Shoulder assessment and evidenced based exam

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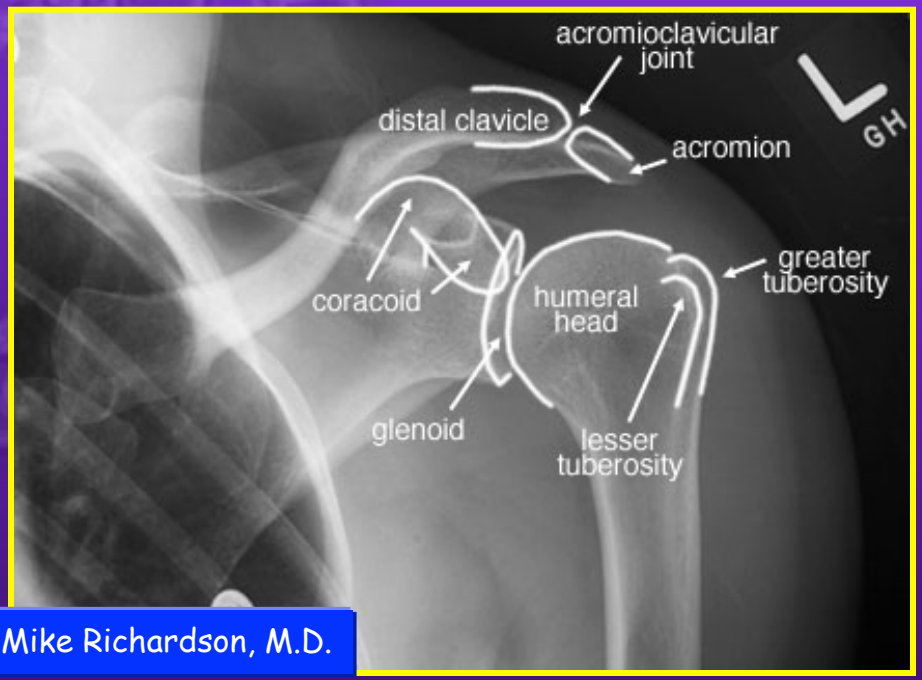
Neither I, John O’Kane, nor any family members, have any relevant financial relationships to be discussed, directly or indirectly, referred to or illustrated with or without recognition within the presentation.

Goals for today

- Review anatomy
- Key historical questions and findings in common shoulder problems
- Explore evidence for physical exam tests and imaging

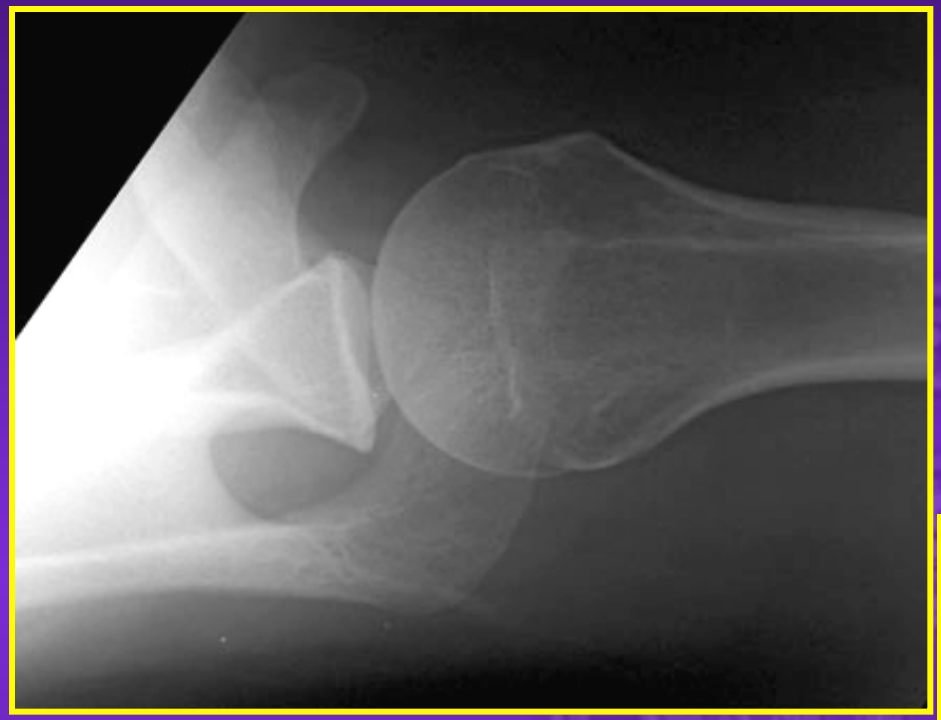
Shoulder anatomy

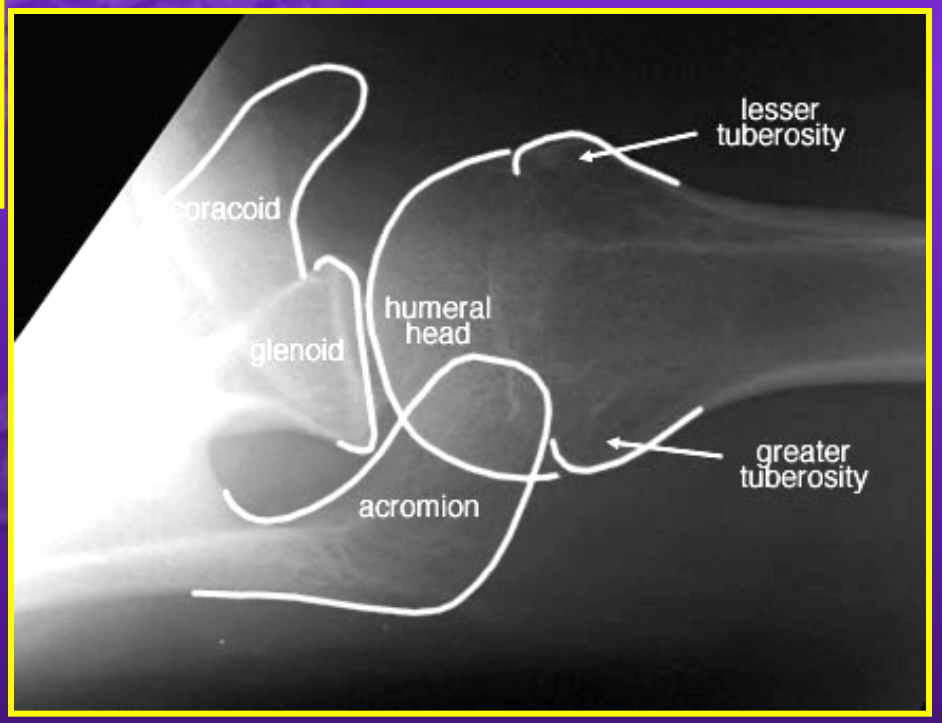
- Bones
  - clavicle
  - scapula
  - humeral head
  - post. rib cage
- Joints
  - sternoclavicular
  - acromioclavicular
  - glenohumeral
  - scapulothoracic



Mike Richardson, M.D.

