

## Radiology Corner

### The Superior Labrum, Anterior-to-Posterior 'SLAP' Lesion

**Guarantor:** Col Timothy G. Sanders, MC, USAF (Ret.)<sup>1</sup>

**Contributors:** Col Timothy G. Sanders, MC, USAF (Ret.)<sup>1</sup>; LT John D. Duerden, MC, USN<sup>1</sup>; COL Les Folio, USAF, MC, SFS<sup>1</sup>

*Note: This is the full text version of the radiology corner question published in the September 2006 issue, with the abbreviated answer in the October 2006 issue.*

**The Superior Labrum Anterior-to-Posterior (SLAP) lesion is a term that was coined to refer to a tear involving the superior glenoid labrum. These lesions are common among military members and athletes that utilize overhead arm movements. They typically occur as a result of a fall on out stretched hand or following repetitive overhead activity that places traction on the shoulder. SLAP lesions represent a specific pattern of injury that involves the partial or complete detachment of the superior labrum and/or the biceps tendon. Patients with SLAP lesions complain of shoulder pain while performing overhead movements and often develop mechanical popping or catching within the shoulder. The following case report reviews the typical clinical presentation, imaging findings, and treatment of the Superior Labrum Anterior-to-Posterior lesion.**



**Fig. 1: Normal Superior Labrum.** Coronal T1-weighted image with fat saturation from an MR arthrogram demonstrates a normal superior labrum. Intraarticular contrast material outlines the dark, triangular appearing superior labrum (arrow). Note the smooth, tapering superior labrum with the articular cartilage undermining medially.

<sup>1</sup> Department of Radiology and Radiological Sciences; Uniformed Services University of the Health Sciences, Bethesda, Maryland 20814-4799  
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## Introduction

Superior Labrum Anterior-to-Posterior (SLAP) lesions predominantly occur in athletes that perform repetitive overhead motions, namely baseball players, gymnasts or swimmers, and individuals that are subjected to direct compression of the shoulder secondary to falls or contact sports (1). The clinical diagnosis of a SLAP lesion can be difficult as patients often present with vague and intermittent symptoms. Since many signs of labral tear overlap with other shoulder pathology it can be difficult to isolate a SLAP lesion in the physical examination. A combination of imaging, physical exam and the patient's description of pain and activity producing the pain are necessary to accurately diagnose the lesion and direct treatment.

**History and Physical:** A 29-year-old right-hand dominant active duty male presented with a long history of shoulder pain and intermittent catching and popping during overhead activities. He played lacrosse for the Naval Academy and has remained active in sports since. He described the pain as sharp and localized deep within the shoulder. He denies history of shoulder trauma, weakness, paresthesias or paralysis of his arm.

Upper extremity exam demonstrated symmetrical shoulders with no bony abnormalities or deformities, 5/5 strength, full range of motion and equal sensation bilaterally. Testing was negative for impingement, rotator cuff disease, biceps tendon pathology, acromioclavicular pathology or obvious labral pathology. The following tests were negative: Neer's impingement, Hawkin's impingement, Apprehension, AC Joint palpation, O'Briens, Crank, Yergeson's and Speed's.

## Imaging Findings

Plain radiography, including anteroposterior (AP) view of the shoulder in internal and external rotation as well as outlet and axillary views were normal (not shown). T1-weighted MR images following the administration of intra-articular contrast in the coronal, sagittal (not shown) and axial views revealed a normal osseous outlet with a Type I acromion, no lateral down sloping, no AC joint degeneration and no bony abnormalities (Fig. 2A, B). The rotator cuff was intact with no tendonopathy, partial or full-thickness tear and no muscular atrophy. The capsular structures were intact with no evidence of Bankart or Hill Sachs lesions. The superior

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labrum showed irregular extension of contrast material into the substance of the labrum with undersurface fraying; the long head of the biceps demonstrated abnormal signal making this tear consistent with a Type IV tear. No osteochondral, cortical or subcortical defects were identified.



