# Evaluation and Management of Anterior Shoulder Instability: Pearls and Pitfalls

Aman Dhawan MD
Associate Professor
Department of Orthopaedics and Rehabilitation
Penn State Hershey Medical Center
Penn State College of Medicine

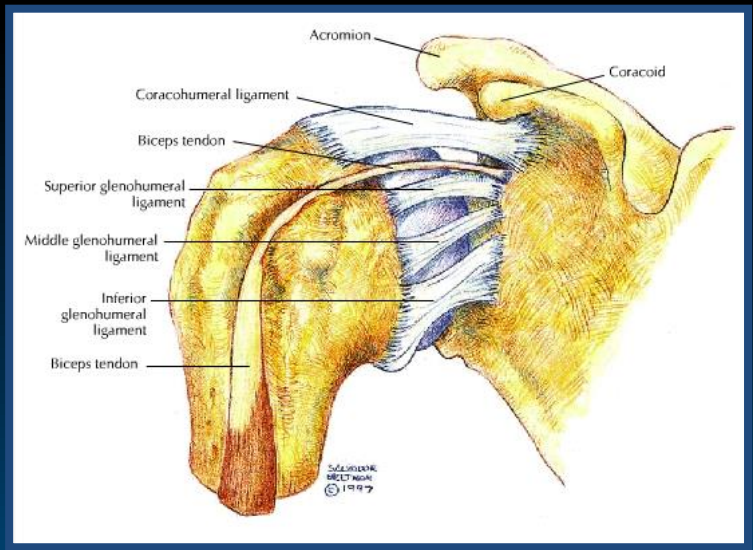
# Shoulder Instability

- Trauma causes approximately 90% of shoulder dislocations
- Most commonly involved sports football, wrestling and hockey
- Most mobile articulation in the body. Static and Dynamic soft tissue restraints
- Most commonly dislocated diarthrodial joint

# Anatomy Basics

# Glenohumeral Ligaments – Static Restraints

- SGHL
  - 1°static restraint to inferior translation of the adducted shoulder
- MGHL
  - Prevents anterior translation when the shoulder is externally rotated and in the middle range of abduction
- IGHL
  - Major static anterior stabilizer of the GH joint, especially during abduction and external rotation



# Dynamic Restraints

- Through Joint Compression ("Concavity Compression") and Positioning Glenoid
  - Trapezius, Rhomboids, Latissimus Dorsi, Serratus Anterior, Levator Scapulae
  - Biceps tendon
    - Stablility in anterior and superior direction
    - Assoc w/ SGHL / MGHL at biceps anchor
- ***Rotator Cuff***

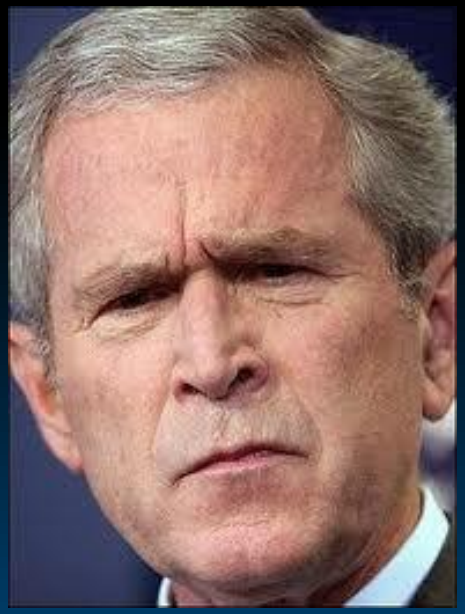
# Pathology

- Bankart Lesion
  - Avulsion of the antero-inferior capsulolabrum from the anteroinferior glenoid rim
  - >90% of initial traumatic anterior humeral dislocations

- Anterior capsular strain/tearing
- Bony Injury (glenoid rim, posterior/superior humerus)
- Rotator Interval Insufficiency

# Bankart and Hill-Sachs

# How do we evaluate?



Need a “Stategerie” to avoid pitfalls…

# Pearls to obtain in history:

- Age
- Gender
- Dominant Side
- Contact Athlete
- Hyperlaxity
- Pain or Frank Instability
- First Time? How many Previous Dislocations?
- Position of Instability/Pain/Dislocation?
- Energy required to get arm to dislocate now (Does this go out in your sleep)?

# Patient Specific Factors

- Contact Athletes

- Recurrence rate of open/arthroscopic bankart recon greater in contact athletes.

- 50% higher (2X vs 3X) risk of recurrent instability in arthroscopic stabilizations
  - Yamamoto et al., Orthop Traumatol Surg Res 2015

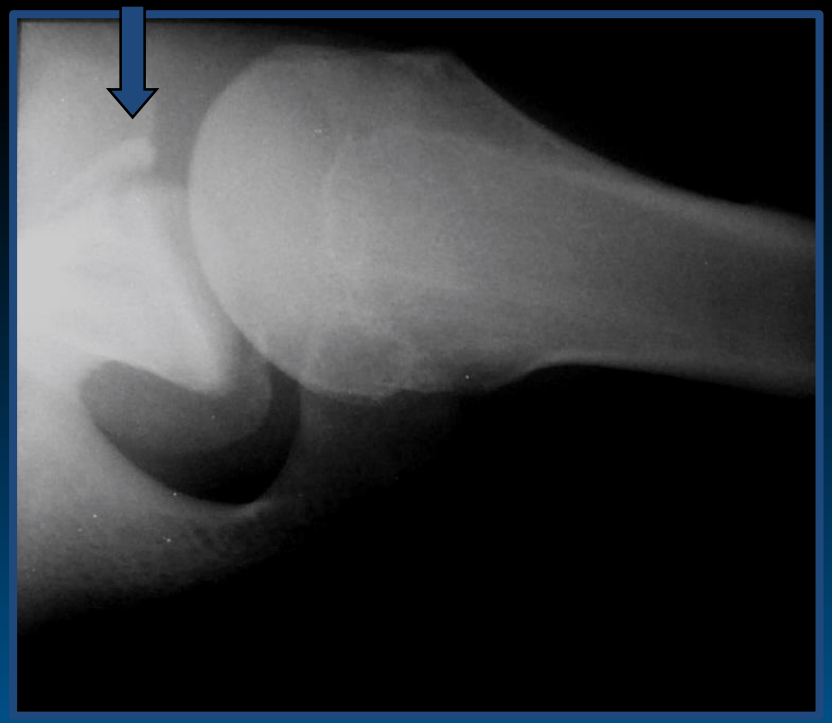
- Young Male

- Risk of recurrent instability is 3X higher in those under the age of 25

- Risk of recurrent instability is 3X higher in those that are male.
  - Mohtadi et al, JBJS 2014

