

Superior Labral Anterior Posterior Lesions of the Shoulder

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Abstract: Superior labrum anterior and posterior (SLAP) lesion is of fairly recent description and its understanding is rapidly evolving. Its incidence and need for surgical treatment has increased exponentially in line with the increase in shoulder arthroscopies. It is of particular importance in the elite over head athlete and the young. A range of arthroscopic techniques and devices have been described with good functional results. The ability to return to pre injury level of sports remains a concern.

Keywords: Arthroscopic shoulder surgery, biceps anchor, glenoid labrum, slap lesion.

INTRODUCTION

Tears of the superior labrum near to the origin of the long head of biceps were first described among throwing athletes by Andrews in 1985 [1]. The label of 'SLAP', an abbreviation for superior labrum anterior and posterior, was coined by Snyder who went on to devise a classification system for these lesions [2]. Since then these lesions have commanded much attention and investigations into their etiology, biomechanical effects and treatment. The true incidence of SLAP lesion in the general population is not known though Snyder reported an incidence of 3.3 to 4.7% in his shoulder series while Maffet reported a higher incidence of 11.8% [3, 4]. As the use of shoulder imaging and arthroscopy has increased over time, so has the incidence of SLAP lesions and the need for their treatment.

This article aims to reflect on the various features and treatment options for the SLAP lesion as well as the associated controversies.

ANATOMY

The labrum is an incomplete ring of fibrous and fibrocartilagenous tissue with sparse elastin fibres that is attached to the edge of the bony glenoid of the scapula and serves to deepen the glenoid and increase its antero posterior and superior inferior dimensions. The labrum also provides attachment to the glenohumeral ligaments. 40% of the fibres of the long head of biceps originate from the superior glenoid while the rest originates from the supra glenoid tubercle of the scapula, though this proportion could be variable [5]. This supra glenoid tubercle is 5 mm medial to the superior rim of the glenoid. The labrum derives its blood supply from branches of the suprascapular artery, circumflex scapular artery and the posterior circumflex humeral artery [6]. It is partly avascular particularly at its anterior and superior sectors. It is normally triangular in shape though a

meniscoid attachment to the glenoid is also considered normal [7]. The surface of the labrum could be flush with the glenoid articular surface or it could be much more proud to form a bumper labrum [8].

The wide variation in the type of labral attachment at the biceps anchor region has been classified by Smith *et al.* based on the extension of the sub labral recess [9]. A superior sub labral recess of more than 5 mm especially in association with a bare superior labral biceps foot print is considered abnormal [10]. The anterosuperior labrum could be loosely attached to the hyaline cartilage covering the bony glenoid, providing for what has been described as a sub labral foramen, or the labrum could be entirely deficient in this sector. When this sub labral deficiency is associated with a thickened or cord like middle gleno humeral ligament, it is termed a Buford complex [11]. A Buford complex should not be confused with a SLAP lesion as any attempt to repair it could result in significant shoulder stiffness. A sub labral foramen is distinguished from a SLAP tear by virtue of its smooth borders and its medial extension between the superior labrum and the bony glenoid, while a labral tear would extend laterally or superiorly into the labrum [7]. Any extension of the sublabral foramen posterior to the biceps anchor should be considered pathological. Differentiating a normal superior glenoid labrum from a non pathological anatomic variant and detecting a pathological SLAP tear can be a challenge even for experienced surgeons [12].

CLASSIFICATION

The original description and classification of Snyder identified four types of SLAP lesions [2]. Further variants and combinations have been added over the years [4].

Type I – This is often an incidental finding in degenerate shoulders where there is fraying and roughening of the biceps anchor area. The biceps anchor cannot be displaced medially on probing.

Type II – Classical SLAP lesion and constitutes more than 50% of cases at arthroscopy. Here the biceps anchor peels off from the supraglenoid tubercle with the associated detachment of the labrum extending for a variable distance anteriorly and or posteriorly. The biceps anchor can be

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displaced medially towards the glenoid neck on probing. A 'peel back' of the anchor could also be demonstrated on abduction and external rotation of the arm. Type II SLAP lesions are further subdivided into three groups based on the extent of labral detachment [13].

