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

Joshua A. Tuck, D.O., M.S. (Med Ed)
LECOM Orthopedic and Sports Medicine
Peek'n Peak Primary Care Conference
Winter 2016

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's and why's 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)

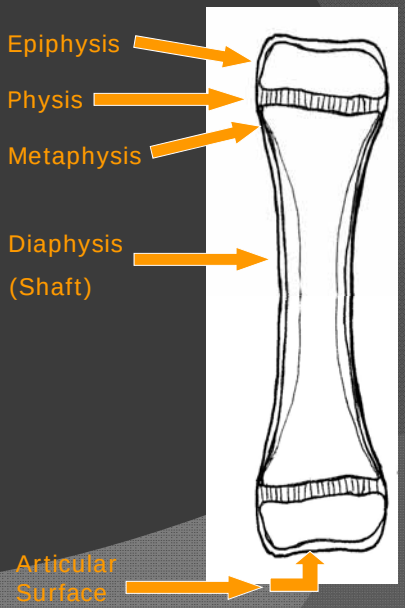
- A: Articular extension
- C: Comminution / Pattern
- I: Intrinsic bone quality
- D: Displacement, angulation, rotation

O: Open vs. Closed

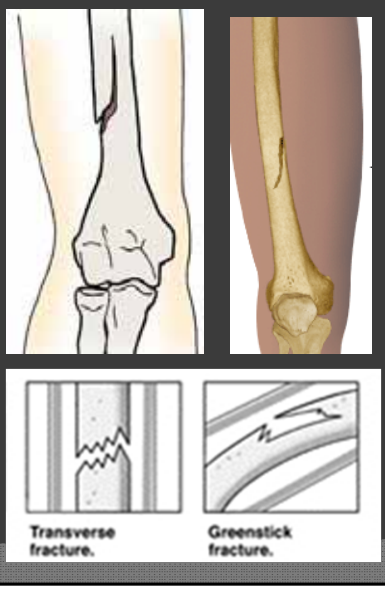
- Open fracture
  - AKA: "Compound fracture"
  - A fracture in which bone penetrates through skin; "Open to air"
  - Some define this as a fracture with any open wound or soft tissue laceration near the bony fracture, i.e. if skin is compromised by fracture assume open
- Closed fracture
  - Fracture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



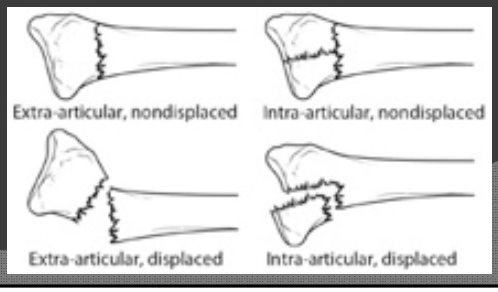
D: Degree of Fracture



- Complete
  - Complete cortical circumference involved
  - Fragments are completely separated
- Incomplete
  - Cortex is not completely compromised
  - "Only one cortex" involved
  - e.g "Greenstick fracture"

