

SLAP lesions - current understanding and future perspectives

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Abstract. Injuries to the superior glenoid labrum, an important source of shoulder dysfunction and pain in throwing athletes and overhead workers are difficult to diagnose and treat. Early recognition and correct treatment are key aspects in the management of SLAP injuries. This paper aims to present current knowledge regarding the management and diagnosis of these injuries by addressing key aspects such as anatomy and pathogenesis, physical examination combined with imaging techniques, and treatment options, both surgical and nonsurgical ones. Literature studies have shown that SLAP lesions can coexist with other pathologies of the shoulder. Together with other aspects, it generates controversy, concluding that the optimal approach is yet to be decided. The diagnosis and management of the SLAP lesions are still a source of controversy. Clinical features should be used in association with imaging techniques for a better diagnosis. The surgical options don't always guarantee the effective reduction of pain, improvement of function and return to sports.

Key words: *athletes, superior glenoid labrum, injuries, early diagnosis.*

Introduction

Injury to the superior glenoid labrum is getting more and more recognized as an important source of shoulder dysfunction and pain in throwing athletes and workers doing overhead labour and the diagnosis and management of this pathology is a challenge for the orthopedic surgeon(1). Swift recognition followed by a correctly applied treatment are being considered important aspects in the management rationale of the affected patients (2,3). Andrews was the first to describe in 1985 the labrum tears being characterized as injuries caused by traction as a result of throwing(4), but the concept of SLAP lesion – short for superior labrum anterior to posterior, was defined only in 1990, when Snyder et al published a paper describing the labrum – biceps attachment pathology(5). Although the initial classification only comprised of four types, this was expanded later by adding more types of injury (6,7), although the most frequent types are Type II. Recent trends seem to acknowledge the long head of the biceps tendon and glenoid labrum as a whole entity, rather than separately, thus the need of a change in the treatment rationale.

This paper is a review of the recent literature which aims to present the current knowledge about these challenging injuries in terms of diagnosis and treatment by the means of researching the latest pertaining literature.

Anatomy and pathogenesis

The glenoid labrum is the fibro-cartilaginous structure being located at the edge of the glenoid cavity in the shoulder blade with the purpose of deepening and stabilizing the socket of the glenoid fossa (8-10).

Together with the long head of the biceps tendon (LHBT), it forms the biceps-labral complex (BLC), an entity that trends to be treated as a whole. LHBT's attachment to the labrum is mainly to its posterior part, although this can be subjected to anatomic variation (9,11).

Certain anatomic variability of both LHBT and glenoid labrum exist, with at least 3 predominant variation in more than 10% of people. These variations are the sublabral recess, sublabral foramen and the Buford Complex (12,13). The clinical relevance resides in the fact that there is data in the literature that suggests the association of certain anatomic variation with SLAP lesions, in particular a type 2 SLAP lesion being associated with the sublabral foramen and Buford complex variations (14,15). SLAP lesions can occur either

separately or in association with a spectrum of other shoulder injuries, such as rotator cuff tears, glenohumeral instability or isolated biceps tendon ruptures(16).

An initial classification of these injuries was outlined by Snyder (5) and included Types I, II, III and IV. Type I injuries consist in degeneration, in which the superior labrum remains attached to the glenoid while becoming eroded. The most common injuries are type II, in which there are also signs of erosion, but the biceps anchor along with the labrum are detached from the superior glenoid, thus leading to instability. Type III injuries consist in a particular tearing of the labrum in a bucket-handle manner, while the insertion of the biceps is still intact. Type IV SLAP lesions are basically a combination between the previous two, involving the tearing of the labrum in a bucket-handle fashion which expands to biceps tendon, promoting the instability of the shoulder(5). Since a lot of injuries identified do not fall into of the above categories, expanding the classification made by Snyder, but these particular lesions associate regularly collateral pathologies, such as the Bankart lesion of the anterior capsule(6).

The mechanism of injury of the SLAP injuries is subjected to debate. Certain studies published in literature suggest that the action of repetitive overhead throwing are linked to these injuries, while other causes were proposed, such as the falling of a person onto a hand that is outstretched (17-19).

Diagnosis

Physical examination

Overhead athletes or throwers are commonly affected, as injuries to the superior labral complex arise from repetitive microscopic trauma or even overuse, causing most frequently pain to the concerned shoulder (20,21).

Assessing the patients with pain to the shoulder is frequently a demanding task, mostly because both the history and the clinical examination is very vague and nonspecific, and the presentation is versatile, sometimes the reported pain being associated with fatigue, lower performance and irregular mechanics(22,23).

The physical examination of an active patient presenting shoulder pain indicating a potential SLAP lesion usually begins by assessing the range of motion (ROM), more exactly gleno-humeral and scapula-thoracic ROM and in these kinds of patients, the ROM is modified in a way that the external rotation is increased, while the internal rotation is decreased (22). A practical sign that can guide the diagnosis is tenderness at palpation at the rotator interval (7).