Shoulder Anatomy: Axillary View





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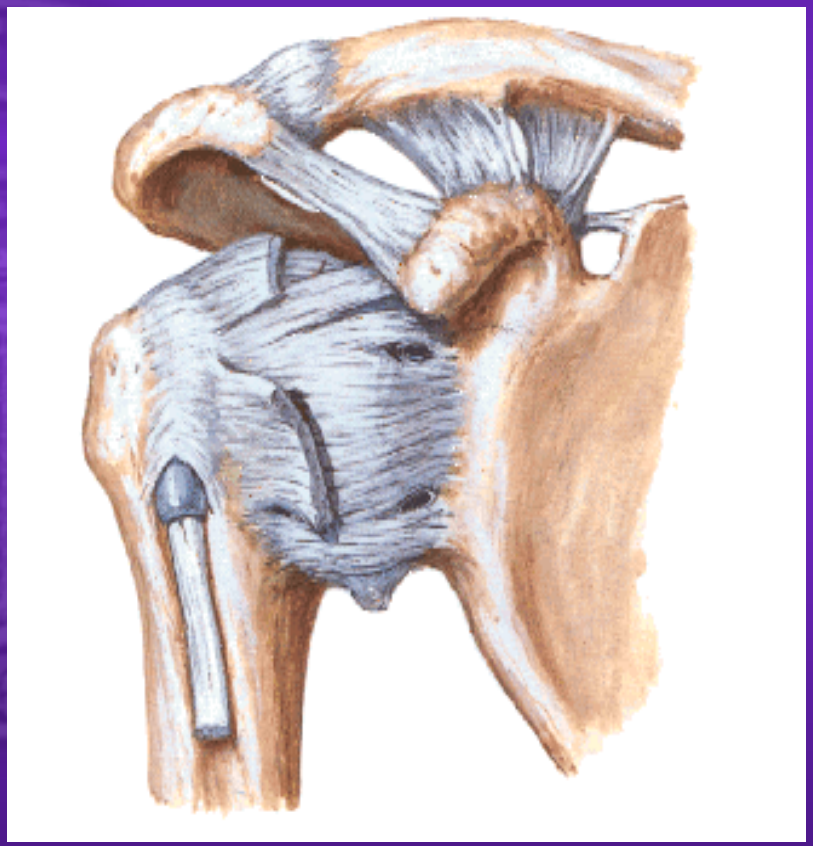
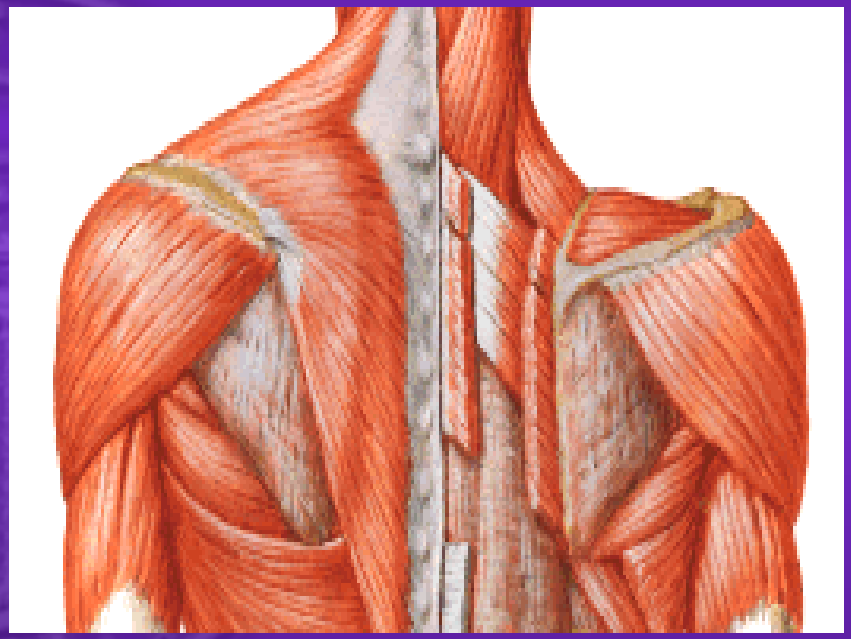
Shoulder Anatomy

- Ligaments
  - coracoclavicular
  - acromioclavicular
  - glenohumeral
    - inf., mid, superior GH
    - coracohumeral
- Function
  - static stabilizers
  - assisted by capsule



