Noncontrast MRI of Shoulder Instability
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Hollis G. Potter, MD
Chief, Magnetic Resonance Imaging
Director of Research, Dept. of Radiology & Imaging
Hospital for Special Surgery
Professor of Radiology
Weill Medical College of Cornell University

High Resolution Noncontrast MRI of Shoulder Instability
• High spatial resolution 273µ x 390µ (1.5T) x 360µ (3T) x 3mm/0 gap
• Moderate TE FSE (28-34) accentuates inherent magnetization transfer contrast
• Strict attention to imaging technique imperative
• Consider optimized noncontrast imaging as an alternative to intra-articular contrast:
  – Visualize “native” capsule
  – Preserves MRI as noninvasive
  – Reduced cost
  – Increased patient throughput; increased unit productivity
  – Same images sensitive for cartilage, ligament and labral pathology

14 year-old girl with mild cuff tendinosis
45 year-old with a Buford complex and a superior labral tear above

17 year-old with meniscoid variant

Anteroinferior labral tear (Bankart) with articular cartilage disruption

16 year old with previous anterior dislocation
70 year old with painful shoulder and limited ROM after a fall

Cuff contusion and Bankart lesion

27 year-old with subacute injury and subtle bone involvement
Bankart with ganglion dissecting into rotator cuff

24 year-old S/P old anterior dislocation

29 year-old 4 days post diving accident
Anterior labral periosteal sleeve avulsion (ALPSA) and posterior capsule tear
30 year-old fell one month prior with pain and inability to lift arm
*Posterior Bankart, posterior capsule injury and humeral chondral shearing injury*

*Lateral avulsion of posterior capsule in a 16 year-old*
17 year-old with subacute trauma

Cuff contusion. Contusion greater tuberosity. Anterior capsular stripping at humerus off pouch.
Humeral Avulsion of Glenohumeral Ligaments (HAGL)

- 64 shoulders with a diagnosis of anterior instability
- 6/64 (9.3%) with HAGL lesions
- more commonly repaired with open techniques than with arthroscopic ones, although both have been described
13 year old hurt shoulder while wrestling.

**ACCURACY OF NONCONTRAST MR IN LABRAL INJURY**

Prospective data collection in 103 Patients; surgical Confirmation
2 independent observers

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
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<tbody>
<tr>
<td>Anterior</td>
<td>37/37</td>
<td>63/63</td>
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<tr>
<td></td>
<td>100%</td>
<td>95%</td>
</tr>
<tr>
<td>Superior</td>
<td>31/36</td>
<td>67/67</td>
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<tr>
<td></td>
<td>86%</td>
<td>100%</td>
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<tr>
<td>Posterior</td>
<td>14/19</td>
<td>80/84</td>
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<tr>
<td></td>
<td>74%</td>
<td>95%</td>
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<tr>
<td>All</td>
<td>89%</td>
<td>97%</td>
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*Radiology 1996; 200:519-524*

*Kappa statistic (interobserver) for all labral tears was 0.86 (p=0.0001)*
3T imaging of shoulder instability

- Correction for signal inhomogeneity necessary (coil sensitivity profile or postprocessing algorithm)
- Sample at wider RBW
- Increased SNR permits higher in/through plane resolution
  - 67 pts with arthroscopic correlation
  - Sens/spec for SLAP 90/100%
  - Sens/spec for ALT 89/100%
  - Sens/spec for PLT 86/100%

Classification of SLAP lesions (Snyder et al 1990)

- Type I: fraying without detachment
- Type II: type I plus stripping of superior labrum and biceps off glenoid
- Type III: bucket handle tear of superior labrum with central displacement and intact biceps
- Type IV: type III plus extension into biceps anchor

MGHL tear. Anterior labral tear and anterior capsular tear.

SLAP
SLAP

22 year-old professional athlete with a superior labral tear

17 year old with Type IV SLAP
Superior Labral Lesions: Noncontrast MRI
AJSM 1999; 27:208-213

- 100/102 superior labral tears were prospectively identified by MRI
- 2 false negatives (SLAP I, SLAP II lesions)
- 4 false positives (1 normal, 2 meniscoid, 1 sublabral foramen)
- MRI:
  - sensitivity 98% (100/102)
  - specificity 89% (34/38)
  - accuracy 96% (134/140)

41 year old man

Dysplastic glenoid with posterior labral tear & ganglion
**Imaging the Throwing Athlete**
- Chronic repetitive microtrauma and excessive load leads to plastic deformation of collagen in tendons, capsule and ligaments
- Increased mobility of water
- Utility of fast spin echo techniques: assess gray scale of collagen
- Tendinosis vs. partial tear vs. cuff delamination
- Importance in assessing the degree of scar remodeling of ligaments
- Acute on chronic injury

**Internal Impingement**
- Impingement between the articular side of the rotator cuff and the posterosuperior edge of the glenoid cavity with abduction and external rotation (Walch et al, JSES 1992)
- Injury occurs during early acceleration phases of throwing: rapid internal rotation
- Partial thickness tear RTC articular side
- MRI: Periosteal new bone formation/ossification of the posterior capsule/triceps attachment to scapula (Bennett)
- Posterior capsule contracture (GIRD)

16 year-old pitcher with internal impingement
RTC delamination in a 37 year-old athlete

9 year-old pitcher with pain and weakness

Partial cuff tear with glenohumeral cartilage loss
44 year-old with 4 part humeral fracture

Absence of anterior humeral cx artery; thrombosis axillary vein; stretched but intact posterior humeral cx artery
Imaging of the postoperative shoulder: Noncontrast strategies

- Minimize susceptibility artifact caused by metallic fixation
- Utility of fast spin echo techniques: limit signal loss due to diffusion
- Avoid frequency selective fat suppression techniques: create more field disturbance and poor image quality (use fast STIR)
- Avoid gradient echo techniques: no correction for field inhomogeneity
- Assess native synovium
  - Infection
  - Inflammatory response to bioabsorbable fixation

Bankart repair and capsular shift 10/97: now with new instability

19 year-old man with new injury; 6 months following Bankart repair

Cuff contusion with new tear 2-5 o’clock
17 year-old S/P recent open anterior stabilization with new trauma

8 months post bioabsorbable tack fixation

25 year-old 6 months S/P superior labral repair with bioabsorbable tacks
45 year old man. Prior tack stabilization with displaced tack in rotator interval

19 year-old woman 2 years S/P bioabsorbable tack labral repair with pain and stiffness

Previous labral repair. Bioabsorbable tack protruding into supra/spino glenoid notch adjacent to suprascapular nerve
12/7/01

3/9/04

19 year-old man S/P stabilization

32 year-old man with tack eroding cartilage and secondary synovitis
33 year-old S/P open stabilization x 2 with thermal capsular shrinkage

Previous thermoplication

**High Resolution Noncontrast MR Imaging**

- Strict attention to imaging technique imperative
- Inflammatory synovitis may reflect mode of fixation in postoperative setting and does not necessarily reflect infection
- Consider optimized noncontrast imaging as an alternative to intra-articular contrast:
  - Visualize “native” capsule
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References