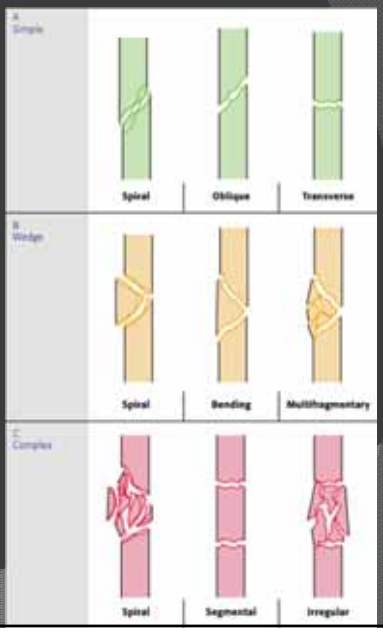
A: Articular Extension / Involvement

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

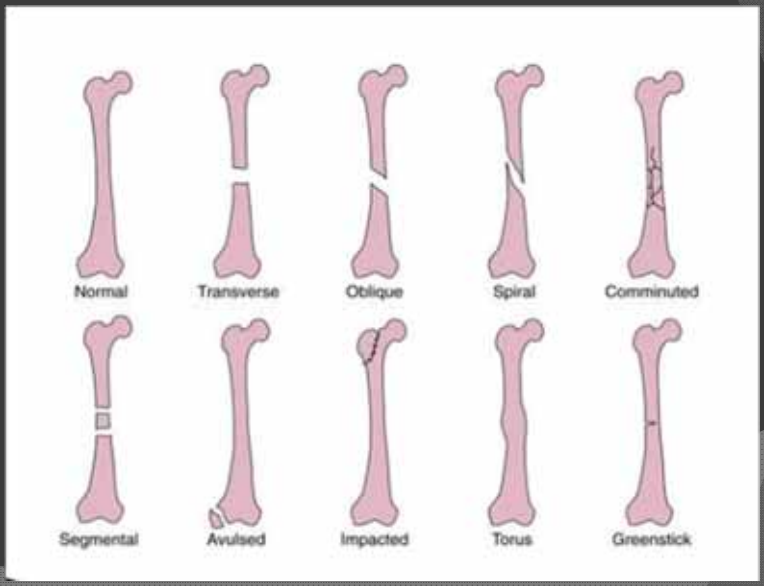


C: Comminution / Pattern

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



Fracture Patterns

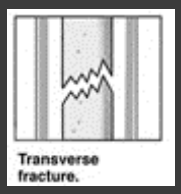


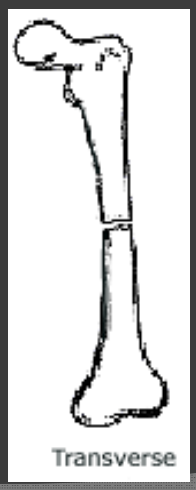
Atypical Fractures

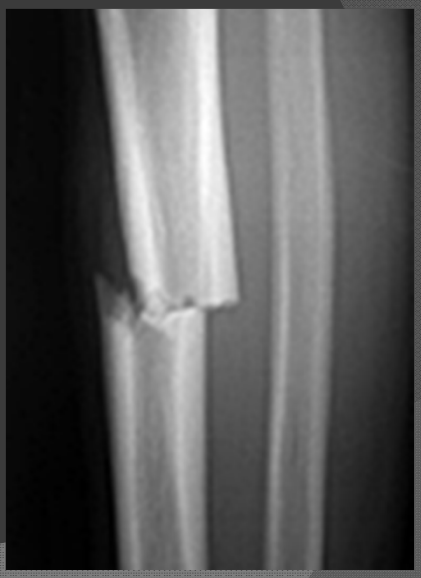
- Greenstick
- Impacted
- Pathologic
- Stress
- Hairline
- Torus (buckle)

C: Comminution / Pattern

- Transverse (Simple)

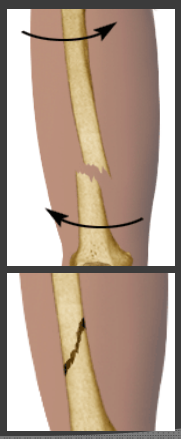






C: Comminution / Pattern

- Oblique (Simple)
- Spiral (Simple)
  - Oblique in 2+ views



C: Comminution / Pattern

- Linear / longitudinal / split

C: Comminution / Pattern

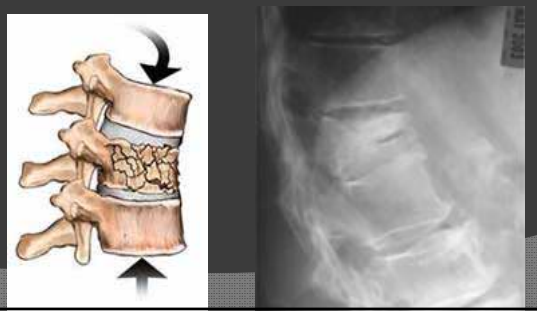
- Segmental
  - Bone broken in 2+ separate places; Fx lines do not connect

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")

