NCBI Bookshelf. A service of the National Library of Medicine, National Institutes of Health.

StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2019 Jan-.

Superior Labrum Anterior Posterior (SLAP) Lesions

Authors

Matthew Varacallo[1]; Scott D. Mair[2].

Affiliations

[1] Department of Orthopaedic Surgery, University of Kentucky School of Medicine
[2] Dept. of Orthopaedic Surgery, UK

Last Update: February 5, 2019.

Introduction

Superior labral anterior to posterior (SLAP) lesions constitute a recognized clinical subset of complex shoulder pain pathologies. SLAP lesions demonstrate a predilection for young laborers, overhead athletes, and middle-aged manual laborers.[1] In 1985, Andrews first described superior labral pathologies, and Snyder later coined the term "SLAP lesion" because of the location and characteristic tear extension patterns.[1][2][1] Snyder developed the initial 4-subtype classification of these lesions. In the ensuing decades, other groups including Morgan et al.[3] and Maffet et al.[4] further subdivided the SLAP classification schemes to ultimately delineate ten different types of SLAP tear patterns, including combined SLAP- and Bankart-type injuries seen in specific associative patterns.

Advances in contemporary diagnostic capabilities and arthroscopic management techniques have led to evolving management paradigms since the original descriptions of SLAP-type lesions. These injuries are not solely limited to young throwing athletes as originally described, and SLAP tears commonly can be seen in various patient populations with varying degrees of actual clinical relevance. There is increasing evidence that SLAP tears are frequently present on MRI in asymptomatic overhead athletes. Thus, clinicians should remain cognizant of the known clinical ambiguity that may present with SLAP lesions recognized in isolation or association with other shoulder pathology.

Etiology

The specific etiology underlying the various SLAP tear presentations is multifactorial and remains a topic of debate and controversy. Regardless of the underlying etiology, patients presenting with symptomatic SLAP tears will commonly report the acute onset of deep shoulder pain accompanied by mechanical symptoms such as popping, locking, or catching with various shoulder movements.

Acute traumatic SLAP lesions

Traumatic injuries commonly occur following acute, index events based on one of the following mechanisms[2]:

- Compression-type injuries
    - Classically advocated by Snyder as his original case series from 1990 reported about half of the patient presentations were status post a fall onto an outstretched arm with the arm in varying degrees of shoulder abduction
- Traction-type injuries
    - Occur secondary to sudden jerking movements or after lifting heavy objects
    - Can occur after an unexpected pull on the arm
- Combined-type injuries

Attritional SLAP injuries

Peel-back mechanism

Compared to the acute, traumatic SLAP injuries, the overhead athlete is more likely to present with attritional-based etiologies. In these scenarios, SLAP tears present with the insidious onset and progressive deep shoulder pain in young athletes with the arm in the abduction and external rotation position during the late-cocking phase of throwing. In this position, the force on the biceps coupled with the posterior glide of the humerus results in the peeling off of the posterosuperior quadrant of the glenoid and posterior labrum.[5]

There remains debate regarding whether the so-called peel-back mechanism versus the deceleration phase of throwing is most responsible for the pathologic forces driving SLAP tears in overhead athletes.[6] The former implicates the late-cocking phase of throwing while the latter would theoretically implicate more traction-based mechanisms. Cadaveric studies have demonstrated SLAP tears are more likely to occur with the shoulder in a forward flexed position compared to positions in extension.[7]

Degenerative SLAP lesions

Degenerative SLAP tears can develop secondary to the normal "wear-and-tear" patterns seen in patients with advanced age. Degenerative SLAP tears often affect overhead laborers with increasing degrees of association in patients over 40 years old[8]

Types I – VIII[9]

- **Type I SLAP tear**
  - Degenerative
  - Fraying occurs at the free edge of the labrum
  - Insertion to the superior glenoid remains intact
- **Type II SLAP tear**
  - Acute
  - The labrum and the long head of biceps tendon (LHBT) are torn and avulses off the glenoid cavity
  - The avulsed area is now devoid of cartilage in the zone of injury
- **Type III SLAP tear**
  - The "bucket-handle" pattern
  - The labral insertion of LHBT is left unaffected
  - Rarest form
- **Type IV SLAP tear**
  - "Type III plus anterior shoulder instability"
  - Type III tear pattern plus extension into the LHBT
  - Often seen in association with shoulder instability, and anterior labral tears
- **Type V Slap tear**
  - "Type II plus anterior shoulder instability"
- **Type VI Slap tear**
  - Incidence rate is unknown

- Tear pattern involves larger superior labral flaps without detachment of the LHBT insertion

- **Type VII Slap tear**
  - Type II SLAP tear pattern plus middle and inferior IGHL compromise
  - Tear pattern seen in the setting of complex shoulder instability presentations
- **Type VIII Slap tear**
  - Type II SLAP tear pattern plus additional cartilage injury adjacent to the bicipital footplate

Epidemiology

It is important to appreciate the limitations in our ability to accurately report the definitive epidemiological trends as the contemporary recognition and diagnosis of SLAP injuries remains debated.[10][11] Furthermore, the respective incidence rates for the clinical diagnosis of SLAP lesions and the incidence of SLAP repairs remains limited given the paucity of available high-quality studies reporting available epidemiologic data and surgical management trends.[12] These concepts are further realized by the fact that a formal diagnosis code was not available until 2001, and it took until 2003 to institute a separate Current Procedural Terminology (CPT) code: 29807.[13][14]

The highest incidence rates of SLAP lesions present in the 20- to 29-year-old and 40- to 49-year-old age groups.[15] Additionally, we now recognize that SLAP lesions commonly occur in asymptomatic overhead athletes.[16][17] Analogous to meniscal cleavage planes, many Major League Baseball (MLB) team physicians now recognize these asymptomatic "tears" as adaptive changes in high-level, experienced overhead throwers and MLB pitchers.[18]

As our knowledge evolved over time with improvements in magnetic resonance imaging (MRI) quality, SLAP tears subsequently became a more frequent diagnosis. However, the ideal treatment of SLAP tears was never fully elucidated, and thus the increasing recognition of SLAP injuries brought about an increased incidence of SLAP repair rates across institutions.

