Imaging Evaluation of Superior Labral Anteroposterior (SLAP) Tears

Jeremy Grubin, MD, Alex Maderazo, MD, MBA, and Darren Fitzpatrick, MD

Abstract

Superior labral anteroposterior (SLAP) tears are common injuries that are best evaluated with magnetic resonance arthrography (MRA), as it provides the most detailed evaluation of the bicipital labral complex. Given the variety and complexity of SLAP tears, distention of the joint with intra-articular dilute gadolinium contrast properly separates the intra-articular biceps tendon, superior labrum, glenoid cartilage and glenohumeral ligaments to optimize assessment of these structures. This allows for increased diagnostic confidence of the interpreting radiologist and provides a better road map for the surgeon prior to arthroscopy. Indirect MRA and high-field magnetic resonance imaging are sensitive and specific alternative modalities if MRA cannot be performed.

Superior labral anteroposterior (SLAP) tears are common labral injuries. They occur at the attachment of the long head of the biceps tendon on the superior glenoid and extend anterior and/or posterior to the biceps anchor. The mechanism of action for SLAP tears is traction on the superior labrum by the long head of the biceps tendon, resulting in "peeling" of the labrum off the glenoid. Such forces may result from repetitive overhead arm motion (pitching) or from direct trauma.

Clinical diagnosis is challenging with SLAP tears, as they often present with nonspecific shoulder pain and may not be associated with an acute injury. A further complication is that they are often associated with other shoulder pathology, such as rotator cuff tears.[1] As physical examination is typically nonspecific, proper diagnostic imaging is essential for diagnosis.

We prefer to assess potential SLAP tears with magnetic resonance arthrography (MRA).[2] Dilute (1:200) gadolinium contrast material (12-15 mL) is introduced into the glenohumeral joint under sonographic or fluoroscopic guidance. Capsular distention by dilute intra-articular contrast enables superior imaging resolution of the labroligamentous complex. We think the increase in diagnostic confidence enabled by direct arthrography outweighs the additional invasiveness and cost associated with MRA relative to noncontrast magnetic resonance imaging (MRI).

The MRA protocol differs from our routine noncontrast shoulder imaging. We perform a fat-saturated coronal oblique T1 sequence that maximizes the conspicuity of intra-articular contrast in the plane that optimally visualizes the superior labrum. Three planes of intermediate-weighted fast spin echo not only contrast the high-signal intra-articular fluid with the low-signal fibrocartilaginous labrum and the stratified intermediate signal of glenoid articular cartilage, but they also allow optimal assessment of the rotator cuff. In addition, we perform a fat-saturated coronal T2 sequence that highlights all fluid signal structures as well as edema.

SLAP tears appear on MRA as the insinuation of intra-articular contrast between the articular cartilage and the attachment of the superior labrum,[3] within the substance of the labrum, or as detachment of the labrum from the glenoid rim[4] (**Figure 1**). Findings can range from labral fraying to complete detachment with displacement. Tears can extend into other quadrants of the labrum, extend from a Bankart lesion, or involve the biceps tendon and/or the glenohumeral ligaments (**Figures 2–4**). Up to 10 types of SLAP tears have been described on arthros-

Figure 1. Fat-saturated coronal T1-weighted magnetic resonance arthrography shows intra-articular contrast insinuating between glenoid articular cartilage and superior labral attachment (arrow) with extension into substance of superior labrum.

Figure 2. Fat-saturated coronal T1 magnetic resonance arthrography shows large tear involving chondrolabral junction and substance of superior labrum, which fills with intra-articular contrast (asterisk). Superior labrum remains attached to superior glenoid tubercle by thread of intact labral tissue (arrow), producing unstable labral fragment and bucket-handle tear.

Authors' Disclosure Statement: The authors report no actual or potential conflict of interest in relation to this article.

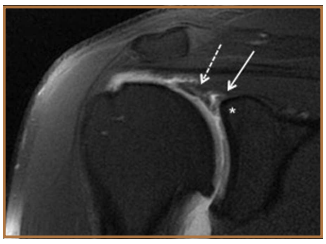

Figure 3. Coronal T1-weighted postarthrographic image shows insinuation of intra-articular contrast at chondrolabral junction of superior labrum (arrow) with extension of contrast into biceps anchor (dashed arrow), consistent with superior labral tear extending into bicipital labral complex. Cartilage fraying and irregularity of superior glenoid articular surface (asterisk) are more conspicuous because of presence of intra-articular contrast.

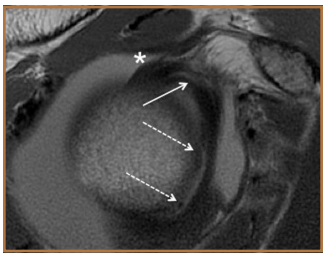

Figure 4. Sagittal oblique intermediate-weighted postarthrographic image in patient with prior history of anterior shoulder dislocation shows stripping of anterior and anterior inferior labrum from glenoid (dashed arrows), consistent with cartilaginous Bankart lesion, which extends superiorly to involve superior labrum (solid arrow) and retrograde to biceps anchor (asterisk).