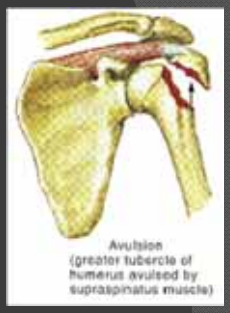


C: Comminution / Pattern

- "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

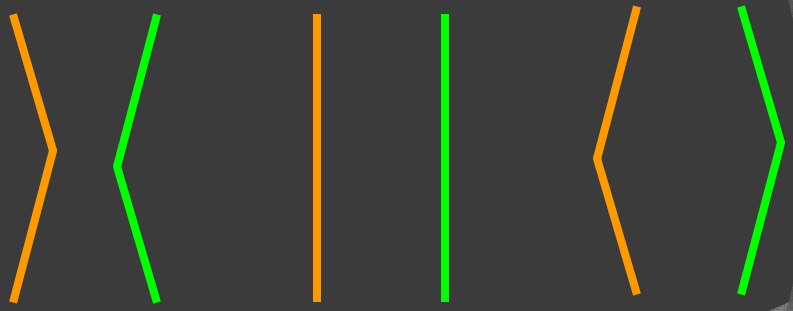
D: Displacement, Angulation, Rotation

- 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)*

D: Displacement, Angulation, Rotation

- Angulation



- Valgus angulated
- Apex medial

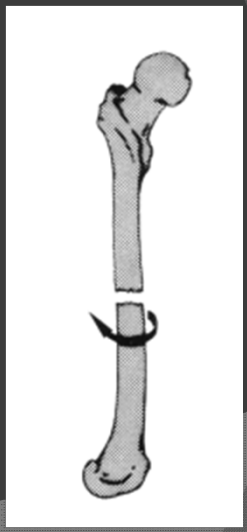
- Parallel
- No angulation

- 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



D: Displacement, Angulation, Rotation

- Rotation

- Normal AP view of hip
  - Greater trochanter in profile

- AP view of externally rotated hip Fx
  - Greater trochanter perpendicular to film

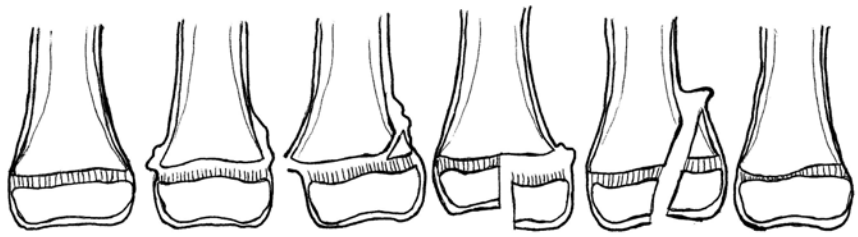
Alternative Mnemonic: BLT LARD

- 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)



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

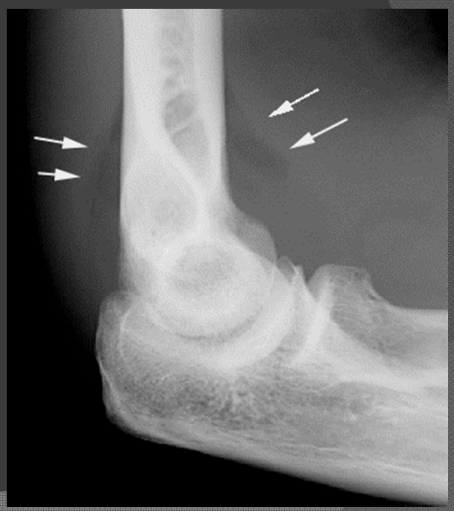
- Callus / Osteosclerosis

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 senstive but > 70% specific for true fracture.



Common Fracture Names and Eponyms

Jones'
Barton's
Bankart
Bennet
Rolando
Boxer's
Colles'
Galleazzi
Essex-Lopresti
Maisonneuve
Monteggia
Segond
Pellegrini-stieda
Smith's
Tillaux
Lisfranc
Jefferson
Chance

Joint Dislocations

Dislocation: Abnormal separation / discontinuity in a joint.

Subluxation: A partial / incomplete separation of a joint.