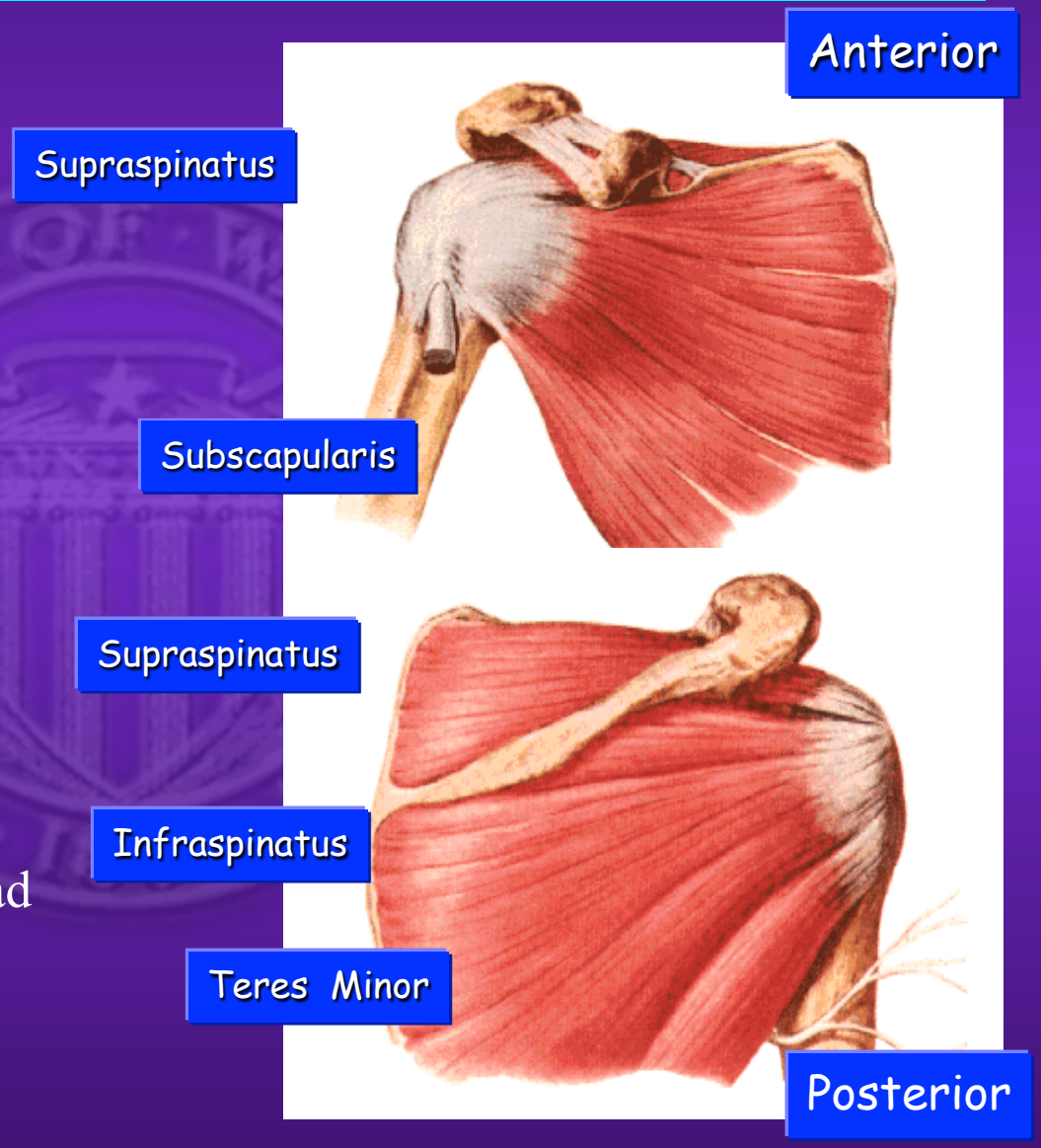
Shoulder Anatomy

- Muscles
  - scapular stabilizers
    - levator scapulae
    - trapezius
    - serratus anterior
    - rhomboids
    - latissimus dorsi
    - pectoralis maj. & minor
- Function
  - control scapula
    - foundation for GH joint



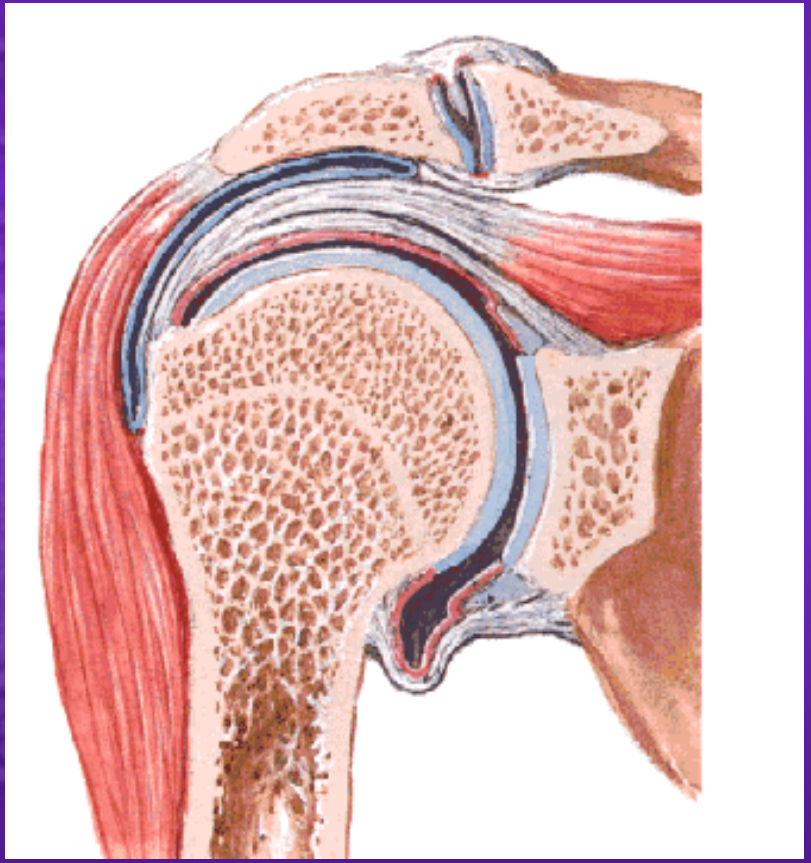
Shoulder Anatomy

- Muscles
  - rotator cuff
    - supraspinatus
    - infraspinatus
    - subscapularis
    - teres minor
- Function
  - dynamic stabilizers
    - force couples
    - depress humeral head