The rise of SLAP repair rates

While Snyder's group reported that SLAP repairs represent about 3% of shoulder cases in a large tertiary referral center, ensuing studies from the first decade of the 2000s reported a consistent rise in the overall increasing rate of SLAP repairs performed at many other institutions. Weber et al. reported surprising trends after mining the American Board of Orthopaedic Surgery (ABOS) Part II database. The ABOS database houses the collection of International Classification of Diseases, Tenth Revision (ICD-10) and CPT coding across eligible ABOS Part II candidates during their respective board collection periods. The authors noted an increase in the SLAP repair rate to greater than 10% of shoulder cases reported by the year 2008.[12]

Similarly, a 2012 study reported the rising incidence of arthroscopic SLAP repair rates within New York State from 2002 to 2010, noting a 464% increase in the number of SLAP repairs. This increase constituted a jump in case volume reporting from 765 to 4313 annual SLAP repairs. This increase translated to a population-based increased incidence rate from 4 per 100000 patients in 2002 to 22.3 per 100000 patients in 2010.[19]

The fall of SLAP repair rates

As our knowledge regarding the actual clinical significance of SLAP tear presentations continued to evolve from 2010 and beyond, the initial rise in the incidence rate of SLAP repairs performed reached its peak before subsequently declining over the last decade. Moreover, clinicians began reporting on the critical importance of differentiating younger, active patient populations (e.g., under 40 years old) and overhead athletes from the older patients (e.g., over 40 years old) with degenerative SLAP tears secondary to repetitive overhead manual laborer occupations.[20]

Erickson et al. reported in 2016 that an institutional trend from 2004 to 2014 (including four fellowship-trained orthopedic surgeons) revealed decreasing rates of total SLAP repairs performed. Further, the age of patients operated

on for SLAP tears was decreasing, and the majority of SLAP repairs still being performed by the latter half of the study were limited to mostly Type II SLAP tears.[8]

A 2015 study investigated the adjusted incidence rates of SLAP tears as reported in the Defense Medical Epidemiological Database between 2002 and 2009. The adjusted annual incidence rate for SLAP lesions increased from 0.31 cases per 1000 person-years in 2002 to 1.88 cases per 1000 person-years in 2009, with an average annual increase of just over 20% during the study period.[11]

Despite the aforementioned limitations, the contemporary consensus regarding SLAP tears is that they account for 80% to 90% of labral pathology in the stable shoulder, although they are typically seen in association with other shoulder pathologies and rarely present in isolation.[21] Furthermore, SLAP tears account for approximately 1% to 3% of injuries presenting to sports medicine referral centers, and SLAP tears are present in approximately 6% of shoulder arthroscopy procedures.[2][21][22]

Pathophysiology

Anchor Anatomy

Variability in the anatomy of the biceps anchor and tendinous origin translates to varying levels of strain on the superior labrum[23]. Vangsness et al. initially described four types of attachments patterns of the long head of the biceps tendon (LHBT) to the superior glenoid rim and the superior labrum.[24] These four types were described based on macroscopic observation of 105 cadaveric shoulder specimens:

- Posterior, complete – 22%
- Posterior, dominant – 33%
- Equal (anterior and posterior) – 37%
- Anterior, complete – 8%

Tuoheti et al.[25] later clarified these attachment types and included their relationships with the glenoid attachment of the glenohumeral ligaments. Moreover, the macroscopic attachment types correlated to the specimen histologic sectioning observed in sagittal section. In this study (also studying over 100 shoulder cadaver specimens), the attachment sites clarified the findings from the previous study:

- Posterior, complete – 28%
- Posterior, dominant – 56%
- Equal (anterior and posterior) – 16%
- Anterior, complete – 0%

The latter study is the contemporary consensus agreement regarding the LHBT attachment patterns.[25]

Sublabral variations

Another potential nidus predisposing certain patients to SLAP tears is the presence of a sublabral recess (or sublabral sulcus). The recess/sulcus can be present during fetal development as early as by 22 weeks in pregnancy, persisting throughout childhood and into adulthood.[26]

In contrast, a sublabral hole or sublabral foramen,[27] is typically located at the 12 to 2 o'clock position and is the anatomic manifestation of a congenital failure of fusion of the labrum which attaches to the glenoid with a smooth margin or a medial slip.[28]

Finally, the Buford complex is a congenitally absent anterosuperior labrum plus a thickened cord-like middle glenohumeral ligament.[27]

Histopathology

Alpantaki et al. previously demonstrated that the tendon of the long head of the biceps contains a complex network of sensory and sympathetic nerve fibers.[29] Previous reports have emphasized the LHBT as a potentially dominant source of anterior shoulder pain at clinical presentation.[30][31]

Boesmueller recently histologically characterized the most proximal extent of the LHBT, specifically the neurofilament distribution as the tendon transitions into the superior labral complex. The authors demonstrated via immunohistochemical staining that there is an inhomogeneous distribution of nerve endings and sympathetic nerve fibers throughout the superior labral complex. Interestingly enough, the anterior aspect of the superior labrum and the labral region anterior to the LHBT origin has the highest density of these fibers.[32]

This factor may have a potential impact on patients experiencing persistent pain following various types of SLAP repairs. More research is necessary regarding the histologic characterization of the superior labrum-LHBT complex.