# Imaging

# Plain X-rays



- 3 view shoulder xrays (AP, Axillary, Scapular Y)
- Pearl/Pitfall: ***Look for Bony Bankart on Axillary*** - Indication for early surgery

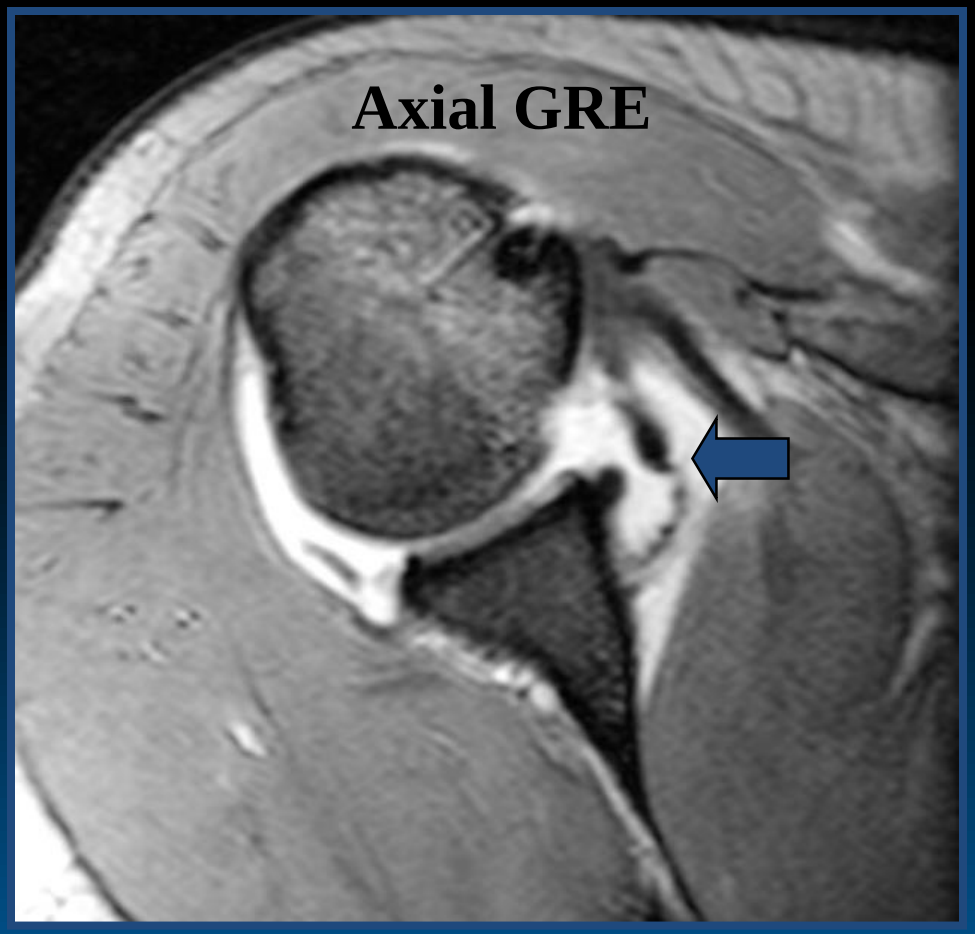
# MRI-MRA

- Most sensitive study for detecting labral tears
- Also demonstrates articular cartilage injuries, rotator cuff pathology, and bony injuries

# MRI-MRA: Pearls and Pitfalls

- Look for labral and chondral pathology (axial cuts)
- Evaluate for Hill Sachs Lesion (Axial and Coronal Cuts)
- Evaluate anterior capsule (Axial and Coronal cuts)
- Measure for Glenoid Bone Loss (Sagittal Cuts)