IIA – Anterior

IIB – Posterior

IIC – Combined anterior and posterior

Type III – Bucket handle tear of the superior labrum without involvement of the biceps anchor.

Type IV – The labral tear extends into the biceps anchor and tendon for a variable distance.

Type V – SLAP with a Bankart lesion.

Type VI – Flap tear of anterior labrum with detachment of biceps anchor

Type VII – SLAP tear associated with anterior capsuloligamentous tear involving the middle glenohumeral ligament (MGHL).

Studies analysing the inter and intra observer variability among shoulder surgeons in identifying the SLAP type show a fair amount of variability though a more consistent picture emerges in simply differentiating a normal from an abnormal labrum and the perceived need for surgical treatment [12, 14, 15].

AETIOLOGY AND PATHOLOGY

Burkhart has suggested two different subsets of patients who develop SLAP lesions [10]. The first one is the group of patients with no previous shoulder problems who sustain an acute shoulder injury. This could be a sudden eccentric biceps contraction as in trying to grab an object while falling from a height or a fall onto the outstretched hand. A SLAP lesion could also be produced by the posterior superior translation of the glenohumeral joint as in a posterior impact car crash. Cadaver studies have demonstrated the ability of traction applied to the long head of biceps in producing a SLAP lesion and the effect of inferior gleno humeral translation in potentiating this [16]. The second and more complex aetiology for a SLAP lesion is in the throwing athlete with a preceding prodrome of shoulder complaints. This subset of patients has significant glenohumeral internal rotation deficits (GIRD) with the shoulder in 90 degrees of abduction. A deficit is said to be present when the dominant throwing shoulder has an internal rotation that is less than that of the non dominant side. This GIRD is often associated with an increased external rotation of the shoulder that aids the throwing ability and also delays the eventual internal impingement of the shoulder at the extreme of the cocking phase [17]. The basic etiology of this GIRD is a contracture of the posterior inferior part of the shoulder joint capsule. This results in posterior superior translation of the gleno humeral contact point in the abducted externally rotated position of the shoulder and tightening of the posterior band of the inferior glenohumeral ligament. This along with the repeated hyper external rotation efforts increases the stresses across the biceps anchor and adjoining labrum producing an attrition failure and a peel back of the anchor characterised by a type II SLAP lesion.

The effect of a SLAP lesion on shoulder function and stability is poorly understood. Almost all studies on the biomechanical effects of SLAP lesions have been on simulated SLAP II lesions on cadaver specimens which fortunately form the overwhelming majority of these lesions in real life. Rodosky *et al.* studied the effect of the superior labrum - biceps anchor complex on shoulder stability and concluded that the structure is important in providing the shoulder with anterior stability against torsional forces in the abducted externally rotated position of the arm [18]. Simulated SLAP tears on cadavers have shown to produce increased anterior and inferior humeral head translation and an increase in the stress across the inferior glenohumeral ligaments [19, 20- 22]. This could account for the sensation of instability and lack of control that throwing athletes with SLAP tears complain of. However there is controversy regarding the effect of this translation on normal glenohumeral joint kinematics [22]. A further cadaver study identified the involvement of the biceps anchor area in the tear to be the most important factor determining the degree of labral displacement on stress testing [23]. Unsurprisingly they found a type IIC lesion to be more unstable compared to a type IIA or type IIB lesion. It can be assumed that the superior labrum with its attached capsuloligamentous structures have a role to play in glenohumeral joint stability and any instability produced by a SLAP lesion is proportionate to the extent of the tear in the antero-posterior direction and the involvement of the biceps anchor. Flap tears of the labrum as in a Type III or VI lesion might produce mechanical symptoms.