History and Physical

Clinicians should obtain a comprehensive history should when evaluating patients presenting with acute or chronic shoulder pain. SLAP tears may present in a relatively nonspecific fashion and association with other shoulder pathologies. Clinicians should inquire regarding certain elements in history taking that may help differentiate SLAP tears from other shoulder injuries.

Pertinent elements in history taking to best elucidate the nature of a potential SLAP tear (or other associated shoulder injuries) include[33][34][35]

- Acute onset of “deep” shoulder pain
- Mechanical symptoms: popping, locking, catching with various movements and activity
- History of any sudden, jerking force to the shoulder with an associated onset of pain
- History of or current episodes of shoulder instability
- History of or current sport-specific participation
    - Including level of competition (e.g., professional, collegiate, recreational)
    - Common SLAP-provoking sports include but are not limited to:
        - Overhead sports (volleyball, baseball pitchers, javelin, swimming)
    - History or current manual/physical laborer occupations

Characteristics of LHBT-associated pathologies have been previously described and may include any combination of the following:

- Atraumatic, insidious onset of anterior shoulder pain
- Symptom exacerbation with overhead activities
- Pain radiating down the anterior arm from the shoulder
- Clicking or audible popping reported in the setting of proximal biceps instability
- Pain at rest, pain at night

In addition, a thorough history includes a detailed account of the patient’s occupational history and current status of employment, hand dominance, history of injury/trauma to the shoulder(s) and/or neck, and any relevant surgical history.

Physical Examination Pearl [36][37][38][39][40][39]

C-spine / neck exam

Co-existing cervical radiculopathy should be ruled out in any situation where neck and/or shoulder pathology is in consideration. Observation of neck posturing, muscular symmetry, palpable tenderness, and active/passive ROM should undergo evaluation. Special tests that are helpful in this regard include the Spurling maneuver, myelopathic testing, reflex testing, and a comprehensive neurovascular exam.

Shoulder exam

Examiners should observe and compare bilateral shoulder girdles for any notable asymmetry, scapular posturing, and muscle bulk comparison or any atrophic changes. The skin should be observed for the presence of any previous surgical incisions, lacerations, scars, erythema, or induration.

Chronic instability patients will almost always exhibit at least a mild degree of asymmetry. The deltoid muscle often demonstrates atrophy in chronic dislocators. The findings can be rather subtle, especially in obese patients.

In the setting of chronic anterior instability, the clinician may be able to appreciate a palpable anterior fullness. Upon observation, the posterior shoulder (when viewed from the side of the patient) will be relatively flat relative to the anterior fullness. Chronic anterior and posterior instability patients may also exhibit corresponding posterior and anterior acromial prominences, respectively.

Scapulothoracic motion and scapular winging should also be evaluated during active and passive motion.

Following the observational component of the physical examination, the active and passive ROM are both documented; this may be limited in the setting of initial follow-up in the clinic after an acute instability event, or the setting of any complex instability case, especially in the setting of glenoid bone loss.

In the setting of chronic anterior instability, the clinician should attempt to assess the current status of the axillary nerve, although chronic dislocators often exhibit normal deltoid function as well as internal and external rotator strength. Specific testing of the supraspinatus muscle can be difficult when passive ROM is limited. Any evidence of significant muscular weakness may hint at an underlying associated neurologic deficit.

A detailed sensory examination should take place in all acute and chronic instability patients. In addition to axillary nerve function, motor function of the elbow, wrist, and hand should undergo an assessment to rule out the possibility of a brachial plexus injury associated with the dislocation. Distal pulses should be assessed at the wrist as well.

Older patients and in the setting of suspected concomitant shoulder pathologies (e.g., rotator cuff injuries or biceps tendon pathology), specialized testing for these pathologies also merit consideration.

Provocative examination testing/maneuver [36][37][38][39]

The available evidence of level I and II studies in the recent literature suggests that a combination of specific tests such as the Speed's and uppercut test is recommended for the clinical detection of biceps tendon lesions. Recent studies have reported on the diagnostic accuracy of specific tests concerning diagnosing SLAP tears:

Speed's test[41][42][36]:

- Sensitivity: 32%
- Specificity: 75%
- A positive test consists of pain elicited in the bicipital groove when the patient attempts to forward elevate the shoulder against examiner resistance; the elbow is slightly flexed, and the forearm is supinated

Uppercut test[43]:

- Sensitivity: 73%

- Specificity: 78%
- The involved shoulder is positioned at neutral, the elbow is flexed to 90 degrees, the forearm is supinated, and the patient makes a fist. The examiner instructs the patient to perform a boxing "uppercut" punch while placing his or her hand over the patient's fist to resist the upward motion. A positive test is a pain or a painful pop over the anterior shoulder near the bicipital groove region

Yergason's test[42][37][42]:

- Sensitivity: 43%
- Specificity: 79%
- The arm is stabilized against the patient's trunk, and the elbow flexed to 90 degrees with the forearm pronated. The examiner manually resists supination while the patient also externally rotated the arm against resistance. A positive test is noted if the patient reports pain over the bicipital groove and/or subluxation of the LHB tendon

Bear-Hug test[43]:

- Sensitivity: 79%
- Specificity: 60%
- The patient places their hand on the contralateral (normal) shoulder in a "self-hug" position. The palm is on the anterior aspect of the contralateral shoulder with the elbow flexed to 90 degrees. The examiner applies a perpendicular external rotational force to try and lift the patient's hand off of the shoulder. A positive test results when the patient cannot hold the hand against the shoulder as the examiner applies an external rotation force

Belly Press test[43][39]:

- Sensitivity: 31%
- Specificity: 85%
- The examiner has the patient's arm at 90 degrees of elbow flexion, and IR testing is performed by the patient pressing the palm of his/her hand against the belly, bringing the elbow in front of the plane of the trunk. The examiner initially supports the elbow, and a positive test occurs if the elbow does not maintain this position upon the examiner removing the supportive force