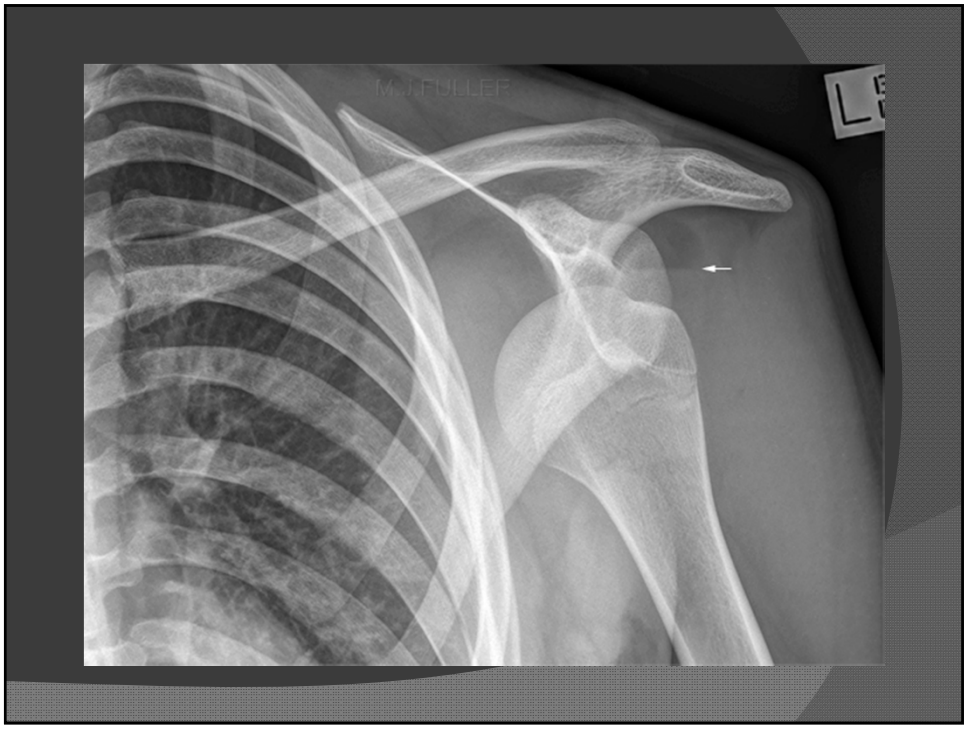
Same rules apply: Identify joint(s) involved in dislocation, determine direction of dislocation, and any associated fractures.