There are a number of clinical tests available for the detection of the SLAP lesions and while they provide good sensitivity, they have decreased specificity (22,23). O'Brien's active compression test has a very good sensitivity, while the specificity is only about 45.7 % (8). O'Brien's active compression test is found to be positive if there is pain described by the patient being located inside the shoulder, while the thumb is pointed down and with the relief of pain while the palm is facing upwards(24). Another test, proposed by Schlechter et al has been proven useful, with sensitivity and specificity comparable to other examination tests used (25). Other tests include Speed's test, Yergason's test and the Anterior Slide test (26,27). In diagnosing type II SLAP lesions, the Whipple test has better sensitivity, while in terms of specificity, Yergason's test is more reliable (28).

Imaging

The diagnosis of a SLAP lesion using only clinical features is a complicated task and urge the use of imaging techniques, such as magnetic resonance imaging (MRI), magnetic resonance arthrography (MRA), or even computed tomography arthrography (CTA).

MRI is an increasingly available procedure and aims to be the norm in diagnosing SLAP injuries. While prone to a significant rate of false positives and proving low sensitivity and specificity in diagnosing the biceps lesions discovered at arthroscopies, it remains useful because it can help uncover other viable shoulder pathology (29). Also, it is important to be used in conjuncture with the thorough history and clinical examination of the patient.

Another useful investigation is the MRA, which is more invasive, require higher amounts of money and time, and can also expose the patient to ionizing radiation when contrast is being administered (30). The superiority of the MRI over the MRA or *vice versa* is still a matter of discussion. In a meta-analysis, direct MRA proved more accurate in diagnosing SLAP lesions than the non-contrast MR. In addition, 3-Tesla MR imaging demonstrated improved accuracy in diagnosing SLAP injuries when compared to 1.5-Tesla MR imaging (31). In another meta-analysis, 3-Tesla MRA showed improved sensitivity, but lower specificity for

SLAP lesions compared with 3-T MRI, and in studies that used lower field strengths, MRA was better at diagnosing SLAP lesions (30, 32).

While conventional CTA was replaced with MRI and MRA, mainly because the former offered limited spatial resolution and soft tissue contrast, the multidetector CT arthrography has been used as a diagnostic tool for shoulder injuries (33). Furthermore, multidetector CTA proved to be a cost-effective test, reliable in the preoperative assessment of SLAP injuries, by decreasing the examination time, being available to patients with metallic devices or implants, while the cost is lower than MRA (34).

Nonoperative management

Regarding the management of patients with SLAP injuries, the nonoperative management is the first line of treatment, with rehabilitation being an important aspect. In a study involving baseball players, about two out of three patients were responsive to rehabilitation that implied balancing exercises and postural correction (3). In a recent study, the authors stated that the initial protocol for all SLAP injuries consists in three principles, decreasing of the inflammation by different means, postural correction and certain rehabilitation exercises to return to normal function (35). Corticosteroid injections administered intra-articular or into the biceps sheath and orally administered anti-inflammatories are most frequently used, alongside gradually increasing physical activity over 3 to 6 months.

Nevertheless, patients with history of trauma and those with mechanical symptoms respond less frequently to this regimen (36,37).

Surgical management

When the patient is unresponsive to nonoperative management, surgery is being considered. Although still a matter of debate, the surgical treatment include SLAP repair, biceps tenodesis and biceps tenotomy, SLAP repair performed arthroscopically being the most commonly performed procedure(38).

The SLAP repair is usually done by using resorbable suture anchors to fix the labrum to the glenoid, while the biceps tenodesis implies tenotomy and then fixing the biceps tendon which is pulled into a humeral socket using a bioabsorbable interference screw (39).

The rate of return to sports of athletes who underwent SLAP repair is modest at best, with only 63% of overhead athletes and 73% of all athletes returning (40). The most frequently cited factors were persisting pain, stiffening of the labrum and residual instability (41-43).

Because of poor results of the SLAP repair in athletes, biceps tenodesis was performed more frequently in the last years and a recent meta-analysis found that in patients aged 30-49, biceps tenodesis was associated with higher rates of return to sport and patient satisfaction (44). An important concern about biceps tenodesis in overhead athletes exists, as the procedure may incompletely restore the translational stability and especially in baseball players, where the power and control of the pitching maneuver may be affected by the biceps tenodesis (43, 44).

Discussion and Conclusion

During arthroscopy and imaging, the interpretation of SLAP can become challenging, as there is a large number of normal anatomic variants of the superior labrum and due to the fact that there are numerous surrounding structures (14).

Another aspect that holds clinical relevance is the fact that SLAP tears diagnosed in patients especially between 45 and 60 years old and without any symptoms may not represent an abnormal finding and caution is advised in order not to over treat these patients (45).

Literature studies have shown that SLAP lesions can coexist with other pathologies of the shoulder. This fact leads to confusion, surgeons not being able to determine if the failure or success of a certain course of action is due to the treatment of the SLAP lesion or the concomitant pathology of the shoulder (15).

The diagnosis and management of the SLAP lesions are still a source of controversy. Clinical features should be used in association with imaging techniques for a better diagnosis.

The surgical options don't always guarantee the effective reduction of pain, improvement of function and return to sports. If surgery is treatment of choice, it should be minimum invasive to allow optimal restoration of function previous to the lesion.

Conflict of interest. Nothing to declare.

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