CLINICAL FEATURES

The presenting history varies based on the two previously described aetiological groups. Pain appears to be the most common long term complaint along with a feeling of instability or lack of control of the arm in the overhead as well as abducted externally rotated positions. The cause of this pain is not fully understood and may be multi factorial. It tends to be poorly localised and may be associated with provocative activities. The over head athlete may present with a 'dead arm syndrome' where the ability and control of the shoulder in throwing activities suddenly deteriorates [10]. The presenting picture could be muddled by a variety of lesions that could coexist with a SLAP lesion including cuff tears, internal or external impingement as well as degenerative and arthritic changes.

The clinical assessment should include an estimation of the active and passive range of movements of the shoulder which should not be affected by a SLAP, though a GIRD may be present. Rarely a SLAP lesion could be complicated by a spinoglenoid cyst which could produce a palsy of the supra scapular nerve and associated clinical findings of muscle wasting and weakness. A variety of provocative tests have been described for testing SLAP lesions. These include the O'Briens test, crank test, Jobe relocation test, speed test etc. Many of these tests are also described as indicated tests for other lesions in the shoulder like anterior instability and acromioclavicular joint pathology. It is not the endeavour of this article to go into the detailed description of these tests or their individual sensitivity or specificity. However, it would suffice to say that most studies that have looked into detail at the clinical utility of these tests have found them to be of

limited value [24-26]. At best these clinical tests could be a guide for the rational use of additional imaging resources.

RADIOLOGICAL INVESTIGATIONS

Screening radiographs of the shoulder should include a true antero posterior, axillary lateral and acromion outlet views. For detailed evaluation of the biceps anchor labrum complex, Magnetic Resonance Imaging (MRI) arthrography with intra articular gadolinium or saline contrast is considered to be superior to conventional non enhanced MRI [9, 27-29]. Images are usually acquired in the axial, coronal oblique and sagittal oblique orientations of the shoulder. Additional images may be acquired in the abducted externally rotated (ABER) position to assess the anterior labrum. The normal variants of the superior labrum make the diagnosis of a type II SLAP lesion particularly difficult on an MR arthrogram [7, 29, 30]. A sub labral recess could be easily confused with a type II SLAP lesion. The extension of contrast underneath the superior labrum with its infiltration laterally (rather than medial in case of a sub labral recess) into the body of the labrum in coronal images and the extension of the tear and hence the contrast posterior to the biceps anchor in the sagittal images are considered to be indicative of a SLAP lesion. It is generally accepted that direct arthroscopy and probing of the superior labrum has better accuracy than an MR arthrogram with the latter showing a sensitivity, specificity and accuracy in the region of 90% [7, 30-33]. A Computerised Tomography (CT) arthrogram gives very similar sensitivity, specificity and accuracy as MR arthrograms, but with better spatial resolution and could be used in patients in whom MRI is contra indicated [7].

TREATMENT

The initial management of a symptomatic SLAP lesion which is confirmed by imaging would be non operative. A short period of abstinence from throwing activities may be appropriate in the overhead athlete. During this period stretching exercises to address any posterior inferior capsular contracture is undertaken. Specific exercises would be directed towards scapular dyskinesia if present. This is followed by slow reintroduction of overhead activities. The elite overhead athlete with a proven SLAP lesion, who can tolerate throwing activities and maintain competitive performance, should be allowed to complete the season before undertaking any invasive treatment. It is unlikely that an established SLAP lesion would heal without operative stabilisation though adequate symptom control may be achieved with activity modification and physiotherapy.

There has so far been only one study which has looked at the results of conservative management of SLAP lesions [34]. This very small study with 19 patients and with a follow up of one year showed good shoulder function in those who had a successful non operative management in the form of scapular stabilisation exercises and posterior capsular stretching. However the study acknowledges that more than half of the patients who were initially prescribed non operative management had failure of treatment and went on to have arthroscopic surgery.