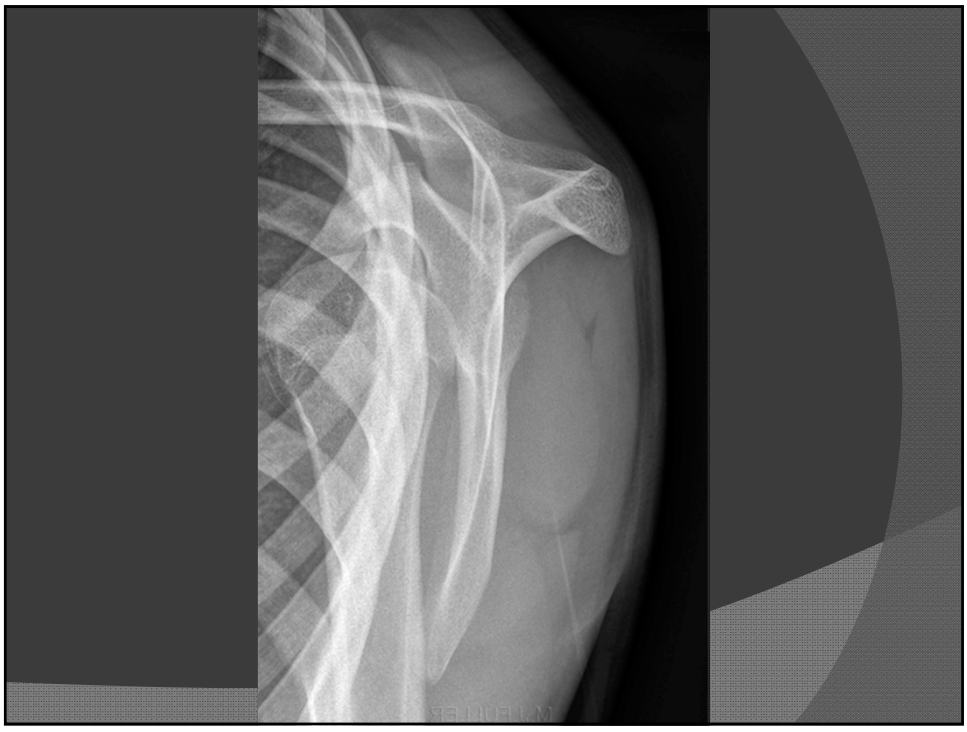
Description of Dislocations

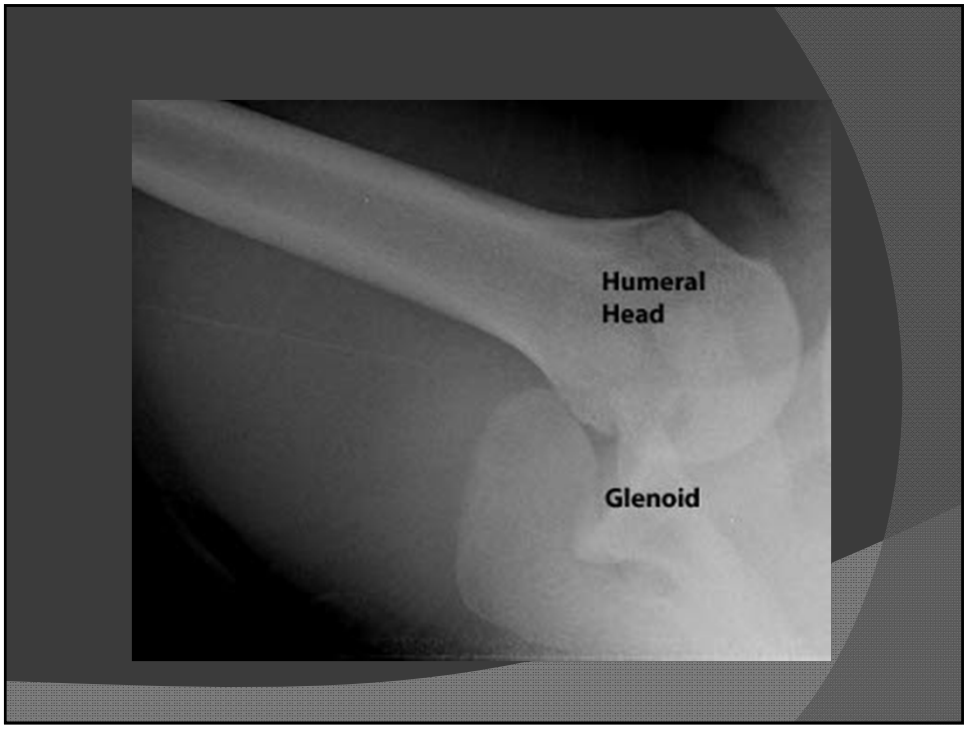
Described by position of distal bone in relation to the proximal bone.