Fig. 2 (A). SLAP tear. Coronal T1-weighted image with fat saturation from an MR arthrogram demonstrates an irregular collection of contrast (arrow) extending into the substance of the superior labrum.

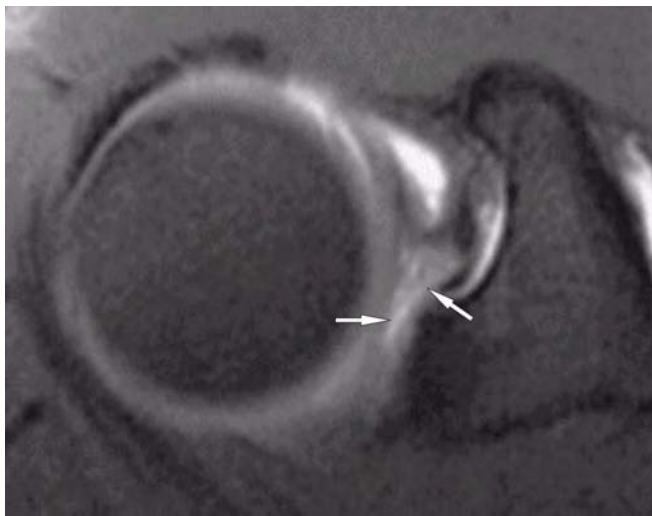


Fig. 2 (B). SLAP tear. Axial T1-weighted image with fat saturation from an MR arthrogram demonstrates fraying of the superior labrum with an irregular collection of contrast material (arrows) extending into the superior labrum. Abnormal signal extends into long head of the biceps tendon.

## Discussion

Superior Labrum, Anterior-to-Posterior (SLAP) lesions describe a specific pattern of injury that begins posteriorly on the superior labrum, extending anteriorly to

potentially involve the attachment of the biceps tendon (2). They are most commonly caused by a fall on an outstretched hand while in abduction and forward flexion, translating the humeral head superiorly causing compressive damage to the superior labrum. Other mechanisms of injury include overhead throwing motions, as in baseball pitchers, gymnasts and swimmers, and traction injuries, which can occur with a fall directly on the shoulder, water skiing, or pulling superiorly on a heavy object (3,4). Patients commonly present with pain during overhead activities, and may report mechanical catching, popping or grinding. Other diagnoses to consider include impingement syndrome, acromioclavicular joint pain, bicipital tendonitis or symptomatic shoulder instability.

The original description of SLAP lesions described four distinct types (1). Type I lesions have degeneration, or fraying, of the superior labrum, but the biceps tendon remains attached at its insertion. Type II lesions involve detachment of the superior labrum from its insertion on the supraglenoid tubercle. Type III lesions have a bucket handle tear of the superior labrum, but the biceps remains attached. Type IV lesions are characterized by a detachment of the superior labrum with the tear extending into the biceps tendon longitudinally (1).

The original classification has subsequently been expanded to include 1) anteroinferior Bankart-type labral lesions in continuity with SLAP lesions, 2) biceps tendon separation with an unstable flap tear of the labrum, and 3) extension of the superior labrum-biceps tendon separation to beneath the middle glenohumeral ligament (4). Type II SLAP lesions have also been subclassified into 1) anterior, 2) posterior, and 3) combined anterior and posterior lesions (5). SLAP lesions with a posterior component may lead to posterior-superior instability that over time may result in articular surface partial thickness tears of the posterior rotator cuff tear (5).