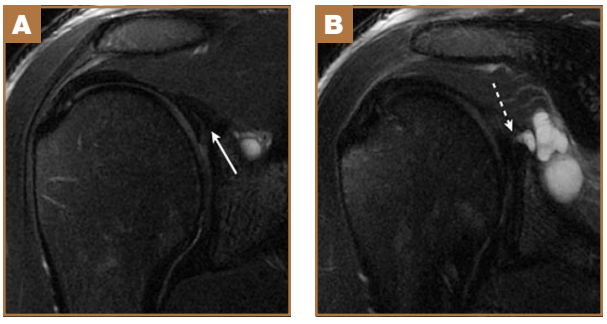

Figure 5. Fat-saturated coronal T2-weighted magnetic resonance imaging of shoulder shows thin, linear focus of signal within chondrolabral junction and substance of labrum (A, solid arrow) with multiloculated, high-signal, paralabral cyst within spinoglenoid notch, which communicates with labral tear (B, dotted arrow). Linear signal of tear is much less conspicuous on conventional imaging than on magnetic resonance arthrography.

copy. This classification scheme, however, is seldom helpful in the interpretation of SLAP tears on MRI. More important in guiding treatment is having a detailed description of the tear, including location, extent, and morphology, along with associated abnormalities.

Several findings can aid in the diagnosis of SLAP tears. Normal anatomical variants of the anterior-superior labrum do not extend posterior to the biceps anchor—an important finding for discerning normal morphologic variants from tears. Therefore, high signal within the posterior third of the superior labrum or extension of high signal laterally within the labrum and away from the glenoid suggests a SLAP tear.[5] A paralabral cyst is almost always associated with a labral tear,[1] so signal abnormality of the superior labrum with a paralabral cyst suggests a SLAP tear (**Figure 5**).

MRA is not the only method for diagnosing SLAP tears. Standard 3-Tesla MRI had 83% sensitivity and 99% specificity for diagnosing SLAP tears in a recent study, though MRA had 98% sensitivity and 99% specificity—a statistically significant sensitivity difference.[6] In another study, computed tomography arthrography (CTA) had 95% sensitivity and 88% specificity for diagnosing recurrent SLAP tears after surgery.[7] CTA is associated with ionizing radiation and is limited in its assessment of other structures that may show concomitant abnormalities, such as the articular cartilage and the rotator cuff. Indirect MRA, wherein magnetic resonance sequences are obtained after intravenous injection of gadolinium contrast and exercise of the affected shoulder, had a high sensitivity of detection of labral tears of all types.[8]

MRA is most sensitive and specific for diagnosing SLAP tears; 3-Tesla MRI, indirect MRA, and CTA are useful alternative modalities for cases in which MRA cannot be performed.

Dr. Grubin is a Musculoskeletal Imaging Fellow, Dr. Maderazo is Section Chief of Musculoskeletal Imaging, and Dr. Fitzpatrick is Director of Musculoskeletal Procedures, Department of Radiology, Icahn School of Medicine at Mount Sinai, New York, New York. Dr. Grubin was Chief Resident at the time the article was written.

Address correspondence to: Darren Fitzpatrick, MD, Department of Radiology, Icahn School of Medicine at Mount Sinai, 1 Gustave Levy Pl, New York, NY 10029 (tel, 212-241-6681; email, darren.fitzpatrick@mountsinai.org).

Am J Orthop. 2015;44(10):476-477. Copyright Frontline Medical Communications Inc. 2015. All rights reserved.

References

1. Chang D, Mohana-Borges A, Borso M, Chung CB. SLAP lesions: anatomy, clinical presentation, MR imaging diagnosis and characterization. *Eur J Radiol*. 2008;68(1):72-87.
2. Jee WH, McCauley TR, Katz LD, Matheny JM, Ruwe PA, Daigneault JP. Superior labral anterior posterior (SLAP) lesions of the glenoid labrum: reliability and accuracy of MR arthrography for diagnosis. *Radiology*. 2001;218(1):127-132.
3. Fitzpatrick D, Walz DM. Shoulder MR imaging normal variants and imaging artifacts. *Magn Reson Imaging Clin N Am*. 2010;18(4):615-632.
4. Bencardino JT, Beltran J, Rosenberg ZS, et al. Superior labrum anterior-posterior lesions: diagnosis with MR arthrography of the shoulder. *Radiology*. 2000;214(1):267-271.
5. Tuite MJ, Cirillo RL, De Smet AA, Orwin JF. Superior labrum anterior-posterior (SLAP) tears: evaluation of three MR signs on T2-weighted images. *Radiology*. 2000;215(3):841-845.
6. Magee T. 3-T MRI of the shoulder: is MR arthrography necessary? *AJR Am J Roentgenol*. 2009;192(1):86-92.
7. De Filippo M, Araoz PA, Pogliacomi F, et al. Recurrent superior labral anterior-to-posterior tears after surgery: detection and grading with CT arthrography. *Radiology*. 2009;252(3):781-788.
8. Fallahi F, Green N, Gadde S, Jeavons L, Armstrong P, Jonker L. Indirect magnetic resonance arthrography of the shoulder; a reliable diagnostic tool for investigation of suspected labral pathology. *Skeletal Radiol*. 2013;42(9):1225-1233.

This paper will be judged for the Resident Writer's Award.