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

Dorsal PIP Dislocation






Humeral
Head
Glenoid


A
B
R

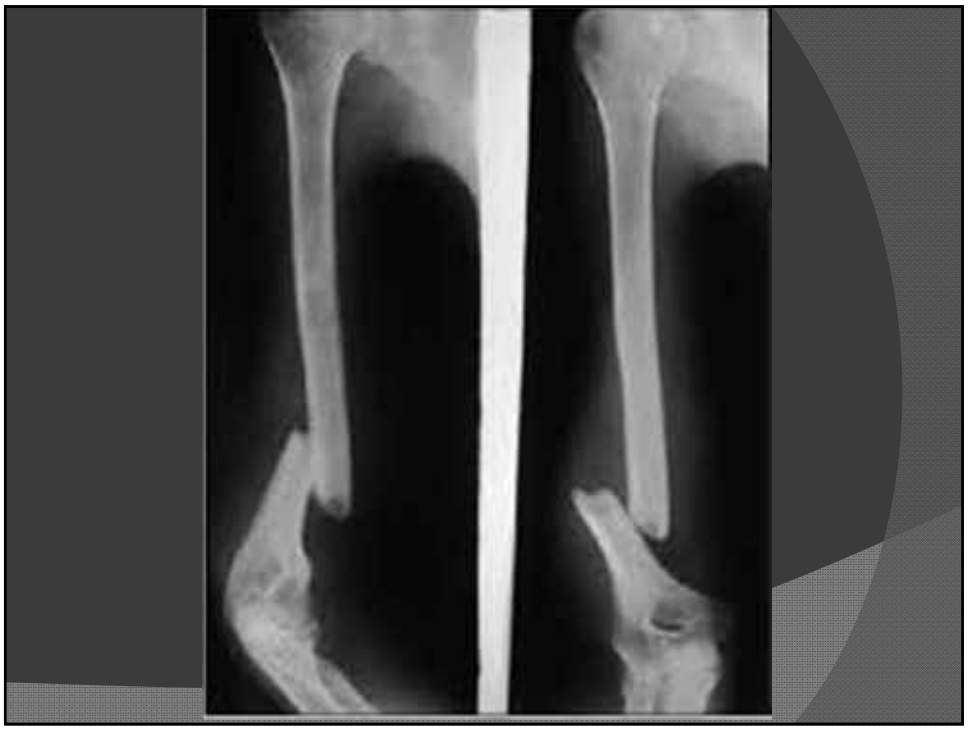
Summary

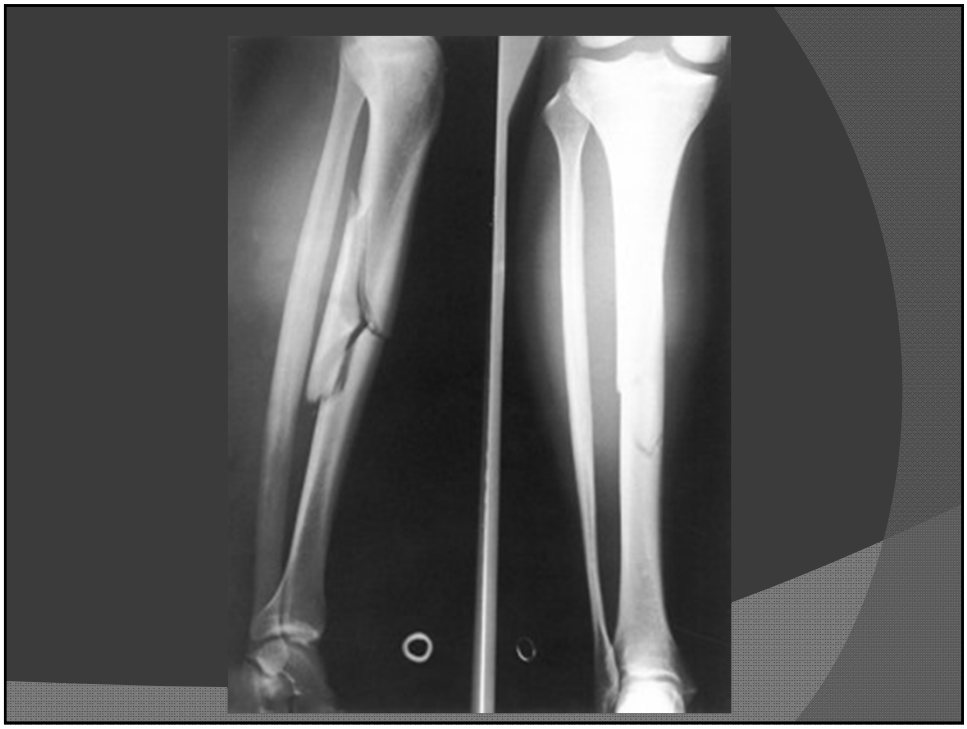
- Systematically read X-rays
  - Bone, location, pattern, soft tissue
  - AO Classification complicated
  - Just describe what you see
- Communicate and share with your consultants
  - Pre-reading
  - Succinct & accurate description of fractures
  - Interdisciplinary medical teams improve patient care

