fractures.
Description of Dislocations

Described by position of distal bone in relation to the proximal bone.

- Anterior (volar)
- Posterior (dorsal)
- Medial
- Lateral
- Any combination

Dorsal PIP Dislocation
Summary

○ Systematically read X-rays
  - Bone, location, pattern, soft tissue
  - AO Classification complicated
  - Just describe what you see

○ Communicate and share with your consultants
  - Pre-reading
  - Succinct & accurate description of fractures
  - Interdisciplinary medical teams improve patient care

Examples

Let’s try a few examples…
Questions?
Thank You!