With advances in endoscopy and suture fixation devices, the overwhelming majority of procedures for SLAP lesions

are now carried out arthroscopically [35- 38]. The specifics of the procedure would be based on the type of SLAP lesion, patient age and activity levels and presence or absence of additional pathologies like rotator cuff tears and degenerative changes. There is general agreement that most Type I SLAP lesions do not require operative management especially in the older patient with degenerative joint changes. When seen as an incidental finding at arthroscopy, it might be reasonable to debride the area.

Most studies looking at the various arthroscopic repair techniques and their results tend to be level 3 and 4 studies based on Type II lesions. Before the advent of modern endoscopic suturing and anchor devices, these lesions were debrided and left to heal with a not too surprising high failure rate [39, 40]. Type II lesions in the younger patient with an acute inciting event is now treated with an arthroscopic labral repair using a variety of suture fixation devices from suture tacks to anchors and knotless devices. Concerns had been raised on the adverse effects of biodegradable suture tacks on the articular cartilage and the preference today is towards the use of anchors [41, 42]. Burkhart based his diagnosis of a type II lesion on four arthroscopic findings – a superior sublabral sulcus of more than 5 mm, a displaceable biceps root, bare superior labral foot print and a positive peel back sign [10, 23]. Most Type II SLAP lesions could be repaired through two anterior working portals – one placed in the rotator interval and one anterosuperiolateral portal. If the tear extends much posteriorly, a further Wilmington portal is required about 1 cm superolateral to the angle of the acromion. This portal transcends the cuff and should be established with care. Different repair methods have been described in the literature with biomechanical studies evaluating the load to failure of various constructs [38, 43]. The repair is best carried out with a double loaded suture anchor superiorly to reattach the biceps root to its foot print at the supra glenoid tubercle taking care not to bunch up the tendon as a certain amount of excursion of the tendon is required for ABER of the shoulder [44]. The secure reattachment of the biceps anchor is the most decisive step in the procedure [23]. Additional single loaded anchors could be used posterior and anterior to this based on the extent of the lesion, though care should be taken not to overdo the repair anterior to the biceps anchor as this could produce post operative shoulder stiffness. Secure repairs of the labrum to the bony glenoid have been shown to reverse the excessive glenohumeral translation found in SLAP lesions [20, 22].

A bucket handle tear of the superior labrum needs to be debrided and any residual instability of the labrum treated accordingly. Tears of the labrum with involvement of the long head of biceps could be treated with debridement and labral stabilisation in the younger patient with less than 30% of tendon involvement. A tenodesis or tenotomy is suggested in cases where there is more extensive tendon involvement or the patient is older. If a tenotomy or tenodesis is carried out, the residual labrum would need to be assessed for instability and treated accordingly as this could be a cause for persistence of pain and discomfort. A small non randomised study has shown better results with biceps tenodesis compared to SLAP repair [45].

SLAP lesions presenting with additional anterior labral detachment as well as 360 degree circumferential labral detachments are treated with more extensive reattachment of the labral constraint with multiple anchors. When simultaneous superior and anterior labral repair is undertaken, it would be advantageous to insert the superior anchor and pass the sutures first, but tie it last after securing the anterior repair. If not access for the anterior part of the procedure might be tedious. Though initially there were concerns with respect to the results of simultaneous SLAP and anterior labral repair, studies have shown this to a safe undertaking [46, 47].

TREATMENT RESULTS

Arthroscopic treatments of SLAP lesions provide consistently good results whether it is a repair, tenotomy or tenodesis in patients not involved in overhead sports [35, 44, 48-51]. The overall good to excellent results for SLAP type II repair varies from 40% to 94% [50]. The results seem to be better for anchor fixation compared to suture tacks. The return to pre injury level of sporting activity is variable and is dependent on the age and activity level of the patient. This is better in the non overhead, non throwing athlete and does not seem to differ between the elite athletes and the sporting for leisure group. In a large systematic review only 73% of athletes returned to their previous level of play which decreased to 63% for overhead athletes [51]. The small proportion of patients who are either not satisfied with their operative treatment or have repeat tears of the superior labrum would have a lesser chance of benefitting from revision surgery than if they were having primary repairs [52].

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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