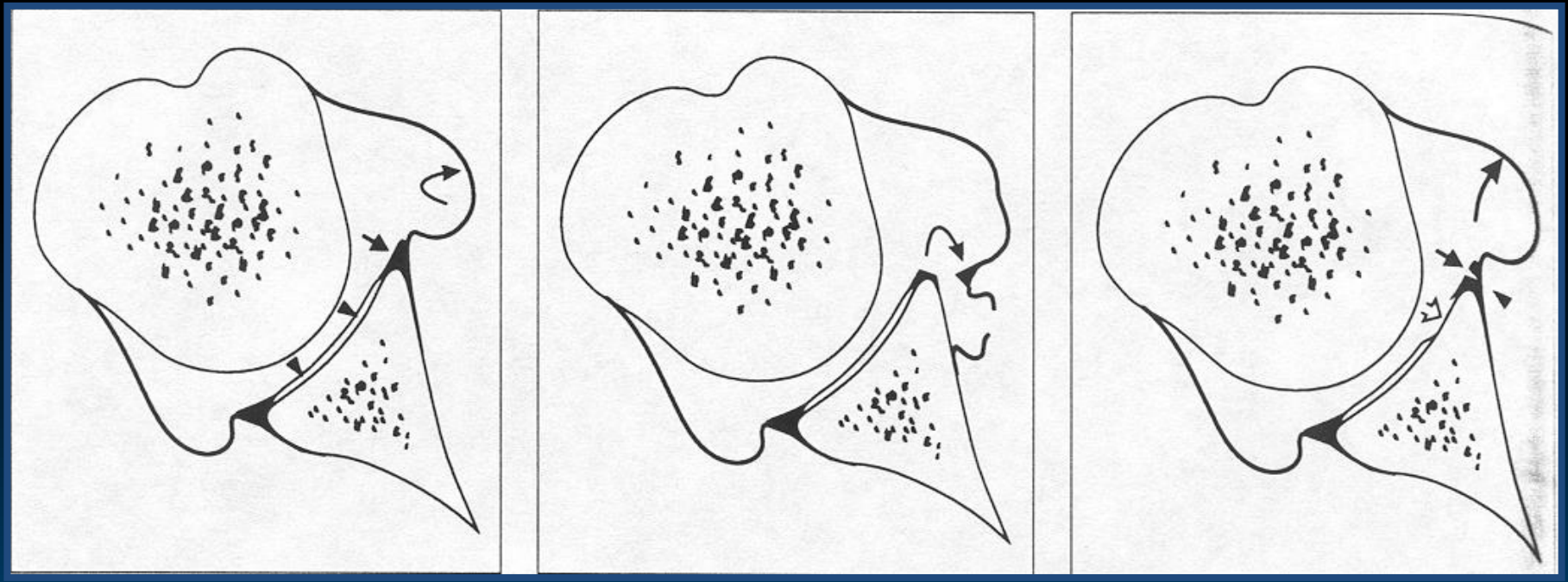
# Alphabet soup- ALPSA Lesion




- **Anterior labroligamentous periosteal sleeve avulsion**

# GLAD Lesion

## Glenoid Labral Articular Disruption)

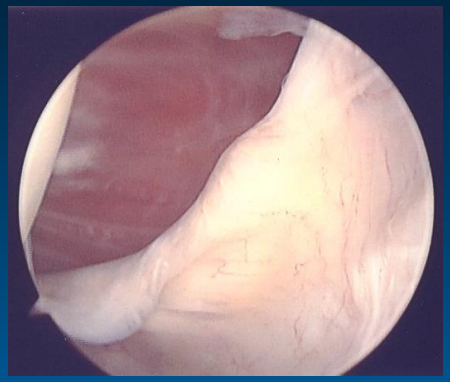


Neviasier TJ. Arthroscopy 1993;9:22-3. Sanders TG et al. AJR 1999;172:171-5

# HAGL Lesion

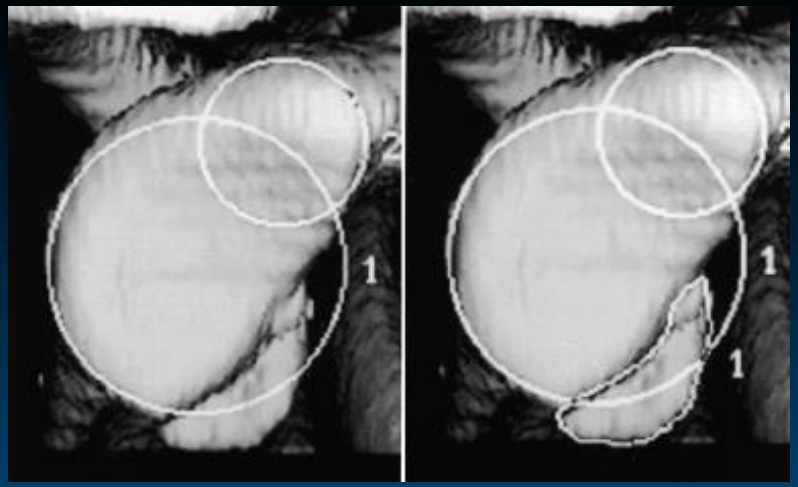
## (Humeral Avulsion of GH Ligaments)

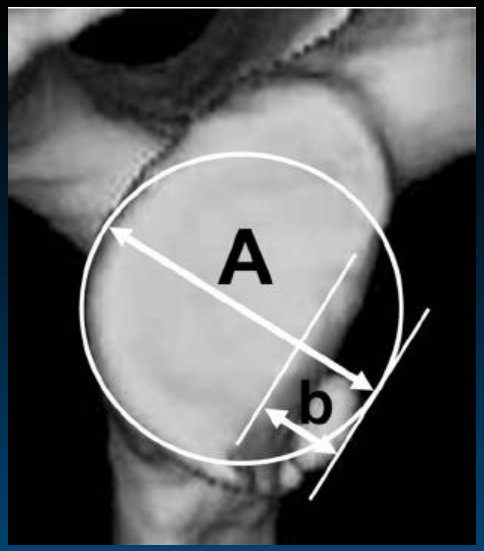
- **Review of 65 instability patients estimated 9.3 % due to HAGL**
- **Pearl/Pitfall: Look for "J sign" on MRI**



# How do we measure Glenoid Bone Loss?

Sugaya Circle Method on CT or MRI



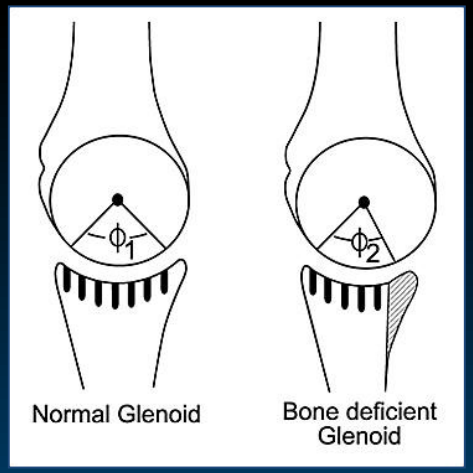

b/A X100 = % bone loss

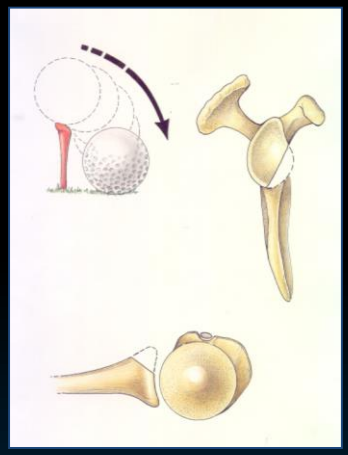
-Sugaya et al, JBJS 2003

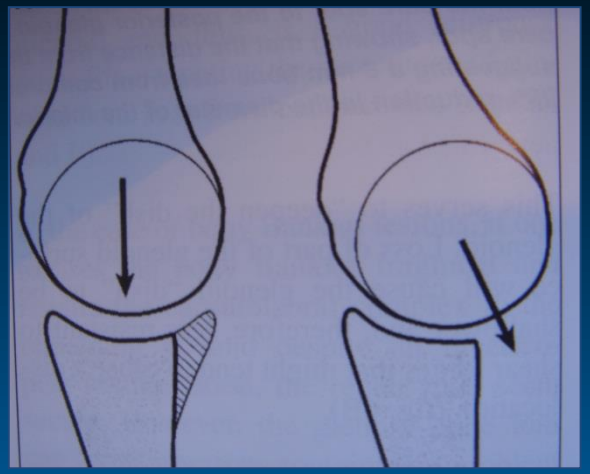
# Patient Factors:
# Glenoid Bone Loss, “The Inverted Pear”

Shorter glenoid arc length-less resistance to humeral forces

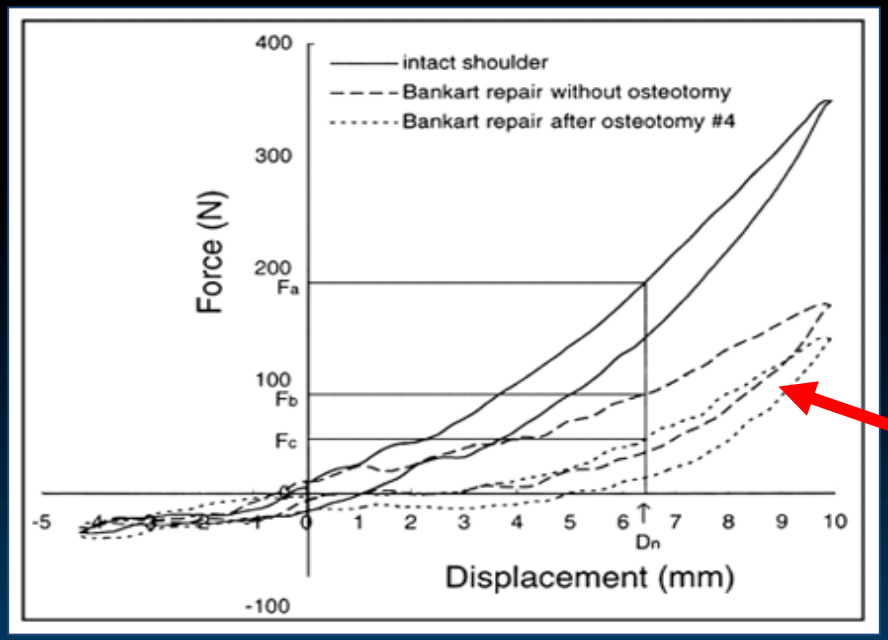
**Greater stress on soft tissue repair (Bankart Reconstruction)**