O'Brien/Active Compression test[43][36]

- Sensitivity: 38%
- Specificity: 61%
- The patient is standing, and the arm of interest is positioned at 90 degrees of forward flexion, 10 degrees of adduction, and internally rotated so the thumb points toward the floor. The examiner places his or her hand over the patient's elbow while instructing the patient to resist the examiner's downward force applied to the arm. This maneuver is repeated with the patient's arm now rotated, so the palm faces the ceiling. A positive test is denoted by pain located at the joint line during the initial maneuver (thumb down/internal rotation) in conjunction with reported improvement or elimination of the pain during the subsequent maneuver (palm up/external rotation)

Anterior slide test[44][36]:

- Sensitivity: 10%
- Specificity: 82%

- The patient stands with his or her hand of the involved arm placed on the ipsilateral hip with the thumb pointing posteriorly. The examiner places one hand on the joint line of the shoulder and the other hand on the elbow. The examiner then applies an axial load in an anterosuperior direction from the elbow to the shoulder. A positive test includes pain or a painful click on the anterior or posterior joint line

Supine Resistance test[45]:

- Sensitivity: 80%
- Specificity: 69%
- The patient lies supine on the exam table with his or her arms resting in full elevation with the forearm and hand supported by the table. The palm is facing upward. The examiner then applies a downward resistive force just distal to the elbow while asking the patient to perform a throwing motion. The test registers positive only if it elicits pain deep inside the shoulder joint or at the shoulder's dorsal aspect along the joint line during the resisted movement. Performance of the test on the nonaffected shoulder should not elicit any pain

Mayo Shear test (also known as the Modified O'Driscoll test or the Modified dynamic labral shear test[46]:

- Sensitivity: 80%
- The patient stands with his or her involved arm flexed 90 degrees at the elbow and abducts the shoulder in the scapular plane to above 120 degrees. The examiner then applies terminal external rotation until resistance is appreciated. Next, the examiner applies a shear force through the shoulder joint by maintaining external rotation and horizontal abduction and lowering the arm from 120 to 60 degrees abduction. A positive test includes a reproduction of the pain and/or a painful click or catch in the joint line along the posterior joint line between 120 and 90 degrees of abduction

Evaluation

Radiographic imaging is necessary for all patients with acute or chronic shoulder pain.

Radiographs

Clinicians should obtain a true anteroposterior (AP) image of the glenohumeral joint (also known as the "Grashey" view). The true AP image is taken with the patient rotated between 30 and 45 degrees offset the cassette in the coronal plane. The beam can otherwise be rotated while the patient is neutral in the coronal plane. Other standard views include the axillary lateral view and "scapular Y"/outlet views.

Advanced imaging

MRI and MR arthrography (MRA) are commonly used imaging modalities to detect a SLAP lesion. Intra-articular contrast media and articular effusion, as well as arm traction and external rotation, improve the sensitivity of the MRI to determine a SLAP lesion. Clinicians should keep in mind the utilization of MRA may promote the overdiagnosis of asymptomatic (or clinically irrelevant) SLAP lesions and thus exercise best clinical judgment in ordering specific advanced imaging modalities. The endemic rate of variations of labral anatomy visible on MRI in asymptomatic overhead throwers should prompt caution before concluding that the labrum is the source of the patient's pain.[18]

Schwartzberg reported MRI documented SLAP lesions can be present in up to 72% of middle-aged, asymptomatic patients.[47] Moreover, it is important to recognize that other shoulder pathologies, such as shoulder impingement (external or internal), rotator cuff syndrome, LHBT tendinopathy, acromioclavicular (AC) arthritis are all common pain generators in the middle-age population.[39][38] Thus, the inadvertent focus given to a potential SLAP lesion may be either overappreciated or misdirected. As mentioned, this concept can also be applied to the young, athletic population as well. In 2005, an MRI analysis of professional handball players demonstrated abnormalities in 93% of shoulders with only 37% being symptomatic.[48]

Treatment / Management

It is essential to understand that not all SLAP tears are created equal. Clinicians should focus on the potential relevance of the SLAP lesion as it attributes to the specific patient's pain and dysfunction. Asymptomatic tears should be observed. Those that are potentially contributing to patient-reported symptoms may require surgery, and depending on the particular SLAP tear pattern and the presence (or absence) of other associated shoulder pathologies, the recommended surgical technique(s) may vary. Moreover, for the vast majority of SLAP injuries, the initial management is nonoperative.

Nonoperative management modalities

Anti-inflammatory medications, cryotherapy/cooling/ice application, rest and activity modification

An initial period of rest following the acute (or acute-on-chronic) injury should be implemented in all patients. In the appropriate patient, the use of NSAIDs and cryotherapy device/ice pack application can be beneficial for pain control. Athletes and overhead laborers should also be placed on a restricted sport-specific timeline protocol, and manual laborers should receive appropriate occupational modifications.

Physical therapy

The goal of physical therapy (PT) modalities should be to treat any underlying pathologic shoulder biomechanics that may have been present at baseline before the acute injury. Also, shoulder girdle proprioceptive training is beneficial to help prevent re-injury.

Scapulothoracic dyskinesia may result from any degree of imbalance of the shoulder girdle muscles and static/dynamic glenohumeral joint stabilizers. In addition, posterior shoulder joint capsular contractures should be addressed with various stretching and strengthening programs. Utilizing dedicated formal PT regimens can help ensure each "SLAP tear" diagnosis is most appropriately managed to help mitigate the risks of inferior patient outcomes.

Multiple reports on high-level (i.e., professional) overhead throwers have demonstrated equivalent outcomes regarding return to play and return to play performance in athletes managed with operative versus nonoperative modalities alone. Nonoperative PT regiments focused on correcting for scapular dyskinesia and glenohumeral internal rotation deficit (GIRD).[49]

If the non-operative therapy fails and symptoms persist that prevent sports activities or activities of daily living, then this would indicate the need for operative treatment.