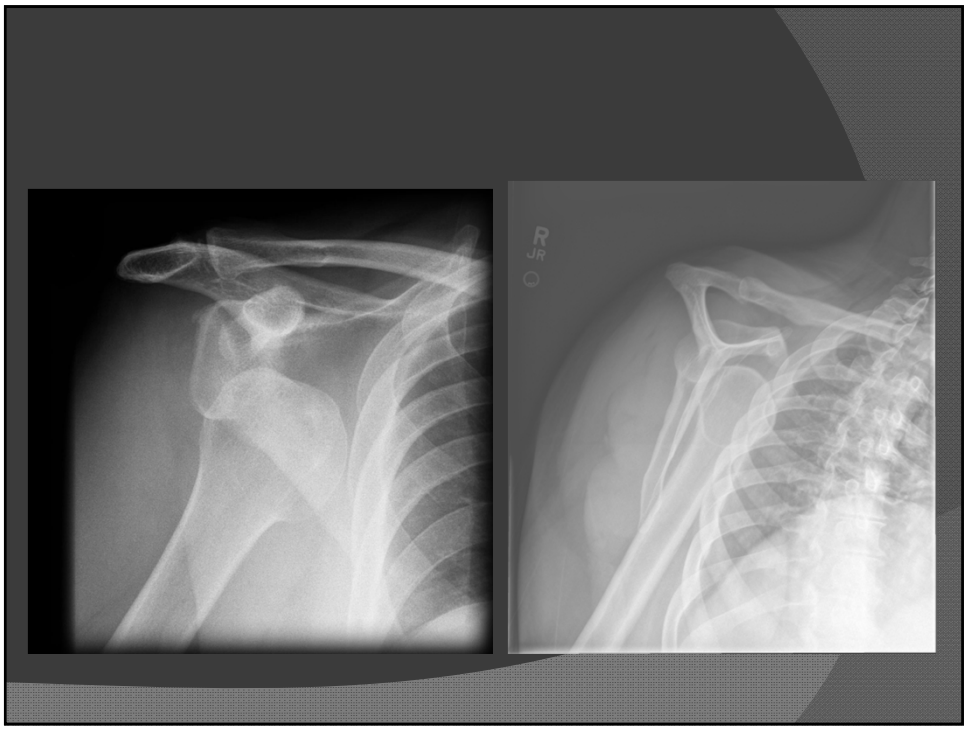
Examples

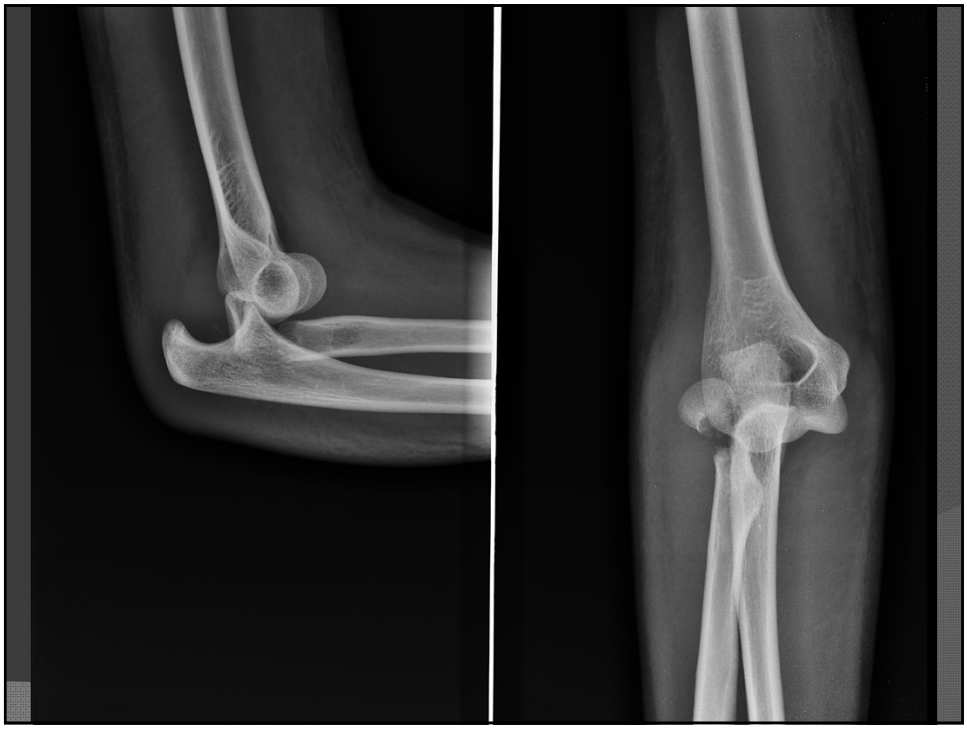
Let's try a few examples…


R
hb









Questions?


Joshua A. Tuck, D.O., M.S.
Orthopedic Surgeon
Specializing in Orthopedic
Sports Medicine and Arthroscopy
LECOM
LECOM Health / Orthopedic & Sports Medicine
5401 Peach Street, Suite 3300, Erie, PA 16509
Ph: 814.868.7840 • Fax: 814.868.2139
jtuck@mch1.org


Thank You!