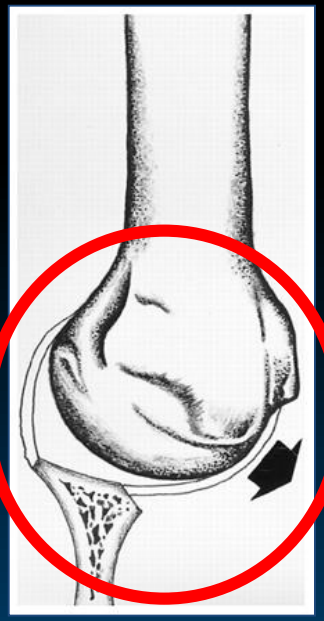




# Biomechanics



Decreasing glenoid surface area decreases amount of force needed to displace

# Osseous Defects - The Problem…

- 194 patients (1992 - 98) arthroscopic Bankart repair with suture anchors

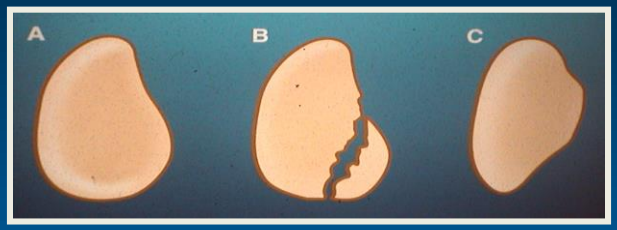
- Significant bone defects in <u>21 patients</u>
  - Inverted-pear glenoid (18 patients)
  - Engaging Hill-Sachs lesion (3 patients)

  - Burkhart, DeBeer Arthroscopy, 2000

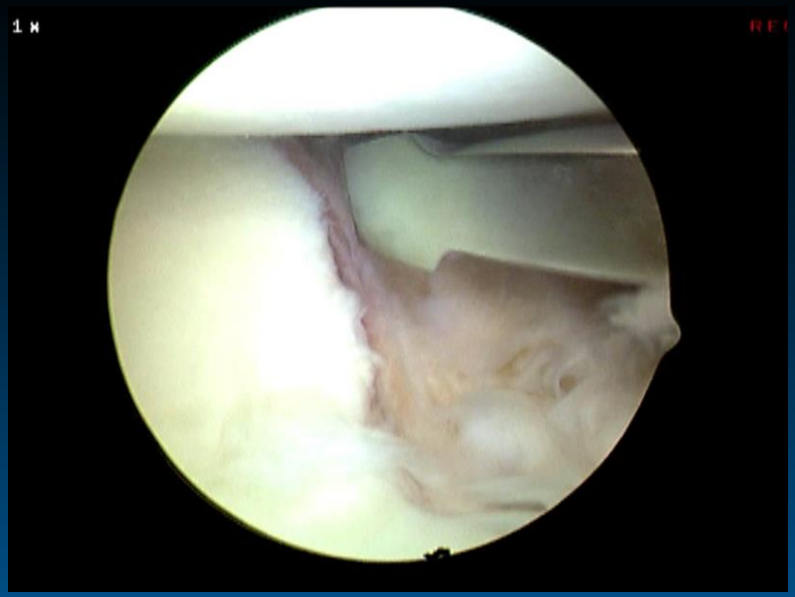
11% overall instability recurrence

No bone defect
4% recurrence

Bone defect
**<u>67% recurrence</u>**



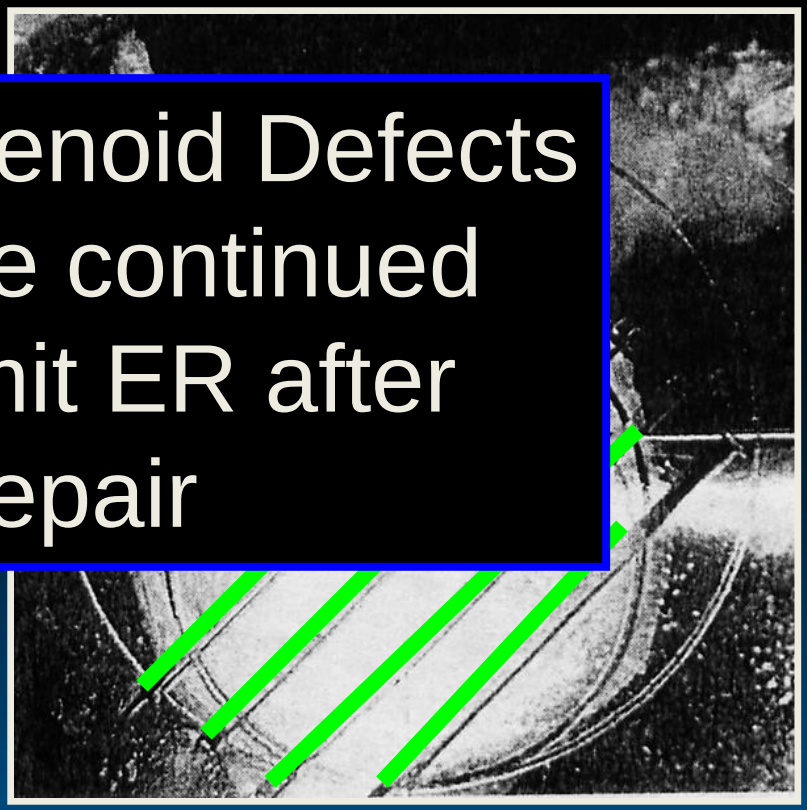
# How much bone loss is clinically relevant…and how to reconcile?