Surgical management

After exhausting nonoperative treatment modalities, operative management is considered in tandem while keeping in mind each patient's age, concomitant pathologies, functional requirements, occupational demands, and sport-specific goals.

Several authors have proposed surgical treatment algorithms depending on the specific type of SLAP lesion identified on advanced imaging, clinical exam, and during intraoperative arthroscopy.[41] It is critical to discern whether the labrum alone is responsible for the patient's symptoms and whether restoring the labral attachment and biceps root to the glenoid will help. In addition, understanding how to treat a SLAP tear in the setting of other concomitant injuries is imperative. For example, in older patients with or without rotator cuff repair, the repair of the SLAP correlates with inferior results in comparison to intentional neglect or performing a bicep tenodesis/tenotomy regarding stiffness, persistent pain and need for revision surgery.[18] However, in younger patients presenting with shoulder instability, the SLAP injury may be present and contributing to symptoms, especially in the setting of an acute anterior and/or posterior labral tear. The following algorithm has been previously proposed[41]

- **Type I SLAP tear**
    - Surgical treatment: arthroscopic debridement

- **Type II SLAP tear**
    - Surgical treatment: SLAP repair versus biceps tenotomy/tenodesis
    - The arthroscopic criterion for a type II SLAP lesion includes the ability to demonstrate (usually with an arthroscopic probe) the definitive separation of the superior labrum from the supraglenoid cartilage rim
    - Burkhart previously described demonstrating a ‘‘peel-back’’ sign during arthroscopy[50]
        - The arm is released from traction and brought into an abducted/externally rotated position. The authors noted that in cases of a positive peel-back sign (i.e., not present in normal shoulders during an arthroscopic examination), the biceps anchor assumes a more vertical and posterior angle that is dynamically visible
- **Type III SLAP tear**
-
    - Surgical treatment: SLAP repair versus resection
    - The bucket-handle tear of the superior labrum is resected, with (rarely) additional repair of the SLAP complex (rare) if needed
- **Type IV SLAP tear**
    - Surgical treatment:
        - IF < 50% of the biceps tendon is affected, consider SLAP repair/resection
        - IF > 50% of the biceps tendon is affected, perform tenotomy/tenodesis
- **Type V Slap tear**
-
    - Surgical treatment: Bankart repair plus SLAP repair
- **Type VI Slap tear**
    - Surgical treatment: SLAP repair versus resection
- **Type VII Slap tear**
    - Surgical treatment: Suture/anchor fixation of anterosuperior labrum plus SLAP repair
- **Type VIII Slap tear**
    - Surgical treatment: SLAP repair versus biceps tenotomy/tenodesis; gentle debridement of any cartilage/chondral unstable flap

SLAP repair technique

Multiple SLAP repair techniques have been previously described. Also, a wide array of implant options are available depending on surgeon preference. Previous authors have advocated for the use of simple versus mattress sutures and the option for knotless fixation devices to minimize the risk of having a bulky knot create symptoms postoperatively.[51][52]

After probing to confirm the diagnosis of a SLAP tear, a shaver can be used to resect unstable flaps of tissue that are deemed irreparable. Glenoid neck preparation is with a tissue elevator, rasp, and/or shaver instrument. The Neviaser portal is often utilized and established under direct visualization once confirming the appropriate trajectory are achieved. The determination of appropriate anchor placement depends on the predominant region of instability regarding the superior labral-biceps tendon complex.

Differential Diagnosis

The differential diagnosis for chronic shoulder pain includes several etiologies:

Impingement

- External/SIS
- Subcoracoid
- Calcific tendonitis
- Internal (including SLAP lesions, GIRD, little league shoulder, posterior labral tears)

RC pathology

- Partial- versus full-thickness tears (PTTs versus FTTs)
- RCA

Degenerative

- Advanced DJD, often associated with RCA
- Glenohumeral arthritis
- Adhesive capsulitis
- Avascular necrosis (AVN)
- Scapulothoracic crepitus

Proximal biceps

- Subluxation–often seen in association with SubSc injuries
- Tendonitis and tendinopathy
- SLAP tears

AC joint conditions

- AC separation
- Distal clavicle osteolysis
- AC arthritis

Instability

- Unidirectional instability–seen in association with an inciting event/dislocation (anterior, posterior, inferior)
- Multidirectional instability (MDI)
- Associated labral injuries/pathology

Neurovascular conditions

- Suprascapular neuropathy–can be associated with a paralabral cyst at the spinoglenoid notch
- Scapular winging–medial or lateral
- Brachial neuritis

- Thoracic outlet syndrome (TOS)
- Quadrilateral space syndrome

Other conditions

- Scapulothoracic dyskinesia
- Os acromiale
- Muscle ruptures (pectoralis major, deltoid, latissimus dorsi)
- Fracture (acute injury or pain resulting from long-standing deformity, malunion, or nonunion)

Prognosis

Although Level I and II studies in the literature are lacking regarding outcomes following arthroscopic type II SLAP repairs, most studies report overall favorable results and good outcomes in the appropriately selected patients.[53][54][55] A number of authors report good results in athletes, including those with sport-specific overhead demand requirements.[56]

Clinicians should recognize that inferior outcomes have been demonstrated in the literature following revision arthroscopic SLAP repairs and in high-level (i.e. professional) overhead athletes.[57] Professional baseball pitchers demonstrate relatively inferior outcomes in terms of return to play and return to prior performance level. In fact, superior outcomes have been reported in this particular subset of athletic patients following non-surgical management alone.[49][57]