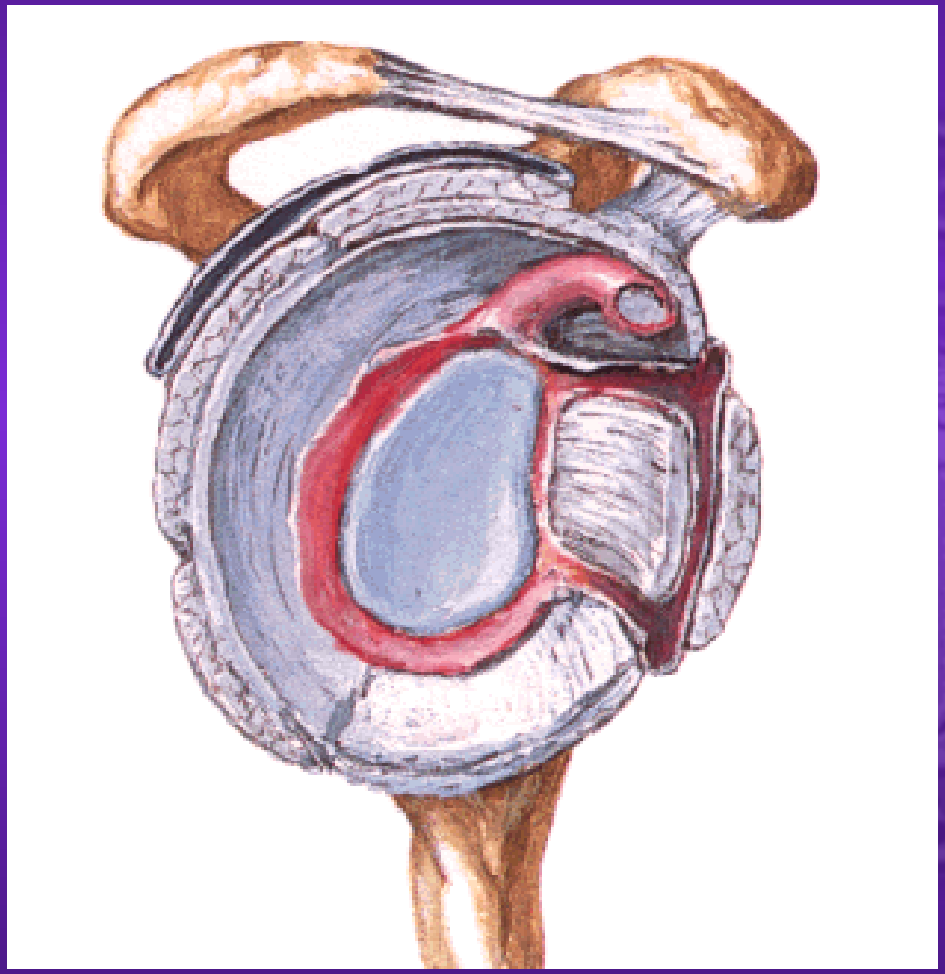


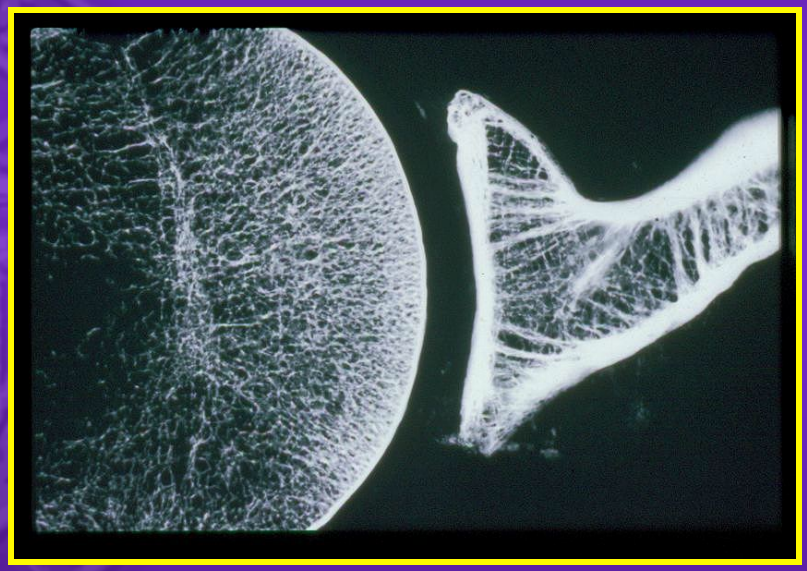
Shoulder Anatomy

- Glenoid labrum
  - fibrocartilagenous
  - increase humeral head coverage from 25-75%
  - superior portion blends with long biceps tendon
  - sup./ant. anatomic variability



Glenohumeral Joint: Circle of Stability





First question in the history: ? Acute trauma

- Acute trauma
  - Fracture or AC separation
  - Dislocation
  - Rotator cuff tear vs strain
- No acute trauma
  - Rotator cuff tendonitis/bursitis
    - Degenerative RC tear with aging
  - Frozen shoulder (adhesive capsulitis)
  - Glenohumeral arthritis

Where does it hurt ?

- Clavicle and AC injury hurts over injury with tenderness
- GH and RC issues cause pain in deltoid and upper arm, can radiate in ulnar distribution
- Trap pain more likely cervical or myofascial
- Distal sensory and motor findings more likely neuropathy

Key symptoms and findings

- Ask about and assess for:
- Stiffness
- Weakness
- Instability

Stiffness

- History- I can't reach seatbelt or bra strap
- Physical- loss of motion, ? symmetric
- Diff Dx of stiffness without acute trauma
  - Get x-ray
  - Joint space narrowing and spurring
    - Glenohumeral arthritis
  - If XR normal- frozen shoulder

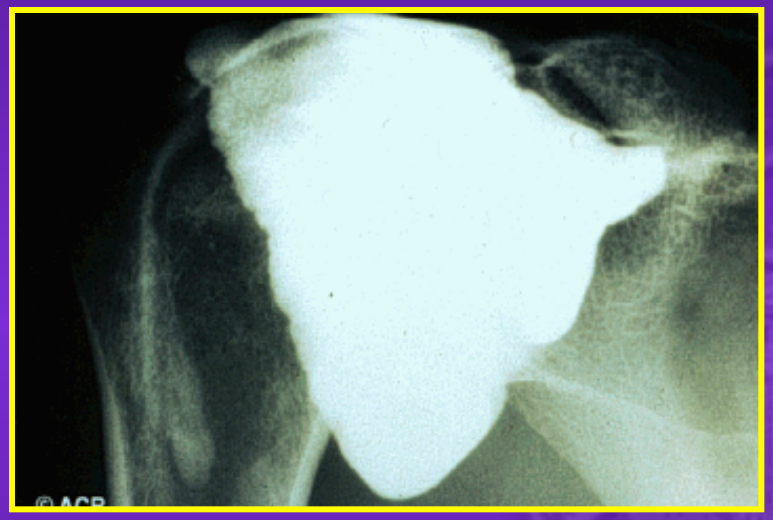
Frozen shoulder

- History
  - Progressive painful symmetric loss of range
  - +/- antecedent trauma
  - Night pain
  - Age around 50, female > male
  - Risk factors
    - diabetes

Frozen Shoulder

- Diagnosis
  - Symmetric loss or motion
  - Motion smooth and painless until end range
  - Normal strength in pain free range
  - Normal radiographs-clinical diagnosis