# Pathoanatomy - Glenoid Deficiency

- Created ant/inf glenoid defects in 10 c
- 4 gl
  - &
- ROI and the glenoid

**CONCLUSION**: Glenoid Defects >21% may cause continued instability and limit ER after Bankart Repair



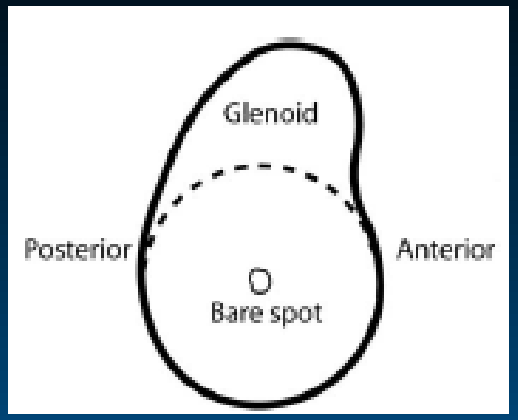
Itoi, et al, *JBJS*, 2000

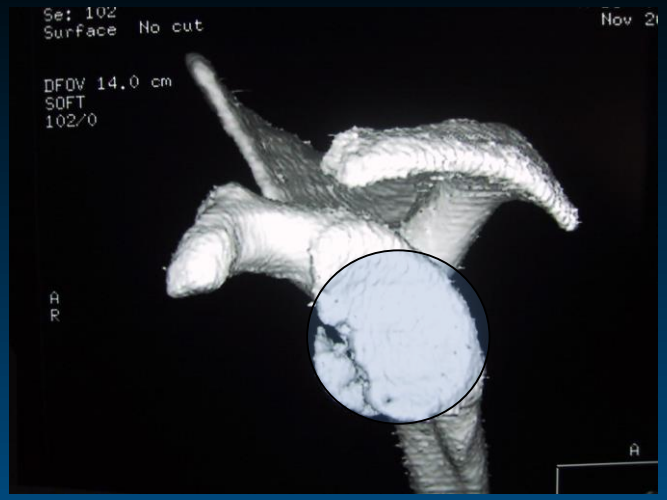
**52% , 36% , 21% , 8%**
**Bone Loss**

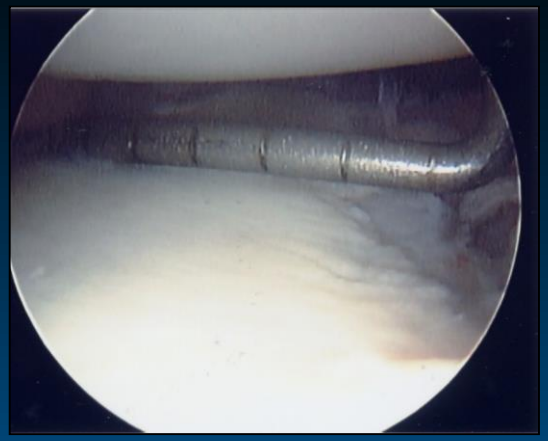
# Quantifying Bone Loss

- Normal Glenoid Diameter, X = 30 mm
- 6 mm Bone Loss = 20% Bone Loss

- Lo and Burkhart *Arthrosc* 2004



# Imaging Pearls and Pitfalls

- Hill Sachs Lesion

- 5.0 higher odds of recurrent instability after Arthroscopic Bankart with HSL visible on plain films.

– Mohtadi et al, JBJS 2014

- Glenoid Track Concept

- Combined glenoid and humeral osseous lesions additive.
- Even small glenoid or humeral defects can compromise an arthroscopic stabilization in the presence of a medium size bipolar lesion

- Arciero AJSM 2015

# 3D CT Scan - When

- Multiple dislocations (>10)
- Trivial trauma (initial episode)
- Failed stabilization procedure
- Radiographs (axillary) or MR glenoid bone loss
- Instability in midranges of motion

# Physical Exam

# EVALUATION: Physical Exam

- Inspection
- Palpation
- Active / passive ROM
- Motor strength
- Neurologic exam

- Pitfall: Connective tissue laxity
  - Beighton Score
  - Score 4 or more hyperlax

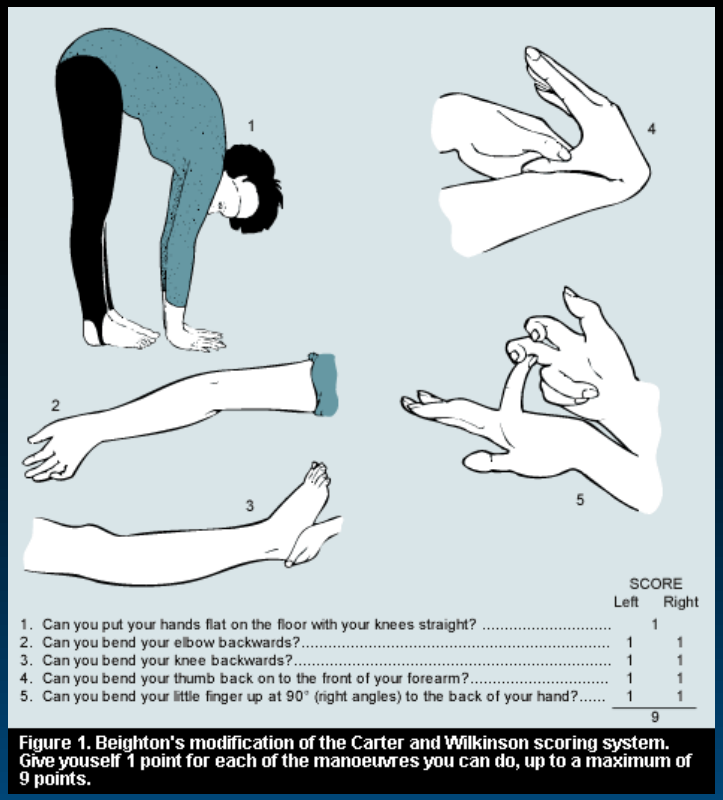


Figure 1. Beighton's modification of the Carter and Wilkinson scoring system. Give youself 1 point for each of the manoeuvres you can do, up to a maximum of 9 points.

# Patient Specific Factors

- Hyperlaxity
  - Recurrence of instability higher with hyperlaxity ( Boileau JBJS 2006).