Complications

Risk factors for revision surgery are critical in discussing overall patient expectations and discussing the risks of continued pain, stiffness, dysfunction, and the potential need for further surgery in the future. A 2017 level III case-control study highlighted the potential risk factors for revision surgery following SLAP repair, with the inclusion of nearly 5000 patients in the database query[58]

- Age greater than 40 years
- Female gender
- Obesity
- Smoking
- Presence of concomitant LHBT tendinitis or tendinosis
    - Odds ratio for revision surgery was 5.1 in the setting of LHBT tearing/fraying
    - Odds ratio for revision surgery was 3.5 in the setting of LHBT tendinitis alone

Postoperative and Rehabilitation Care

Weeks 0 to 4 to 6 postop

- Sling immobilization until 4W postop
- Early shoulder pendulum exercises, periscapular muscle activation exercises
- Passive and active-assist forward elevation encouraged, may progress limitations depending on surgeon preference
- Avoid extremes of abduction and external rotation

Weeks 4 to 6 postop

- Begin incorporation of active ROM; Rotator cuff strengthening/Periscapular stabilizers
- Avoid extremes of abduction and external rotation

Weeks 6 to 12 postop

- Functional exercise and light strengthening can be progressively incorporated
- OK to begin biceps resistance exercises beyond 6-8 weeks postop
    - Resisted elbow flexion, resisted forearm supination

Week 12 and beyond

- Advance strength and ROM, sport-specific; OK for everything except overhead throwing (approx 5 months)
- Typical return to sport around 5 to 6 months

Consultations

Primary care sports medicine specialists experienced in managing SLAP tears nonoperatively. Given the clinical complexity of SLAP injuries and concomitant shoulder pathologies, early consultation with an orthopedic surgeon is encouraged.

Deterrence and Patient Education

Patients presenting with concerns over a potential SLAP tear should receive education regarding the contemporary clinical knowledge we now have regarding these injuries. Moreover, patients will often present with an MRI final report stating a SLAP tear was present on imaging. In these clinical scenarios especially, the recommendation is to reassure the patient and educate them regarding the high incidence rate of "incidental" or "clinically irrelevant" SLAP injuries and detailed and focused attention should be given to appropriately delineating the extent of all potential underlying shoulder girdle pathologies.

Enhancing Healthcare Team Outcomes

SLAP lesions first gained recognition in the 1980s. Over the last two decades, our knowledge and appreciation of SLAP tear recognition, diagnosis, treatment, and potential surgical management has evolved dramatically. There is an increasing body of literature evidence now recognizing that appropriate patient selection is critical, and management must consider a multitude of factors include the patient's age, activity level, sport-specific requirements, occupational demands, and expectations of a good to excellent outcome. **Level of evidence:** Level II-III

Questions

To access free multiple choice questions on this topic, click here.

References

1. Andrews JR, Carson WG, McLeod WD. Glenoid labrum tears related to the long head of the biceps. Am J Sports Med. 1985 Sep-Oct;13(5):337-41. [PubMed: 4051091]
2. Snyder SJ, Karzel RP, Del Pizzo W, Ferkel RD, Friedman MJ. SLAP lesions of the shoulder. Arthroscopy. 1990;6(4):274-9. [PubMed: 2264894]
3. Morgan CD, Burkhart SS, Palmeri M, Gillespie M. Type II SLAP lesions: three subtypes and their relationships to superior instability and rotator cuff tears. Arthroscopy. 1998 Sep;14(6):553-65. [PubMed: 9754471]
4. Maffet MW, Gartsman GM, Moseley B. Superior labrum-biceps tendon complex lesions of the shoulder. Am J Sports Med. 1995 Jan-Feb;23(1):93-8. [PubMed: 7726358]