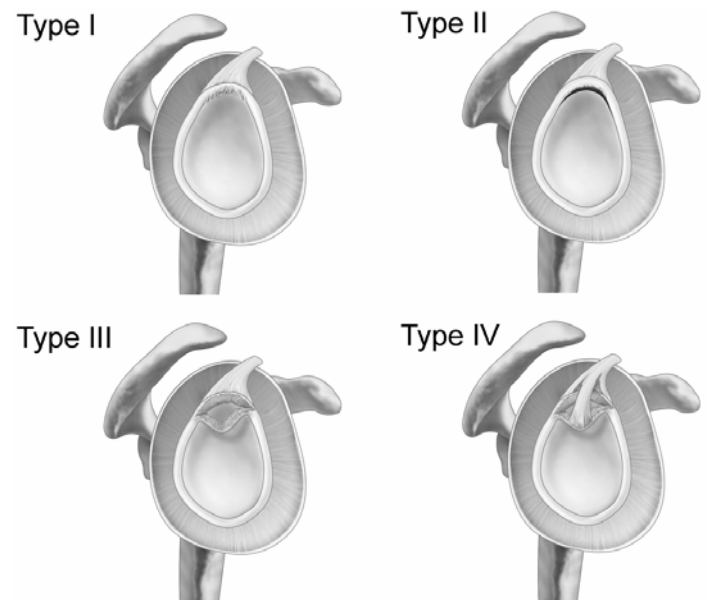


Fig. 3. SLAP classification scheme. See figure 4 for detailed drawings of each type.

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should also be conducted (6). Magnetic resonance imaging should be ordered when an alternative diagnosis is not evident on conventional radiographs. Although SLAP lesions are usually depicted very nicely using standard multiplanar T1- and T2-weighted MR imaging, MR arthrography with an intraarticular injection of dilute gadolinium will improve diagnostic accuracy, with a sensitivity of 89%, a specificity of 91% and an accuracy of 90% in the detection of labral lesions (7). Oblique coronal or oblique sagittal, T1-weighted MR images are useful in identifying and classifying SLAP lesions.

### Type I



Fig 4 (A). Type I lesions have degeneration, or fraying, of the superior labrum, but the biceps tendon remains attached at its insertion.

### Type II



Fig 4 (B). Type II lesions demonstrate detachment of the superior labrum from the glenoid.

Diagnosis requires a high degree of clinical suspicion and the use of appropriate imaging modalities. Initial evaluation of the shoulder with plain radiography should include anteroposterior (AP) view of the shoulder in internal and external rotation as well as outlet and axillary views. Although radiographs are usually normal, rarely osteochondral impaction injuries of the superomedial humeral head can be seen. Evaluation for other potential pathology such as an os acromiale, anterior acromial spur or a degenerative AC joint

### Type III

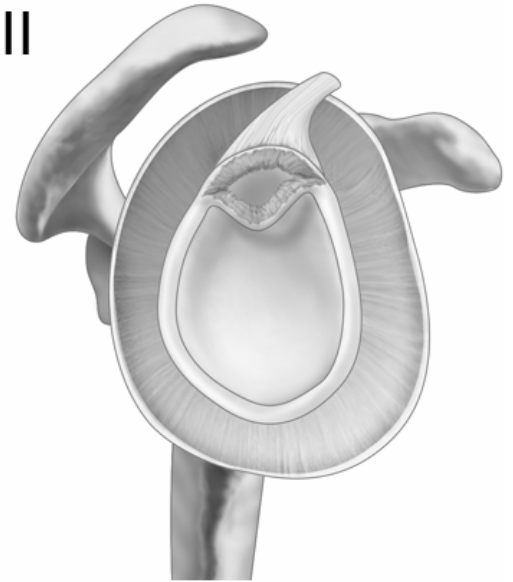


Fig 4 (C). Type III lesions have a bucket handle tear of the superior labrum, but the biceps tendon and labral rim attachment remain intact.