ER > 85˚ with the arm at the side = Anterior Hyperlaxity

Hyperabduction (Gagey) Test

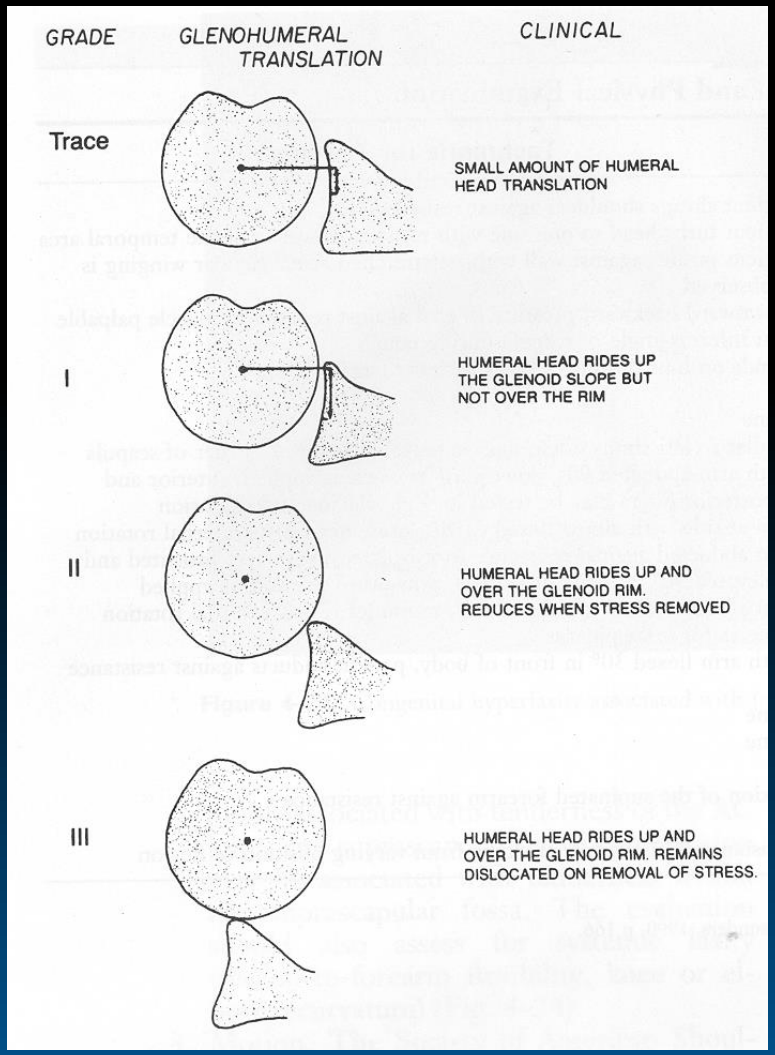
Hyperabduction of 20˚ or more between the sides = inferior shoulder hyperlaxity

# Physical Examination

## INSTABILITY TESTING

- Load shift test
- Sulcus test
- Apprehension test
- Relocation test

# Load and Shift Circumduction Test

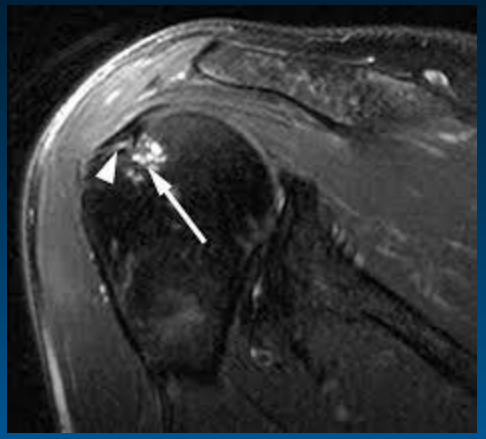



Pearl/Pitfall:

***Don't be fooled by a posteriorly subluxated/dislocated humerus that is being reduced with anterior shift***

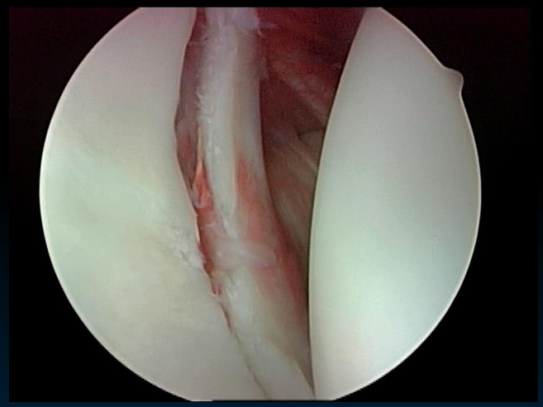
# Micro-Traumatic Anterior Instability

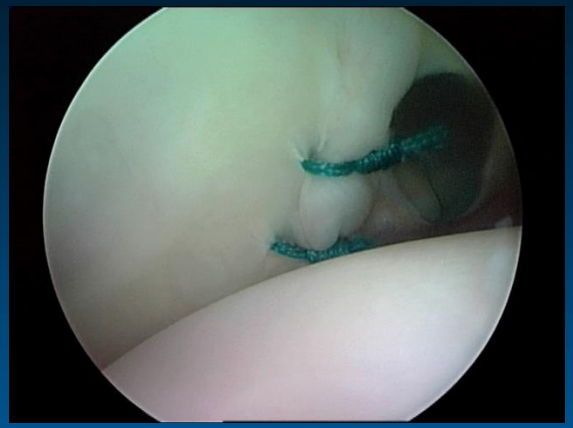
- Often seen in overhead athletes
- Symptoms of pain with throwing, especially during “Late Cocking” Phase
- Rarely is frank “instability reported”
- Pain relieved by Relocation Test
- Typically no Labral lesion seen, only capsule
- Look for the Hill Sachs equivalent on Humerus
- Often concomitant with Internal Impingement



# Treatment

- Non-operative Management
  - Esp. for micro-traumatic anterior instability
- Operative Management
  - Arthroscopic Repair
  - Open Bankart Reconstruction
  - Bone Block Procedures





# Anterior GH Joint Instability: Initial Treatment

- Brief period of immobilization (3-7 days max)
- No evidence that longer immob. (3 - 4 wks) dislocation results in decreased recurrent instability compared w/ early ROM (within 1 week)
- Rehabilitation program that avoids the provocative position for 3-4 wks and incorporates strengthening of the dynamic shoulder stabilizers
- Proprioception and return to sport-specific activities (Variable depending upon sport/position/rehab. gains).
- Possible earlier RTP with brace

# Treatment

- Nonoperative
  - Recurrence rate up 39-96%
    - Related to age,  rehabilitation, and activity type
    - Wheeler et al. Arthroscopy 1989 92% recurrence rate in USMA cadets
    - Buss AJSM 2004 In-season return to sport (brace and PT)
      - 39% Redislocate that season

# Return to Sport – Nonop (In Season)

- Goal is 7-21 days
- Criteria is symmetric pain-free ROM, symmetric strength, ability to perform sport-specific skills pain free
- Far more challenging with a throwing, overhead, or contact athlete

# Bracing

- Various braces can be used to limit overhead motion and external rotation (motion limiting)

- Sully Brace, Duke Wyre Brace, Sawa Brace

# Bracing

- There appears to be a proprioceptive benefit that may also be helpful – Chu et al. J Athl Train 2002

- **No studies have demonstrated a decrease rate of dislocation with bracing compared to rehab alone**