5. Burkhart SS, Morgan CD, Kibler WB. The disabled throwing shoulder: spectrum of pathology Part I: pathoanatomy and biomechanics. Arthroscopy. 2003 Apr;19(4):404-20. [PubMed: 12671624]
6. Kuhn JE, Lindholm SR, Huston LJ, Soslowsky LJ, Blasier RB. Failure of the biceps superior labral complex: a cadaveric biomechanical investigation comparing the late cocking and early deceleration positions of throwing. Arthroscopy. 2003 Apr;19(4):373-9. [PubMed: 12671620]
7. Clavert P, Bonnomet F, Kempf JF, Boutemy P, Braun M, Kahn JL. Contribution to the study of the pathogenesis of type II superior labrum anterior-posterior lesions: a cadaveric model of a fall on the outstretched hand. J Shoulder Elbow Surg. 2004 Jan-Feb;13(1):45-50. [PubMed: 14735073]
8. Erickson BJ, Jain A, Abrams GD, Nicholson GP, Cole BJ, Romeo AA, Verma NN. SLAP Lesions: Trends in Treatment. Arthroscopy. 2016 Jun;32(6):976-81. [PubMed: 26907371]
9. Clavert P. Glenoid labrum pathology. Orthop Traumatol Surg Res. 2015 Feb;101(1 Suppl):S19-24. [PubMed: 25596985]
10. Kampa RJ, Clasper J. Incidence of SLAP lesions in a military population. J R Army Med Corps. 2005 Sep;151(3):171-5. [PubMed: 16440960]
11. Waterman BR, Cameron KL, Hsiao M, Langston JR, Clark NJ, Owens BD. Trends in the diagnosis of SLAP lesions in the US military. Knee Surg Sports Traumatol Arthrosc. 2015 May;23(5):1453-9. [PubMed: 24318507]
12. Weber SC, Martin DF, Seiler JG, Harrast JJ. Superior labrum anterior and posterior lesions of the shoulder: incidence rates, complications, and outcomes as reported by American Board of Orthopedic Surgery. Part II candidates. Am J Sports Med. 2012 Jul;40(7):1538-43. [PubMed: 22628153]
13. Rossy W, Sanchez G, Sanchez A, Provencher MT. Superior Labral Anterior-Posterior (SLAP) Tears in the Military. Sports Health. 2016 Nov/Dec;8(6):503-506. [PMC free article: PMC5089360] [PubMed: 27765830]
14. Waterman BR, Arroyo W, Heida K, Burks R, Pallis M. SLAP Repairs With Combined Procedures Have Lower Failure Rate Than Isolated Repairs in a Military Population: Surgical Outcomes With Minimum 2-Year Follow-up. Orthop J Sports Med. 2015 Aug;3(8):2325967115599154. [PMC free article: PMC4622306] [PubMed: 26535389]
15. Zhang AL, Kreulen C, Ngo SS, Hame SL, Wang JC, Gamradt SC. Demographic trends in arthroscopic SLAP repair in the United States. Am J Sports Med. 2012 May;40(5):1144-7. [PubMed: 22328710]
16. Miniaci A, Mascia AT, Salonen DC, Becker EJ. Magnetic resonance imaging of the shoulder in asymptomatic professional baseball pitchers. Am J Sports Med. 2002 Jan-Feb;30(1):66-73. [PubMed: 11798999]
17. Connor PM, Banks DM, Tyson AB, Coumas JS, D'Alessandro DF. Magnetic resonance imaging of the asymptomatic shoulder of overhead athletes: a 5-year follow-up study. Am J Sports Med. 2003 Sep-Oct;31(5):724-7. [PubMed: 12975193]
18. Mathew CJ, Lintner DM. Superior Labral Anterior to Posterior Tear Management in Athletes. Open Orthop J. 2018;12:303-313. [PMC free article: PMC6110067] [PubMed: 30197712]
19. Onyekwelu I, Khatib O, Zuckerman JD, Rokito AS, Kwon YW. The rising incidence of arthroscopic superior labrum anterior and posterior (SLAP) repairs. J Shoulder Elbow Surg. 2012 Jun;21(6):728-31. [PubMed: 22608836]
20. Johannsen AM, Costouros JG. A Treatment-Based Algorithm for the Management of Type-II SLAP Tears. Open Orthop J. 2018;12:282-287. [PMC free article: PMC6110057] [PubMed: 30197709]
21. Ilahi OA, Labbe MR, Cosculluela P. Variants of the anterosuperior glenoid labrum and associated pathology. Arthroscopy. 2002 Oct;18(8):882-6. [PubMed: 12368786]
22. Kim TK, Queale WS, Cosgarea AJ, McFarland EG. Clinical features of the different types of SLAP lesions: an analysis of one hundred and thirty-nine cases. J Bone Joint Surg Am. 2003 Jan;85-A(1):66-71. [PubMed: 12533574]
23. Yeh ML, Lintner D, Luo ZP. Stress distribution in the superior labrum during throwing motion. Am J Sports Med. 2005 Mar;33(3):395-401. [PubMed: 15716255]
24. Vangsness CT, Jorgenson SS, Watson T, Johnson DL. The origin of the long head of the biceps from the scapula and glenoid labrum. An anatomical study of 100 shoulders. J Bone Joint Surg Br. 1994 Nov;76(6):951-4. [PubMed: 7983126]
25. Tuoheti Y, Itoi E, Minagawa H, Yamamoto N, Saito H, Seki N, Okada K, Shimada Y, Abe H. Attachment types of

the long head of the biceps tendon to the glenoid labrum and their relationships with the glenohumeral ligaments. Arthroscopy. 2005 Oct;21(10):1242-9. [PubMed: 16226654]

