Upper Extremity Trauma: Shoulder

**Goal:** Better 3-D Understanding of The Shoulder
- Anatomy
- Imaging

**Objectives:**
- a) Illustrate Anatomy
  - 3-D Scapula
- b) Imaging Techniques
  - Radiographic Views
  - CT Optimization
- c) Shoulder Trauma
  - How not to miss a posterior dislocation

---

**Shoulder: 3 Bones**

- Scapula
- Clavicle
- Humerus

**Scapula: Anterior View**

- "Flat Bone"
  - Scapula
  - Skull
  - Pelvis
  - Sternum
  - Ribs
  - As opposed to "Long Bones"

**Scapula: Anterior Medial View**

- Parts:
  - Body
  - Spine

**Scapula: Medial View**

- Parts:
  - Body
  - "Shoulder Blade"
  - No articular surfaces
  - Origin of all 4 Rotator Cuff (RC) Muscles
Upper Extremity Trauma: Shoulder

**Scapula: Posterior Medial View**

- **Parts:**
  - Body
  - Spine
  - Posterior Structure
    - Off back of body
      - Defines RC muscles
    - Supraspinatus
      - Above the spine
    - Infraspinatus
      - Below the spine

**Scapula: Posterior View**

- **Parts:**
  - Body
  - Spine
  - Posterior Structure
    - Off back of body
      - Defines RC muscles
  - Origin of RC Muscles
    - Supraspinatus
    - Infraspinatus
    - Teres Minor

**Scapula: Lateral View**

- "Y-view"
- "3 Limbs:"
  - Spine
  - Coracoid
  - Glenoid
- Coracoid not on Elbow

**Scapula: Anterior Lateral View**

- Coracoid
  - Most anterior part of the scapula
  - Arises from anterior glenoid
- Acromion
  - Arises from posterior spine
  - Points anterior

**Clavicle: "collarbone", "key"**

- "Long Bone", but not a straight bone
  - Elongated-
  - Elongated-∫
  - Integral Symbol

**Clavicle: 2 Joints**

- Acromial-Clavicular Joint (Lateral end)
- Sterno-Clavicular Joint (Medial end)
- Only bone connects scapula to the thorax
- Shoulder has wide ROM
- The most fractured bone?
  - 3-10% of all fractures
  - 35% of shoulder injuries
  - Males<20yo

---

©Ken L Schreibman, PhD/MD 11/17/15  www.schreibman.info
Upper Extremity Trauma: Shoulder

Humerus: 1 Head, 2 Necks

- Lateral view
- Anterior view
- Greater Tubercle
- Lesser Tubercle
- Articular Head

Upper Extremity Trauma

Humerus: External vs Internal Rotation

- External Rotation
- Profiles GT
- Internal Rotation
- GT en face

Radiographs: AP view Humerus Int. Rotated

- Shows alignment of AC Joint
- Does not profile GH Joint nor GT

Neer Classification Proximal Humerus Fractures

- 1-Part Fx
- 1-Part Fx
- 2-Part Fx
- 3-Part Fx

Shoulder: 3 Bones & 2 Joints

- Acromio-Clavicular Joint
- Gleno-Humerus Joint

Radiographs: Oblique Humerus Ext. Rotated

- Shows alignment of AC Joint
- Shows profile of Surgical Neck

©Ken L Schreibman, PhD/MD 11/17/15 www.schreibman.info
Upper Extremity Trauma: Shoulder

Radiographs: Technical Points

- Both AP & Oblique:
  1) Shot Standing
  2) Shield Genitals
  3) Boomerang Filter

- Less stuff to penetrate here:
  That here:

- Usually we see only the internal radiopaque tracer chain.

- Sometimes we can see the filter on radiographs.

- Well exposed ACJ.

- Well exposed GHJ.

Boomerang Filter

- ACJ way over-exposed
- ACJ now well-exposed

- Technologist forget to use boomerang filter in place.
- Repeated with boomerang filter in place.

Radiographs: Need Orthogonal Views

- AP/Obl = Orthogonal views of humerus
- Internal/External rotation of humerus
- AP/Obl ≠ Orthogonal views of GH joint
- AP doesn’t even profile glenohumeral joint

- The 3 Orthogonal views to the GHJ are:

- Oblique (Grashey)
- Axillary (supine)
- West Point (prone)

Radiographs: Axillary view (supine)

- Profiles glenohumeral joint

- Width
- Arthritis
- Alignment
- Dislocations

Radiographs: West Point view (prone)

- Profiles glenohumeral joint

- Width
- Arthritis
- Alignment
- Dislocations

©Ken L Schreibman, PhD/MD 11/17/15  www.schreibman.info
Upper Extremity Trauma: Shoulder

Radiographs: West Point vs Axillary

Both well show GHJ width/alignment
- AP: Anterior glenoid overlaps clavicle
- WP: Well shows anterior glenoid