# Who gets surgery?

- Most initial anterior shoulder dislocations can be treated non-operatively
- Large glenoid or humeral defects (>20%). Bony bankart (even if less than 20%) is indication for early surgery
- Persistent instability with ADL's
- ??Contact and Overhead/Throwing sport??
- Unable to tolerate restrictions
- Young Patient (Under 21 yrs)

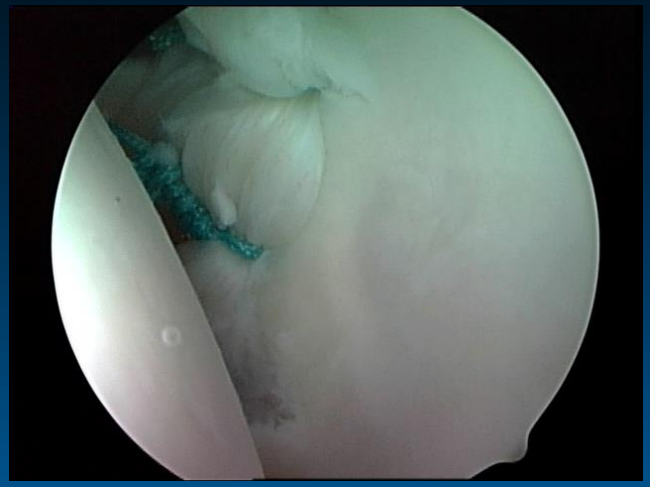
# Who gets surgery?

- **Recurrence of dislocation or subluxation despite attempts at rehab**
- **Pain due to recurrent transient shoulder subluxation when the arm is used for overhead activities**

  **Overhead athletes will often report pain (vs instability) especially with external rotation**

# Arthroscopic vs Open Bankart Reconstruction

- Current literature shows equivalent results compared to open surgical treatment in the *correct* patient population
- Recurrent instability rates vary b/w 3 - 15%



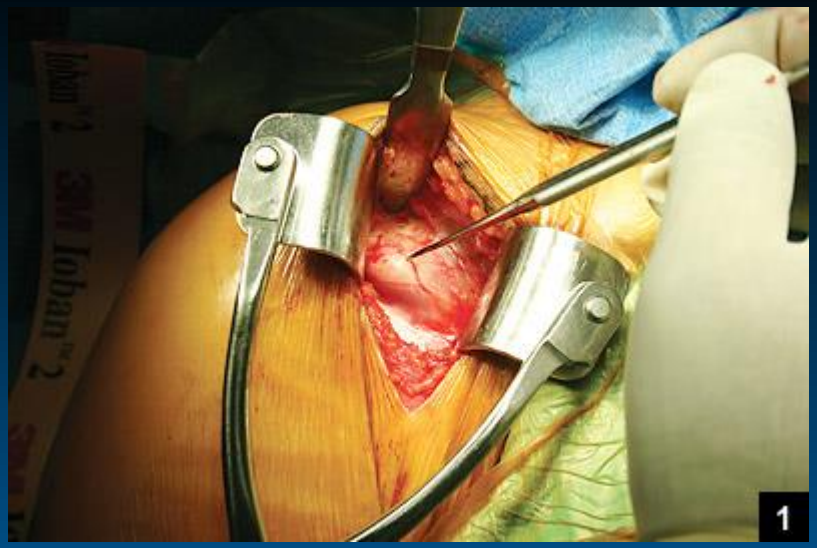
# Arthroscopic vs Open

- Arthroscopic pros
  - Decreased loss of ER (5° vs. 11°)
  - Cosmesis
  - Less postop pain
  - Less risk of subscap rupture
  - Better assess posterior labrum and other concomitant intraarticular pathology

- Cons to Arthroscopic stabilization
  - Difficulty in assessing capsular laxity
  - Technically demanding
  - ? Higher recurrence in collision athletes

# Need to Individualize Treatment

- Both Arthroscopic and Open Stabilization have important roles




# Factors that increase risk of failure (recurrence) with Arthroscopic Shoulder Stabilization

***Patient Specific/Selection***

- Glenoid Insufficiency
- Humeral Head Defects
- Contact Sports
- Age
- Male Gender
- Hyperlaxity

***Surgical Technical***

- # of Anchors utilized
- Knotless Anchors
- Bioabsorbable Anchors

# Instability Severity Index Score (ISIS)

| Prognostic factors | Points |
|---|---|
| Age at surgery (yrs) | |
| ≤ 20 | 2 |
| > 20 | 0 |
| Degree of sport participation (pre-operative) | |
| Competitive | 2 |
| Recreational or none | 0 |
| Type of sport (pre-operative) | |
| Contact or forced overhead | 1 |
| Other | 0 |
| Shoulder hyperlaxity | |
| Shoulder hyperlaxity (anterior or inferior) | 1 |
| Normal laxity | 0 |
| Hill-Sachs on AP* radiograph | |
| Visible in external rotation | 2 |
| Not visible in external rotation | 0 |
| Glenoid loss of contour on AP radiograph | |
| Loss of contour | 2 |
| No lesion | 0 |
| Total (points) | 10 |

* AP anteroposterior

- Patients with a score ≥7 points had recurrence risk of 70% ($p < 0.001$) with Arthroscopic Stabilization

  - Balg and Boileau JBJS Br 2007

- Score 5 or less = Arthroscopic
- Score 6 or more = Open Procedure

  -Rouleau et al AJSM 2013

# Current Surgical Epidemiology

- >90% of all anterior shoulder stabilizations are done arthroscopically
- Bone block procedures (i.e. Laterjet, etc) are increasing in incidence
- Open Soft Tissue Bankart Reconstruction decreasing in incidence
- Pts who underwent bone block stabilization were significantly less likely to undergo a second stabilization procedure compared to open Bankart repair (OR 0.582, 95%CI: 0.405-0.836, P<.05) and arthroscopic Bankart repair (OR 0.587, 95%CI: 0.418-0.824, P<.05)
- No statistically significant difference in revision stabilization rates was seen when comparing primary arthroscopic versus open Bankart repair (OR 0.934, 95%CI: 0.863-1.139).

- *Bonazza and Dhawan OJSM 2017*

# Patient M.D.

- 20 year old male football and track athlete at Loch Haven University.
- Recurrent right shoulder instability for 4 years
- Failed rehab, counseled for an arthroscopic stabilization.

