Advances in Shoulder MRI
2016 Orthopaedic Summit

Hollis G. Potter, MD
Chairman, Dept. of Radiology & Imaging
The Coleman Chair, MRI Research
Hospital for Special Surgery
Professor of Radiology
Weill Medical College of Cornell University
Disclosures

**Research Funding:**
General Electric Health Care
NIH/NIAMS RO1 AR064840-01
NIH/NIAMS 1R01AR066069-01A1
NIH NIAMS 1R01AR065023-01A1
NIH 1 RO1 HD087459-01
American Orthopaedic Society for Sports Medicine

**Consultant:** FDA; Smith & Nephew; Arthrex; RTI

**Stockholder:** Imagen
High Resolution Noncontrast MRI of the Shoulder

- Emphasize alterations in tissue morphology as opposed to signal alteration (cuff tears, labral tears)
- Use high spatial resolution
- Interslice gap should be avoided
- Consider optimized noncontrast imaging as an alternative to intra-articular contrast:
  - Visualize “native” capsule
  - Preserves MRI as noninvasive with risks of infection or NSF reaction to gadolinium
  - Reduced cost
  - Same images sensitive for cuff, cartilage, ligament and labral pathology
IMPINGEMENT SYNDROME
Assess Secondary Signs

- Acromial morphology: anterior +/- lateral subacromial slope/spur
- Acromioclavicular arthrosis
- Thickened CA ligament
- Thickened subacromial bursa
- Assess underlying tendon
55 year-old woman with multifocal calcific tendinosis
Partial thickness rotator cuff tears

- Partial tendon discontinuity; visually "scope" the tendon
- Increased signal intensity on moderate to long TE sequence
- Bursal vs. articular vs. intrasubstance
Subcoracoid impingement with partial tear subscapularis tendon
Partial tear bursal margin supraspinatus
Use all planes of imaging for partial tears!
High level tennis player with cuff weakness
Chronic denervation in teres minor
46 year-old patient with symptoms of impingement: “R/O RTC tear”
Early GH OA

Make sure your radiologist uses cartilage sensitive imaging!
57 year-old woman with symptoms of restricted ROM: “R/O RTC tear”

Stage II adhesive capsulitis
Acute on Chronic RTC
MR methods of fat assessment

- **Qualitative**
  - Estimation of fat content based on visual inspection of muscle in cross section (Goutallier)
    - Stage 0 normal muscle
    - Stage 1 (some fatty streaks)
    - Stage 2 muscle > fat
    - Stage 3 muscle = fat
    - Stage 4 fat > muscle

- **Quantitative**
  - H+ spectroscopy
    - Requires special pulse sequences, high magnet homogeneity, specialized post-processing software
Failure in continuity of the subscapularis tendon
Ultrashort TE imaging of RTCR
T2* mapping of biologic augmentation of repair
80 year-old man with pain and stiffness following arthroplasty
24 year-old professional cornerback with fall in abduction: pre-arthrogram
Acute HAGL and chronic PT cuff tear
25 year-old man with anterior dislocation 6 weeks prior with new injury

Remember subscapularis with a HAGL!
“Circle concept of instability”

Anterior Bankart and Posterior HAGL
Lateral avulsion of posterior capsule in a 16 year-old
35 year-old man 2 months following tackle injury
Signs of chronicity
9 year-old pitcher with pain and weakness
13 year-old with chronic Little League shoulder and features of internal impingement
Glenoid dysplasia and posterior instability
“engaging lesions”
31 year-old athlete with re-injury following Bankart repair
31 year-old athlete with re-injury following Bankart repair
The value of visualization of the “native” capsule

2/11/2016

3/15/2016
Shoulder MRI with ZTE: Bone analysis

- ZTE MRI samples signal from short T2 species (like cortical bone)
- Amenable to 3D modeling

Shoulder - quantitative
- 2 Readers (blinded); 31 shoulders
- Measured glenoid vault depth, Bankart and Hill-Sachs lesions
- ICC (0.60 – 0.75) indicated good to excellent inter-observer agreement
- Bland-Altman analysis indicated little intermodal (ZTE vs CT) bias (< 1mm) in linear distance metrics
Superior soft tissue contrast c/w CT
  – Direct multiplanar capabilities
  – 3D modeling possible

Same images sensitive for cuff, cartilage, ligament, labral, capsule and bony pathology (one stop shopping)

Evaluate chondral shear and educate patient expectations for stiffness following reconstruction
Thank you

HSS MRI Lab
Matthew F. Koff PhD
Sarah Pownder DVM
Ryan Breighner PhD
Tina Jeon PhD
Parina Shah MS
Alissa Burge MD
Darryl Sneag MD
Mauro Miranda BS
Erin Argentieri BS