Frozen shoulder arthrogram



Normal Capsule Volume

Frozen shoulder

Shoulder weakness

- Neuropathy
  - Cervical nerve root
  - Brachial plexis
    - stingers
  - Long thoracic nerve
- Rotator cuff pathology

Rotator cuff pathology

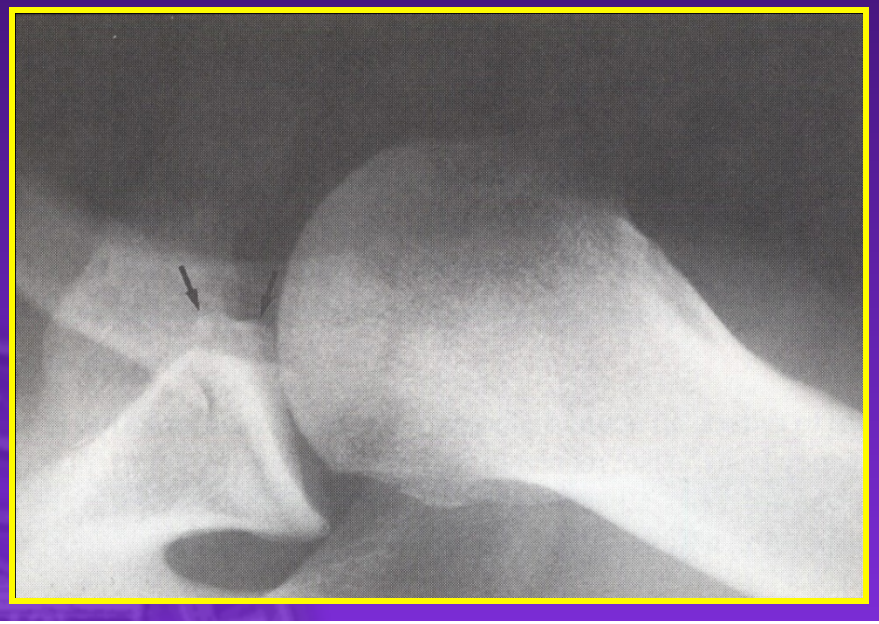
- Tendonopathy
  - Deltoid pain
  - Overuse
  - Weakness secondary to pain
- Tear
  - Increases with age
  - Following acute trauma if younger
  - Acute change in function
  - Significant weakness without pain