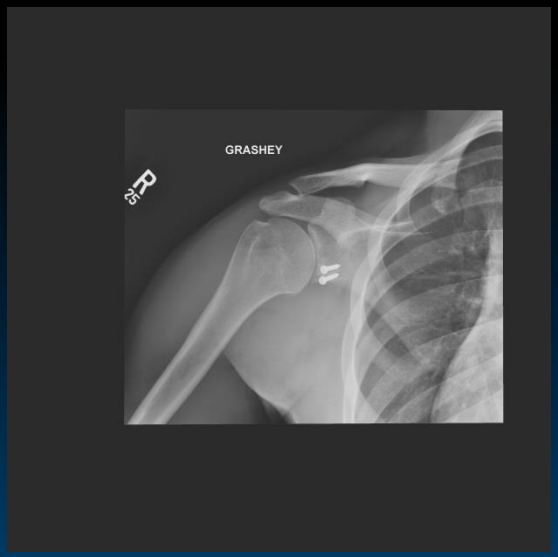

# Patient M.D.

- **Intraoperatively, signif anterior glenoid bone loss encountered (approx 30%).**
- **Procedure aborted (no arthroscopic stabilization performed), portals closed.**
- **Patient referred for further eval and management.**

# Patient M.D.


**CT obtained**

# Patient M.D.



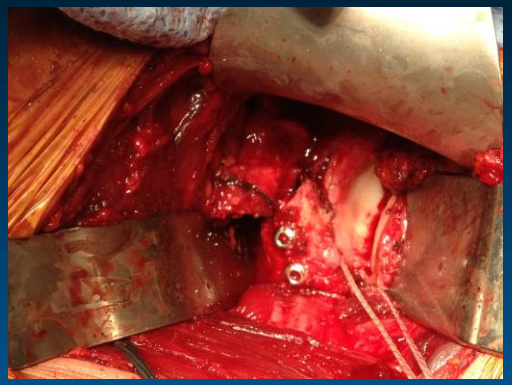



**Open Laterjet Procedure (Coracoid Grafting) performed**

# Patient M.D.

- Patient returned to Football and Track in 6 months, no further episodes of instability.

- 6 months later we performed his contralateral shoulder  Laterjet procedure



# Patient M.F.

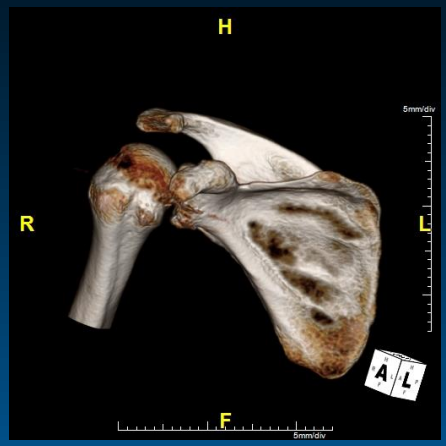


- 28 yr old male prev Arthroscopic Bankart 8 yrs ago
- Felt ok for 3-4 yrs.
- Now progressive increasing instability and mechanical symptoms over past 4-5 yrs, feels like it did before surgery.

# M.F.

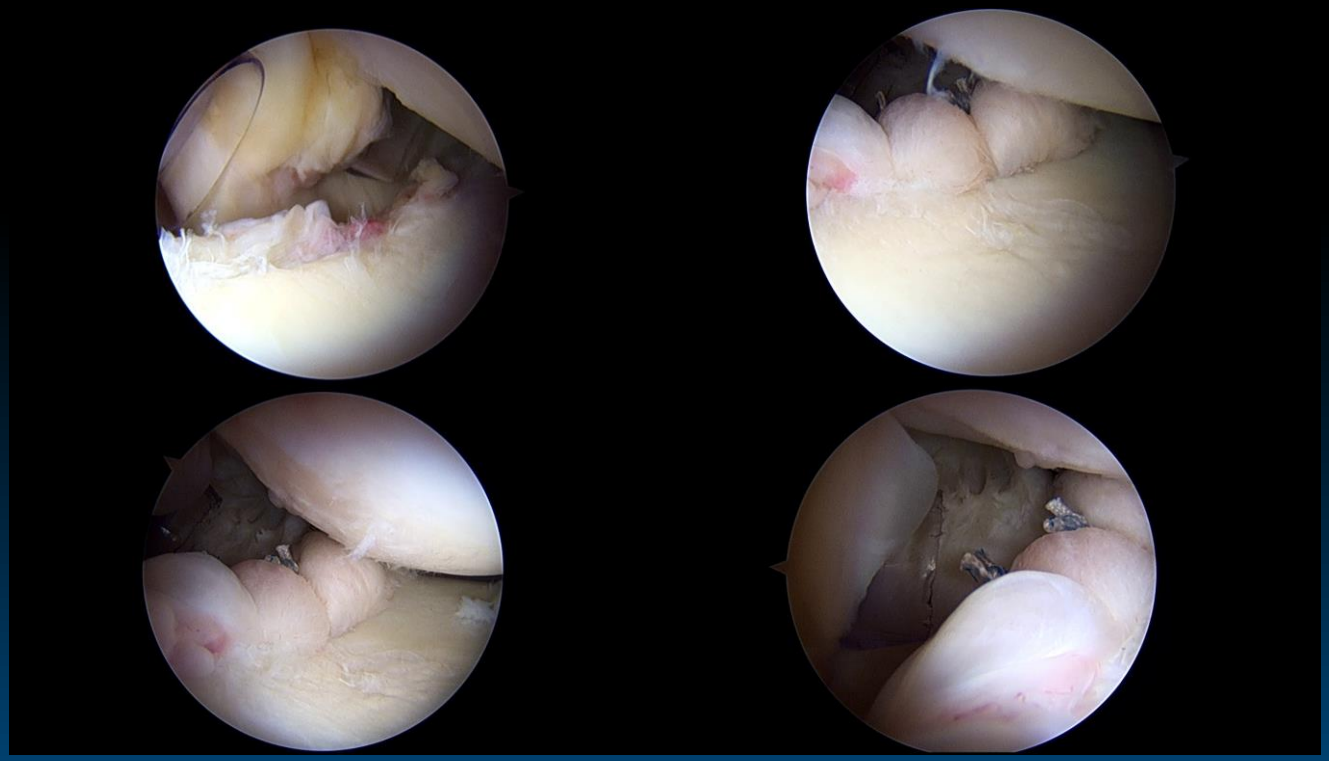


CT scan demonstrated no significant osseous deficiency on the humerus or glenoid

# Patient MF

Revision arthroscopic stabilization restoring AIGHL anatomy using 3 anchors



# Conclusion

- History – Age, Contact Athlete, Position of instability
- Xrays – Look for Bony Bankart, Bone loss on humeral or glenoid side
- MRA – Eval for concomitant intra-articular pathology. Look for HAGL. Glenoid and Humeral Bone Loss
- 3D CT in certain instances
- Physical Exam – Assess for MDI and hyperlaxity
- Most patients can be treated initially non-operatively
- For those that require surgery, match the patient to the right surgery.

# Thank You