26. Fealy S, Rodeo SA, Dicarlo EF, O'Brien SJ. The developmental anatomy of the neonatal glenohumeral joint. J Shoulder Elbow Surg. 2000 May-Jun;9(3):217-22. [PubMed: 10888166]
27. Kwak SM, Brown RR, Resnick D, Trudell D, Applegate GR, Haghighi P. Anatomy, anatomic variations, and pathology of the 11- to 3-o'clock position of the glenoid labrum: findings on MR arthrography and anatomic sections. AJR Am J Roentgenol. 1998 Jul;171(1):235-8. [PubMed: 9648795]
28. Chang D, Mohana-Borges A, Borso M, Chung CB. SLAP lesions: anatomy, clinical presentation, MR imaging diagnosis and characterization. Eur J Radiol. 2008 Oct;68(1):72-87. [PubMed: 18499376]
29. Alpantaki K, McLaughlin D, Karagogeos D, Hadjipavlou A, Kontakis G. Sympathetic and sensory neural elements in the tendon of the long head of the biceps. J Bone Joint Surg Am. 2005 Jul;87(7):1580-3. [PubMed: 15995126]
30. Tiwana MS, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Nov 14, 2018. Anatomy, Shoulder and Upper Limb, Biceps Muscle. [PubMed: 30137823]
31. Eovaldi BJ, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Dec 3, 2018. Anatomy, Shoulder and Upper Limb, Shoulder Muscles. [PubMed: 30521257]
32. Boesmueller S, Nógrádi A, Heimel P, Albrecht C, Nürnberger S, Redl H, Fialka C, Mittermayr R. Neurofilament distribution in the superior labrum and the long head of the biceps tendon. J Orthop Surg Res. 2017 Nov 22;12(1):181. [PMC free article: PMC5700685] [PubMed: 29166912]
33. Popp D, Schöffl V. Superior labral anterior posterior lesions of the shoulder: Current diagnostic and therapeutic standards. World J Orthop. 2015 Oct 18;6(9):660-71. [PMC free article: PMC4610908] [PubMed: 26495243]
34. Hill L, Collins M, Posthumus M. Risk factors for shoulder pain and injury in swimmers: A critical systematic review. Phys Sportsmed. 2015 Nov;43(4):412-20. [PubMed: 26366502]
35. Nickerson M, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Jan 19, 2019. Swimmer's Shoulder. [PubMed: 29262079]
36. Varacallo M, Mair SD. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Jan 9, 2019. Biceps Tendon Dislocation and Instability. [PubMed: 30475566]
37. Varacallo M, Mair SD. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Jan 19, 2019. Proximal Biceps Tendinitis and Tendinopathy. [PubMed: 30422594]
38. Varacallo M, Mair SD. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Oct 27, 2018. Rotator Cuff Tendonitis. [PubMed: 30335303]
39. Varacallo M, Mair SD. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Oct 27, 2018. Rotator Cuff Syndrome. [PubMed: 30285401]
40. Jeanmonod R, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Nov 26, 2018. Geriatric Cervical Spine Injury. [PubMed: 29262191]
41. Brockmeyer M, Tompkins M, Kohn DM, Lorbach O. SLAP lesions: a treatment algorithm. Knee Surg Sports Traumatol Arthrosc. 2016 Feb;24(2):447-55. [PubMed: 26818554]
42. Holtby R, Razmjou H. Accuracy of the Speed's and Yergason's tests in detecting biceps pathology and SLAP lesions: comparison with arthroscopic findings. Arthroscopy. 2004 Mar;20(3):231-6. [PubMed: 15007311]
43. Ben Kibler W, Sciascia AD, Hester P, Dome D, Jacobs C. Clinical utility of traditional and new tests in the diagnosis of biceps tendon injuries and superior labrum anterior and posterior lesions in the shoulder. Am J Sports Med. 2009 Sep;37(9):1840-7. [PubMed: 19509414]
44. Meserve BB, Cleland JA, Boucher TR. A meta-analysis examining clinical test utility for assessing superior labral anterior posterior lesions. Am J Sports Med. 2009 Nov;37(11):2252-8. [PubMed: 19095895]
45. Ebinger N, Magosch P, Lichtenberg S, Habermeyer P. A new SLAP test: the supine flexion resistance test. Arthroscopy. 2008 May;24(5):500-5. [PubMed: 18442680]
46. Pandya NK, Colton A, Webner D, Sennett B, Huffman GR. Physical examination and magnetic resonance imaging in the diagnosis of superior labrum anterior-posterior lesions of the shoulder: a sensitivity analysis. Arthroscopy. 2008 Mar;24(3):311-7. [PubMed: 18308183]
47. Schwartzberg R, Reuss BL, Burkhart BG, Butterfield M, Wu JY, McLean KW. High Prevalence of Superior

Labral Tears Diagnosed by MRI in Middle-Aged Patients With Asymptomatic Shoulders. Orthop J Sports Med. 2016 Jan;4(1):2325967115623212. [PMC free article: PMC4710128] [PubMed: 26779556]
48. Jost B, Zumstein M, Pfirrmann CW, Zanetti M, Gerber C. MRI findings in throwing shoulders: abnormalities in professional handball players. Clin. Orthop. Relat. Res. 2005 May;(434):130-7. [PubMed: 15864042]
49. Fedoriw WW, Ramkumar P, McCulloch PC, Lintner DM. Return to play after treatment of superior labral tears in professional baseball players. Am J Sports Med. 2014 May;42(5):1155-60. [PubMed: 24674945]
50. Burkhart SS, Morgan CD. The peel-back mechanism: its role in producing and extending posterior type II SLAP lesions and its effect on SLAP repair rehabilitation. Arthroscopy. 1998 Sep;14(6):637-40. [PubMed: 9754487]
51. Tennent D, Pearse E. A Percutaneous Knotless Technique for SLAP Repair. Arthrosc Tech. 2016 Feb;5(1):e33-5. [PMC free article: PMC4809739] [PubMed: 27073775]
52. Dines JS, Elattrache NS. Horizontal mattress with a knotless anchor to better recreate the normal superior labrum anatomy. Arthroscopy. 2008 Dec;24(12):1422-5. [PubMed: 19038714]
53. Neri BR, Vollmer EA, Kvitne RS. Isolated type II superior labral anterior posterior lesions: age-related outcome of arthroscopic fixation. Am J Sports Med. 2009 May;37(5):937-42. [PubMed: 19229044]
54. Park JH, Lee YS, Wang JH, Noh HK, Kim JG. Outcome of the isolated SLAP lesions and analysis of the results according to the injury mechanisms. Knee Surg Sports Traumatol Arthrosc. 2008 May;16(5):511-5. [PubMed: 18193193]
55. Brockmeier SF, Voos JE, Williams RJ, Altchek DW, Cordasco FA, Allen AA., Hospital for Special Surgery Sports Medicine and Shoulder Service. Outcomes after arthroscopic repair of type-II SLAP lesions. J Bone Joint Surg Am. 2009 Jul;91(7):1595-603. [PMC free article: PMC2702251] [PubMed: 19571081]
56. Neuman BJ, Boisvert CB, Reiter B, Lawson K, Ciccotti MG, Cohen SB. Results of arthroscopic repair of type II superior labral anterior posterior lesions in overhead athletes: assessment of return to preinjury playing level and satisfaction. Am J Sports Med. 2011 Sep;39(9):1883-8. [PubMed: 21737836]
57. Gorantla K, Gill C, Wright RW. The outcome of type II SLAP repair: a systematic review. Arthroscopy. 2010 Apr;26(4):537-45. [PubMed: 20362836]
58. Taylor SA, Degen RM, White AE, McCarthy MM, Gulotta LV, O'Brien SJ, Werner BC. Risk Factors for Revision Surgery After Superior Labral Anterior-Posterior Repair: A National Perspective. Am J Sports Med. 2017 Jun;45(7):1640-1644. [PubMed: 28282498]

Bookshelf ID: NBK538284 PMID: 30855868