### Type IV

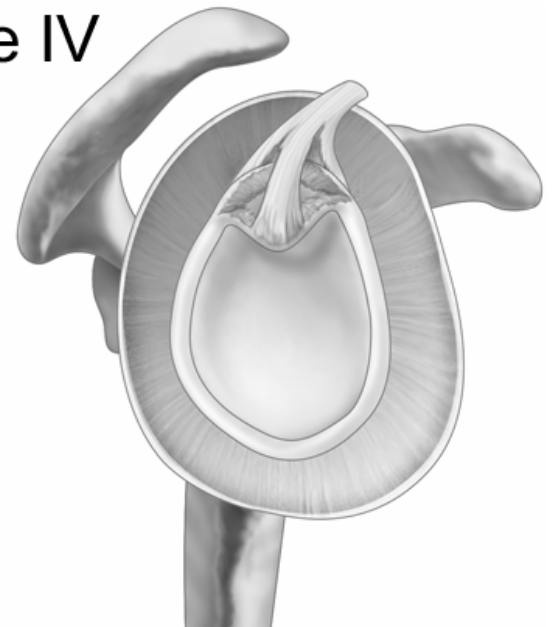


Fig 4 (D). Type IV lesions are characterized by a detachment of the superior labrum with a tear also extending into the biceps tendon.

**Differentiating types of SLAP injuries on MRI:** Type I SLAP injuries show irregularity and pooling of contrast material within the labrum, without evidence of complete extension of the lesion throughout the superior labral substance. Type II SLAP lesions show complete separation of the labrum from the superior glenoid rim. Type III SLAP lesions show detachment and inferior displacement of the superior labrum, consistent with a bucket handle tear, as well as preservation of the biceps tendon insertion. Type IV SLAP lesions show contrast material dissecting into the fibers of the long head of the biceps tendon (7). Knowledge of normal labral variants must be understood because a congenital cleft and anatomic variations of the anterosuperior labrum, such as sublabral foramen or Buford complex, can be misleading (6). In summary, the presence of an irregular collection of contrast material extending into the substance of the superior labrum on MR arthrography is diagnostic of a SLAP lesion (2).

Treatment varies with the type of SLAP lesion. Conservative therapy is reserved for superior labral lesions in which the biceps tendon is stable as in type I and III lesions. The use of nonsteroidal anti-inflammatory medications and corticosteroid injections may decrease symptoms, but do not cure the mechanical problems associated with a superior labral lesion. A shoulder rehabilitation program centered on rotator cuff exercises, scapular stabilization exercises, and regaining a full normal range of motion can improve symptoms of instability or rotator cuff disease and optimize surgical outcomes. Shoulder arthroscopy is the mainstay of diagnosis and treatment for most patients with SLAP lesions (1). A complete diagnostic arthroscopy should include an inspection of the rotator cuff for associated partial thickness or full-thickness tears and inspection of the biceps anchor. While type III and type IV SLAP lesions are fairly obvious arthroscopically, it may be difficult to distinguish a type I from a type II lesion or accurately differentiate the various subtypes of the type II lesion. Surgical management includes

debridement of degenerative labral tissue and repair of avulsed labral fragments or torn biceps tendon.

Following surgery, the patient is typically kept in a sling for 3 weeks. Pendulum and passive range of motion exercises are initiated during week 2. No external rotation in abduction is allowed for the first 3 weeks because of the peel-back mechanism (8). Range of motion exercises, including passive posterior capsule and internal rotation stretching, are initiated and increased through weeks 3-6. At 6 weeks, progressive strengthening of the rotator cuff, scapula stabilizers, biceps, and the deltoid is initiated. At 3-4 months, athletes can begin a sports specific interval-training program, while non-athletes can usually resume full activities. At 5-6 months, athletes can begin to resume full activities on an individualized basis. Throughout the rehabilitation, as well as after, a recurrence of the capsular contracture can occur, placing the shoulder at risk for a recurrent SLAP lesion, so daily stretching of the posteroinferior capsule should be performed.

Superior Labral Anterior-to-posterior (SLAP) lesions are a clinically important cause of shoulder pain and disability. Diagnosis requires an understanding of normal and abnormal anatomy of the superior labrum along with performance of an adequate shoulder exam. High clinical suspicion and the use of appropriate imaging modalities to include conventional MR or MR arthrography of the shoulder can help identify SLAP lesions earlier allowing for appropriate treatment and pre-operative planning.

*Note: Follow this link for a case in the MedPix™ digital teaching file with more information and Category 1 CME and CNE:*

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