Radiographs: UW 3-view series

Standard (trauma, pain)
1) AP
2) Oblique
3) Axillary

Instability (3-views Glenohumeral Joint)
1) Oblique
2) Axillary
3) West Point

If need orthogonal views Scapula, ACJ
4) Lateral ("Scapular Y", "Arch"/"Outlet")

Radiographs: Scapular Y view (PA)

Orthog. view:
- Scapula
- Body
- Coracoid
- Spine
- Acromion
- AC Joint

For discussion of Ys Arch views:
- Coracoid
- Axillary
- Oblique
- C-W
- AP

Radiographs: AC Joints (Bilateral)

Anatomic alignment of Acromia with lateral ends of Clavicles

Shoulder: 3 Bones & 2 Joints

2 Ligaments attach clavicle to scapula:
- AC Lig
- CC Lig

AC injury types based on:
- Which ligaments are torn
- Degree/direction of A-C displacement

©Ken L Schreibman, PhD/MD 11/17/15 www.schreibman.info
Upper Extremity Trauma: Shoulder

Acromioclavicular Injury: Type 1

- **AC Lig:** Sprain (intact)
- **CC Lig:** Intact
- **ACJ:** Aligned
- Radiographs: Normal
- AC injuries most commonly occur in males <30 related to contact sports
- Galen (120-199AD) diagnosed his own AC dislocation received from wrestling.
- Treated himself with tight bandages to hold clavicle down, keeping arm elevated.
- He abandoned the treatment after only a few days as it was so uncomfortable.

Rockwood & Green's Fractures in Adults 8th Ed. ©2015 [Kindle Edition]

Fig 41-2

Asymptomatic

S,C

Symptomatic

10mm

18mm

Deltoid/Trapezius muscles are torn from clavicle

Acromioclavicular Injury: Type 2

- **AC Lig:** Torn
- **CC Lig:** Intact
- **ACJ:** Subluxated
- While clavicle appears displaced up, it's the scapula that's displaced down

AC injuries most commonly occur in males <30 related to contact sports

Rockwood & Green's Fractures in Adults 8th Ed. ©2015 [Kindle Edition]

Loc 60286

Asymptomatic

H,C

Symptomatic

14mm

32mm

Subtle overlap of Acromion on Clavicle

Acromioclavicular Injury: Type 3

- **AC Lig:** Torn
- **CC Lig:** Torn
- **ACJ:** Very Dislocated
- C↔C distance is increased more than twice the normal distance

This type is very rare

Subtle overlap of Acromion on Clavicle

Acromioclavicular Injury: Type 4

- **AC Lig:** Torn
- **CC Lig:** Torn
- Clavicle Posterior to Acromion
- Hard to see on AP view
- Need to look at Axillary view

This type is so rare I've never seen one

Asymptomatic

W,N

Symptomatic

14mm

32mm

Subtle overlap of Acromion on Clavicle

Acromioclavicular Injury: Type 5

- **AC Lig:** Torn
- **CC Lig:** Torn
- **ACJ:** Very Dislocated
- C↔C distance is increased more than twice the normal distance

This type is very rare

Subtle overlap of Acromion on Clavicle

Acromioclavicular Injury: Type 6

- **AC Lig:** Torn
- **CC Lig:** Torn
- Clavicle Posterior to Acromion
- Hard to see on AP view
- Need to look at Axillary view

This type is very rare

Subtle overlap of Acromion on Clavicle
Upper Extremity Trauma: Shoulder

**Shoulder: 3 Bones & 2 Joints**

- GHJ: Shallow Socket
  - Glenoid covers only ~25% humeral head
  - 360° range of motion
  - Most dislocated joint
  - 45% of ALL dislocations
  - ~70,000/year in US

**Shoulder Range of Motion**

- GH Dislocations: Anterior
  - Glenoid covered only
  - 360° range of motion
  - Most dislocated joint
  - 45% of ALL dislocations
  - ~70,000/year in US

**Gleno-Humeral Dislocations**

- GHJ: Shallow Socket
  - Glenoid covers only ~25% humeral head
  - 360° range of motion
  - Most dislocated joint
  - 45% of ALL dislocations
  - ~70,000/year in US

**GH Dislocations: Inferior**

- GHJ: Shallow Socket
  - Glenoid covers only ~25% humeral head
  - 360° range of motion
  - Most dislocated joint
  - 45% of ALL dislocations
  - ~70,000/year in US

**GH Dislocations: Anterior**

- GHJ: Shallow Socket
  - Glenoid covers only ~25% humeral head
  - 360° range of motion
  - Most dislocated joint
  - 45% of ALL dislocations
  - ~70,000/year in US

**GH Dislocations: Subcoracoid**

- GHJ: Shallow Socket
  - Glenoid covers only ~25% humeral head
  - 360° range of motion
  - Most dislocated joint
  - 45% of ALL dislocations
  - ~70,000/year in US
Upper Extremity Trauma: Shoulder