Instability:
Born loose or torn loose

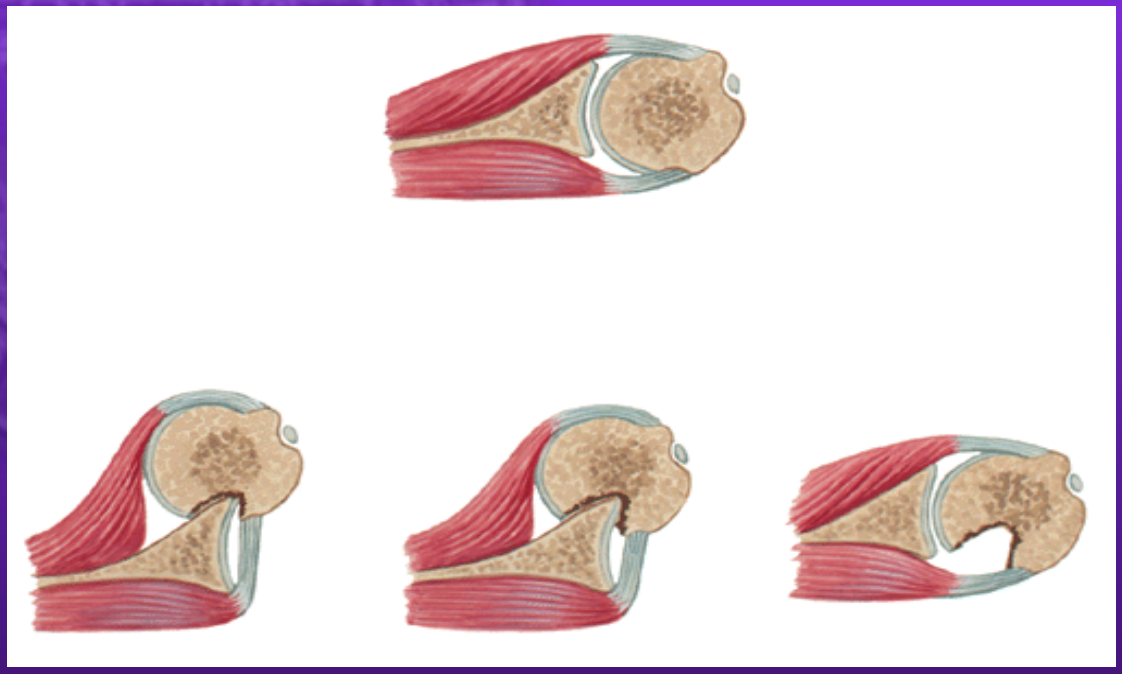
+ sulcus, baseline laxity and MDI

Acutely traumatically dislocated shoulder

Anterior dislocation

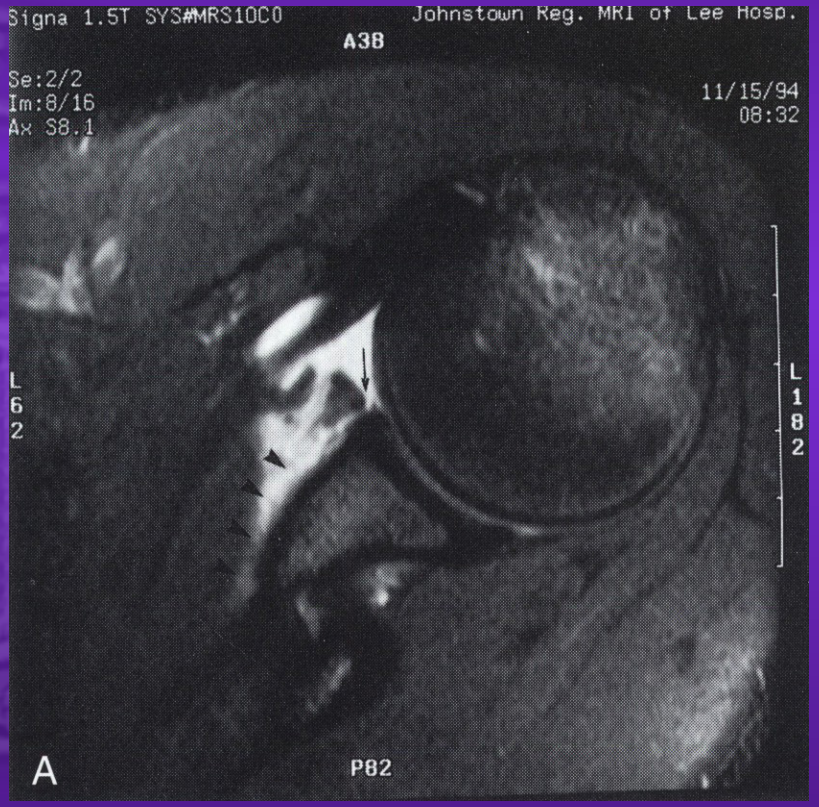


- Associated fractures
  - Bankhart
  - Hill-Sachs



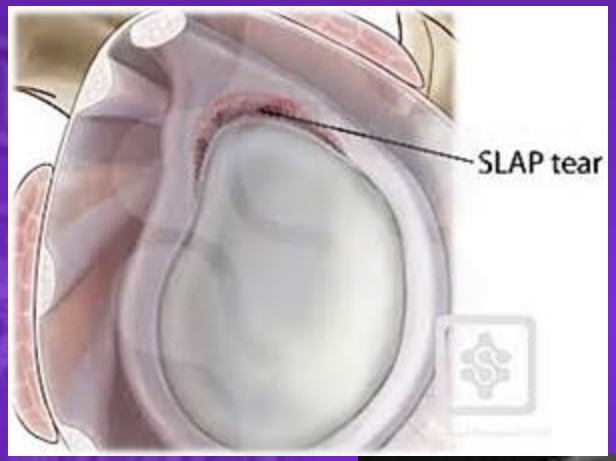
Labral tear

- Anterior or posterior following dislocation
- 90% anterior
- Posterior in football lineman, fall forward



Superior labral tear - SLAP

- Superior labrum anterior to posterior
- Overuse- overhead athlete
- Symptoms from biceps traction or catching in joint



Physical Exam

The Evidence

- Systemic review, meta-analysis 2006-2012 including articles otherwise identified by authors including prior meta analysis.
- Medline and CINAHL 2006-2012
- EMBASE and Cochrane no date restrictions
- 1766 identified
- 32 included

Hegedus, E BJSM 2012

Applied QUADAS-2 tool

- Rates studies as low, moderate , high bias
- Major concerns in high bias studies
  - Reference(gold) standard inconsistent or questionable
  - Time from index test to ref standard long or absent
  - Assignment of reference standard unblinded to index test result
  - Failure to describe index test

Index tests were evaluated for:

- **Sensitivity**- proportion of positives with condition
- **Specificity**- proportion of negatives without condition
- **Positive likelihood ratio-** large numbers indicate disease is present when the test is positive
- **Negative likelihood ratio-** decreasing values < 1 indicate disease is not present when the test is negative

Likelihood ratios

LR+

$$\frac{\text{Probability that one with condition has (+) test}}{\text{Probability that one without condition has (+) test}}$$

LR-

$$\frac{\text{Probability that one with condition has (-) test}}{\text{Probability that one without condition has (-) test}}$$

Interpretation of LR

LR	Interpretation (likelihood of disease)
>10	Large/conclusive increase
5-10	Moderate increase
2-5	Small increase
1-2	Minimal increase
1	No change
0.5-1	Minimal decrease
0.2-0.5	Small decrease
0.1-0.2	Moderate decrease
<0.1	Large/conclusive decrease

Shoulder exam performance from meta-analysis- Hegedus ‘12

Subacromial impingement (SI)

- Hawkins-Kennedy
  - Most sensitive
  - SN 80%
  - SP 56%
  - LR+ 1.84
  - LR- 0.35

SLAP lesion

- Yergason's
  - Strongest specificity
  - SN- 12.4 (6.6, 20.6)
  - SP- 95.3 (90.6, 98.1)
  - LR+ 2.49, LR- 0.91
- All 8 tests for SLAP had diag. odds ratio with CIs containing null value

Hegedus '12

SLAP lesion- diagnostic challenge with variable pathology

- No diagnostic historical factors (Kim et al ‘03)
- Morphology of tears vary complicating PE directed at specific morphology
  - Tear catching in joint- compression rotation
  - Tear pulled by biceps- active compression
- MRA specificity challenged by normal superior labral variability
- Arthroscopy- agreement amongst surgeons reviewing video only 60% (Sasyniuk ‘07)

Anterior instability

- Apprehension test
  - SN 65.6
  - SP 95.4
  - **LR+ 17.21**
  - LR- 0.39
- Strongly associated with condition, strong LR+

Take away from meta-analysis

- The highest statistical bar is difficult to reach
- Apprehension test for instability is best test by this criteria

Tests with potential from low bias studies

- Shoulder shrug sign can rule out
  - frozen shoulder
    - LR+ 1.9 **LR- 0.1**
  - GH OA
    - LR+ 3.6 **LR- 0.12**
  - Jia ‘08

Tests with potential from low bias studies

- Belly off test for subscap tendon tears
  - **LR+ 9.67 LR- 0.14**
  - Bartsch ‘10

Tests with potential from low bias studies

- External rotation lag sign for full thickness RC tear
  - Ant. Supraspin
    - SN 32, SP 93,
    - LR+ 4.6, LR- 0.73
  - Full width Supra
    - SN 56, SP 98
    - **LR+ 28**, LR- 0.45
  - Supra+infra
    - SN 97, SP 93
    - **LR+ 13.9**, **LR- 0.03**
  - *Hertel '96 and Castoldi '09*

Tests with potential from low bias studies

- Modified dynamic labral shear for SLAP
  - Arthroscopy standard
  - **LR+ 31.57** LR- 0.29
  - Kibler ‘09

Tests with potential from low bias studies

- Passive distraction test for SLAP tear
  - **LR+ 8.83,** LR- 0.5
  - Schlechter ‘09

Tests best performed by original author

- Active compression for SLAP tear.
- O'Brien '98- original description
  - SN 1.0, SP .98
- Hegedus MA- 6 studies (n=782)
  - SN 0.67, SP 0.37
  - LR+ 1.06(0.9-1.5)
  - LR- 0.89 (0.67-1.20)

Combined tests and findings: SLAP

- Passive distraction and active compression
  - SN-70, SP-90, **LR+ 7, LR- 0.11**
  - *Schlecter '09*

Combined tests and findings: Anterior instability

- Apprehension and relocation
  - SN 81, SP 98
  - **LR+ 39.7, LR- 0.19**
  - *Farber '06*
- Compares to LR+ 17.21, LR- 0.39 with apprehension alone in meta-analysis

Combined tests and findings: supraspinatus tendinopathy

- Age > 39
- Painful arc
- Self report popping and clicking
  - With all 3 positive findings
    - SN 38, SP 99, **LR+ 32.2**, LR- 0.63
  - *Chew '10*

Rotator cuff strength testing
Kim et al '09

- 237 asx subjects, ultrasound and cuff dynamometry
- 41 RC tears
  - Age 40-49- no tears in age group
  - Age 50-59- 10%
  - Age 60-69- 20%
  - Age >69- 41%

Rotator cuff strength testing
Kim et al '09

- Dynamometry
  - Abduction and ER strength decreases with age (in females ER preserved)
  - In large RC tears
    - Abduction weak
    - Ratio abduction to ER decreased

The key historical variable in shoulder pain???- Age

272 consecutive patients specialty shoulder clinic. *Matsen et al '94*

Diagnosis	Age (Mean +/- SD	#
Atraumatic instability	23 +/- 7	51
Traumatic ant. instability	30 +/- 10	32
RCT- incomplete	41 +/- 11	18
Frozen shoulder	53 +/- 10	46
RCT- complete	62 +/- 12	58
DJD	64 +/- 10	46

Gold standard ??

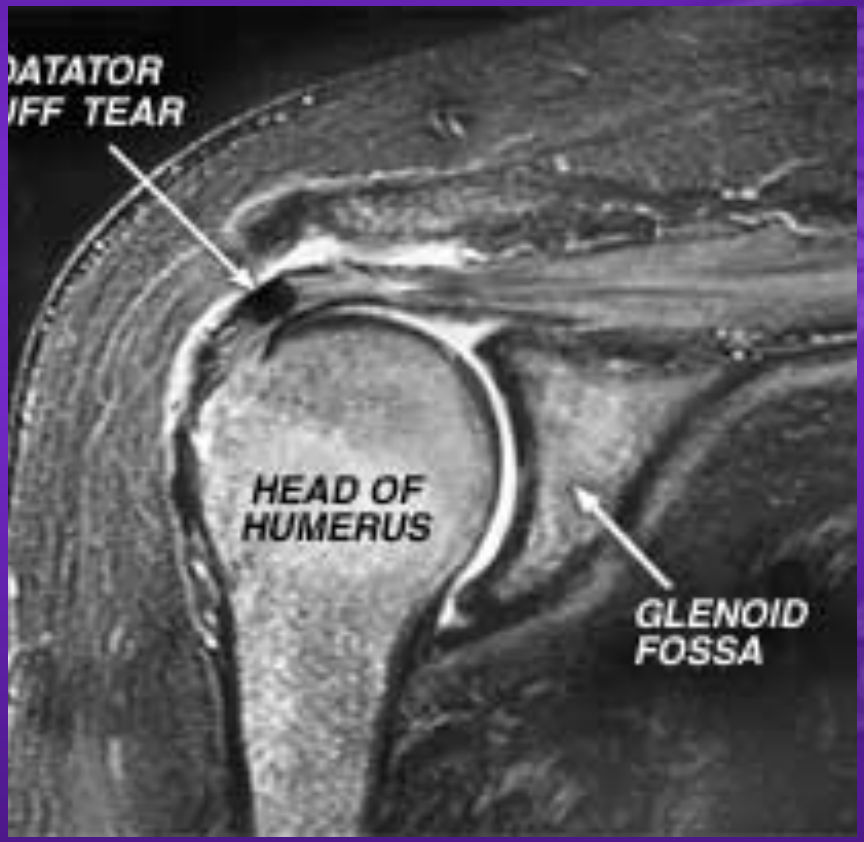
Is imaging the answer ?
RCT

- Partial thickness rotator cuff tear
  - MRI: SN 98, SP 79, LR+ 4.7, **LR- 0.03**
  - U/S: SN 91, SP 85, **LR+ 6.1, LR- 0.11**
- Full thickness rotator cuff tear
  - MRI: SN 94, SP 93, **LR+ 13.4, LR- 0.09**
  - U/S: SN 92, SP 93, **LR+ 13.1, LR- 0.09**
  - MRA: SN 94, SP 92, **LR+ 11.8, LR- 0.07**
- No statistically significant differences in performance, all perform well