**GH Dislocations: Subglenoid**
- Humerus Anterior-Inferior to Glenoid
  - Easy to see on all radiographic views
  - Half Anterior Dislocations are subglenoid

**GH Dislocations: Anterior**
- Humerus Anterior-Inferior to Glenoid
  - Easy to see on all radiographic views
  - AP view: Abnormal G-H overlap
  - Obli: Lack of G-H parallelism
  - Ax: Humeral Head Ant. to Glenoid
  - Subcoracoid = ½, Subglenoid = ⅓
  - Subcavicular, Intrathoracic, Luxatio Erecta = all rare
  - Can have characteristic fractures:
    - Humeral Head (Hill-Sachs)
    - 40-90% single disloc. ~ 100% recurrent dislocations
    - Anterior Glenoid (Bony Bankart)

**GH Dislocations: Hill-Sachs**
- Posterior Humeral Head impacted on Anterior Glenoid
  - Creating wedged fracture in the posteroinferior glenoid
  - Hill-Sachs Defect

**GH Dislocations: Bankhart Fx**
- Anterior humerus dislocates, postero-superior head impacts into anterior-inferior glenoid (creating Hill-Sachs fracture)
  - Bankart fracture anterior-inferior glenoid
  - Bankart fracture "Bony Bankart"
  - The defect Bankart described was not of the bone, but of the cartilaginous labrum

©Ken L Schreibman, PhD/MD 11/17/15  www.schreibman.info
Upper Extremity Trauma: Shoulder

Upper Extremity Trauma

Bankart: Often best seen on WP

Bones & CT
Oblique view
Anterior view
Axillary view: Clavicle overlaps anterior glenoid
West Point view
No fracture seen
West Point view: Well shows anterior glenoid

Dislocations: Anterior vs Posterior

Bones & CT
AP & Obl
Ax & WP
Y & ACJ
AC Injury
GH Dislocate
Anterior
Posterior
CT

Anterior Dislocations (97%)
- Goes anterior & inferior
- Easy to see
- Indirect trauma
- Rarely from direct blow
- 48% fall at home, 35% during sports

Posterior Dislocations (3%)
- Goes straight posterior
- Harder to see
- 67% Trauma (Falls > MVA > Sports)
- 31% Seizure
- 2% Electrocuton

Posterior Dislocation Clues: 1

Humerus Stuck in Internal Rotation

Dislocated
West Point!
Humeral Head Posterior to Glenoid
Articular surface humeral head
Articular surface glenoid

Posterior Dislocation Clues: 2

Lack of Parallelism on Oblique View

Dislocated
Relocated
Humeral Head stuck in Internal Rotation

Posterior Dislocation Clues: 3

Look at the Axillary/WP View!

Dislocated
West Point!
Humeral Head Posterior to Standard

Trough Line Sign (Reverse Hill-Sachs)

Anterior Dislocation:
- Anterior Glenoid impacts into Anterior Humerus
- "Hill-Sachs"
Posterior Dislocation:
- Posterior Glenoid impacts into Posterior Humerus
- Trough Line Sign

Reverse Hill-Sachs

TLS

AJR 1978; 130: 945-950

©Ken L Schreibman, PhD/MD 11/17/15  www.schreibman.info
Upper Extremity Trauma: Shoulder

**Shoulder: What to Order When**

- **Radiographs (Obl + Ax + WP ± Y)**
  - $207
  - Hx: Trauma (Fractures, Dislocations)
  - Hx: Pain (Arthritis, Calcific Tendonitis, …)

- **MR**
  - Rotator Cuff tears (without contrast) $2,046
  - Labral tears (with intra-articular contrast) $4,325

- **US**
  - Dx: Rotator Cuff tears (sizeable tears) $865
  - Rx: Calcific Tendonitis Lavage*

- **CT**
  - Mostly for surgical planning $1,473

- **Elbow**
  - Surgical Neck Fracture
  - Angulated > 45°
  - 2-Part Fracture (at least)

- **Coracoid**
  - Bankart Fracture

**Multiple Views…**

- R,D 58yoM: Cleaning gutters, fell from 6ft ladder.
  - Fell on elbow, shoulder pain

**3D Reformats**

- R,D 58yoM: Cleaning gutters, fell from 6ft ladder.
  - Fell on elbow, shoulder pain

**Goal: Better 3-D Understanding of Shoulder**

- Illustrate Anatomy: 3-D Scapula, Glenohumeral Joint
- Imaging Techniques: Radiographs, CT Optimization
- Shoulder Trauma: How not to miss posterior dislocation

**Three Easily Missed Dislocations:**

1. Every Elbow, look for Radial Head dislocation
2. Every Shoulder, look for Posterior dislocation
3. Every Foot, look for Lisfranc dislocation

*Can download this and all of my lectures in various formats*