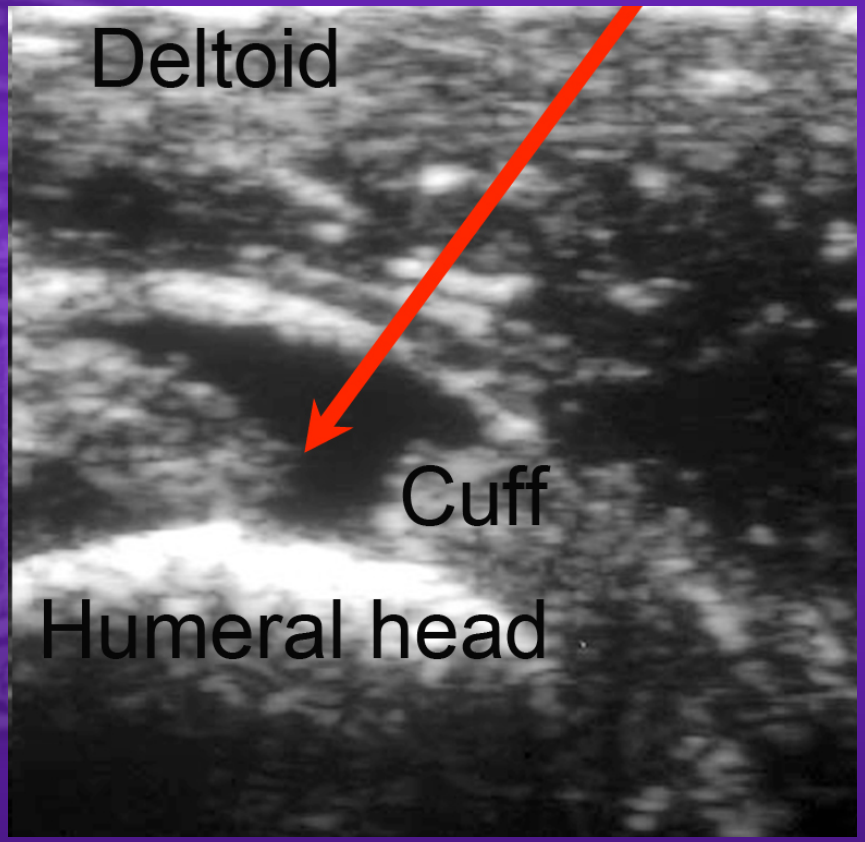
Lenza et al '13

Rotator cuff tear

MRA



Ultrasound



Is imaging the answer ?
SLAP

- MRI- useless (Phillips et al 2013)
  - SN 86, SP 13, LR+ 0.98, LR- 1.1
- MRA- better able to rule out than rule in SLAP (Amin & Youssef 2012)
  - SN 90, SP 50, LR+ 1.8, **LR- 0.2**
- But remember- combined passive distraction and active compression
  - SN-70, SP-90, **LR+ 7, LR- 0.11**

Putting it back together again

- Shoulder tests often debut well…
- Performance deteriorates in the face of time and further scrutiny
- Soft gold standard = soft test performance
- Imaging is not necessarily the answer
- Diagnostic accuracy improves though incorporating history and multiple exam findings

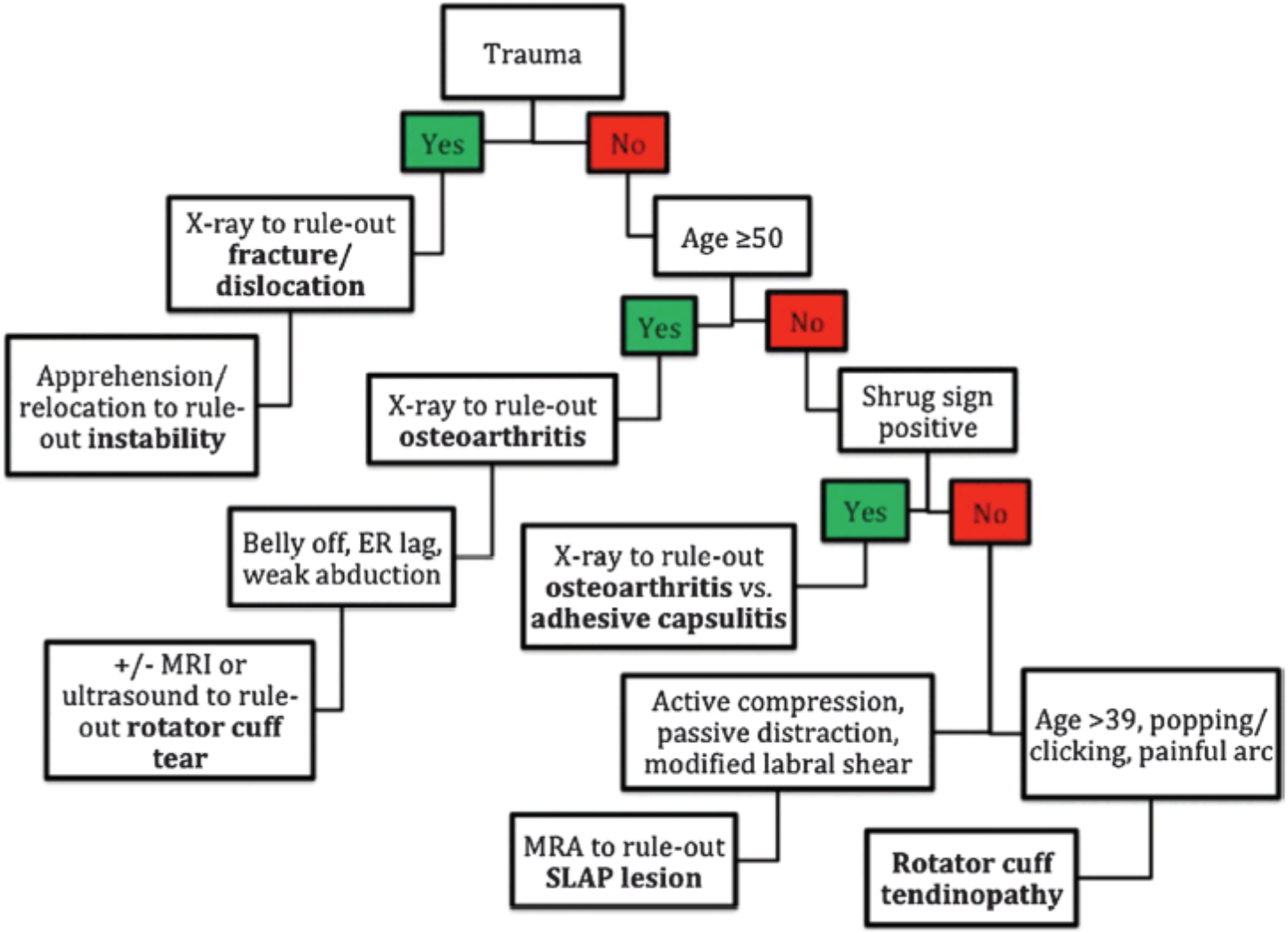


Figure 1: Flow diagram outlining evidenced-based shoulder examination.

Current Sports Medicine Reports, 2014

EXTREMITY AND JOINT CONDITIONS

The Evidenced-Based Shoulder Evaluation

John W. O'Kane, MD and Brett G. Toresdahl, MD

Abstract

The physical examination of the shoulder has been studied extensively, but the quality and statistical power of the published research often is lacking. The initial reports of new shoulder examination techniques commonly describe impressive performance. However recent meta-analyses have found that when the majority of these tests are used in isolation, they lack the ability to rule in or rule out the pathology in question, with few exceptions. The diagnostic accuracy of the physical examination improves when the shoulder tests are evaluated in combination, such as positive passive distraction and active compression identifying a superior labral anterior to posterior (SLAP) lesion. The accuracy also can be improved when the shoulder tests are evaluated in conjunction with specific historical find-

evidence for several physical examination techniques and imaging modalities and to propose an evidenced-based strategy for the evaluation of the painful shoulder.

Methodology

Articles were identified through a 2014 PubMed search of "shoulder and physical examination" and "shoulder and imaging." Abstracts were screened for statistical assessment of examination or imaging performance. In developing the

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