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Tim Rose
Pierre Hepp
Jan Korner
Christoph Josten
Helmut Lill

Anterosuperior labrum lesions of the shoulder joint: pathogenesis, arthroscopic treatment, and results

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T. Rose (✉) · P. Hepp · J. Korner
C. Josten · H. Lill
Department of Trauma
and Reconstructive Surgery,
University of Leipzig,
Liebigstrasse 20a, 04103 Leipzig, Germany
e-mail: rost@medizin.uni-leipzig.de,
Tel.: +49-341-9717320,
Fax: +49-341-9717319

Abstract The anterosuperior labrum lesion of the shoulder without biceps anchor involvement is a rare injury, and it is unclear whether the refixation has advantages over resection. We describe the pathophysiology and treatment, and compare the functional outcome of these procedures of refixation and resection in 21 patients (median follow-up 6 months, range 5–16). The labrum was refixated in 11 cases. Clinical evaluation used the Constant score. Synovialitis in the area of the labral tear was detected in all cases. In refixation patients there was a significant postoperative improvement in Constant score (91.5 vs. 70). Débridement showed a greater increase in the Constant score range (92 vs. 48). An anterosuperior labrum lesion without involvement of the biceps anchor is a separate entity. The pathology is the consequence of degenerative labral lesions without loss of stability in the glenohumeral joint. In view of this background and the results of this study refixation of loose labral tears in anterosuperior labral lesions without loss of stability should not considered.

Keywords Anterosuperior labrum lesion · Shoulder joint · Pathogenesis · Arthroscopic treatment

Introduction

The injury pathology of the superior glenoid labrum was first described by Andrews et al. [1]. The transmission of traction power at the long head of the biceps tendon on the superior glenoid labrum has been found to be one cause of this injury. Snyder et al. [13] coined the term superior labrum anterior and posterior (SLAP) lesion. The most frequent mechanism of injury has been considered to be a compression force of the shoulder by a fall onto an outstreched arm with the shoulder positioned in abduction and forward flexion at the time of impact [13]. The combined injury affecting the superior glenoid rim and the base of the long biceps tendon together leads to reduced superior joint stability. This pathomechanical situation results in anteroinferior destabilization and secondary impingement [6]. However, in some cases this lesion is not detected, but comparable troubles are found in the patient's history. The patient has pain in overhead activity and sometimes onset of pain at night, especially when lying on the affected side. Arthroscopically the tears are located at the typical position as described by Andrews et al. [1], but it is not possible to lift the biceps-labrum complex away from the glenoid; the biceps anchor is still attached to the glenoid. A surrounding synovialitis is demonstrated by irritation of the labrum and the cause of the trouble. Most patients have been subjected to a long-term shoulder overload caused by overhead work or sports (canoeing, handball, volleyball) when the symptoms occurred.

This lesion should be distinguished from a sublabral foramen below the anterosuperior labrum as an anatomical variation with an unusual appearance [17]. Williams et al. [17] found this unusual variant in 12% of their study population (n=200). In these cases no further diagnostic or therapeutic treatment should be performed. The injury pattern in anterosuperior labral lesions without biceps an-

chor involvement cannot be explained using the classical pathomechanism according to Snyder et al. [13].

Two different procedures in arthroscopic therapy were used: refixation or resection of the labral tear. However, it is still unclear which method is preferable. Here we compare the functional outcome in the two treatments considering the pathophysiology of the anterosuperior labral lesions without biceps anchor involvement.

Materials and methods

The study consisted of 21 patients with evidence of anterosuperior labrum lesions without biceps anchor instability. The study period was between January 1998 and September 1999. The study included 15 men and 6 women with a mean age of 38 years (range 21–55). Patients were interviewed about their medical history. The physical examination of the shoulder consists of several phases. Positive results on the test described by O'Brian et al. [11] were taken as indicative of a superior labrum anterior and posterior lesion. The impingement test was used to exclude an impingement syndrome. The Apprehension Test and the Relocation Test were used to exclude the instability of the shoulder. Ultrasonographic examination in the six standard planes, radiography, and magnetic resonance imaging were used for preoperative diagnosis. The clinical evaluation was performed using the Constant score [4], which increased in the follow-up periods (maximum 100 points). The median follow-up was 6 months (5–16).

Every shoulder was scoped using a standard posterior portal. All shoulders were systematically evaluated arthroscopically. The tears were located on the anterosuperior portion of the glenoid labrum near the origin of the tendon the long head of the biceps muscle into the glenoid (Fig. 1). The origin of the biceps tendon into the glenoid labrum was checked using an arthroscopic hook. It was not possible to lift the biceps-labrum complex or the origin of the middle glenohumeral ligament away from the glenoid in any of the cases. The superior labrum did not show any marked fraying with any degenerative appearance. The type of therapy depended the condition of the labral defect. The labrum was refixed with anchors in 11 cases. In 10 cases the labrum was resected. When the labrum was refixed the range of motion was limited to 90° in abduction and 0° in external rotation to for 3 weeks. The range of motion was unlimited in the cases of resection or after 3 weeks.

All results were recorded on a database. The Wilcoxon test was used to calculate the significance for two bound random samples, and the Mann-Whitney U test for two unbound random samples, and $P<0.05$ was taken as being significant.

Fig. 1 Illustration of the anterosuperior labrum lesion

Results

Only two patients had suffered from a fall onto an outstreched arm in the typical trauma pattern. In nine cases there were minor traumata, such as impact (n=5), twisting (n=3), and ventral traction (n=1) triggers of the complaints. A chronic progression without any trauma was found in ten patients. A predisposition for repetitive microtraumata of the shoulder was found in eight cases due to overhead sport and to nine cases as overhead work. No cause was found in four patients (Fig. 2). There was no significant difference between the level of complaints (follow-up Constant score) whether there was a trauma as a trigger sensation or not (with trauma: 87 points, without Trauma: 90 pts). The Constant score in the follow-up in overhead athletes (94±7 points) was significantly better (P=0.048) than in overhead workers (82±15 points). The preoperative Constant score for overhead workers was 41.4±25.5 points and the preoperative score of the overhead athletes was 62.7±29.3 points.

The preoperative physical examination of the extremity was associated with a painful reduction in the range of motion actively (abduction: median 155°, range 95°–180°). Clinical tests pointed towards an injury with a superior labral lesion. All patients complained of a reduction in the range of motion due to pain when attempting overhead activity. The preoperative median Constant score was 51 (range 32–91), and the median follow-up Constant score was 91 (range 50–100). The Constant score detail were:

- Pain: maximum 15, preoperative 6±19, postoperative 10±3.2

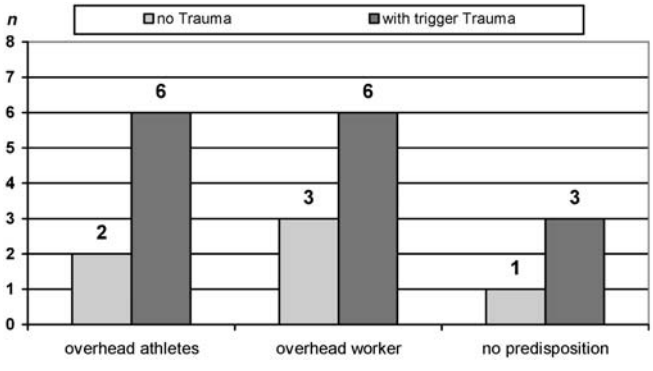


Fig. 2 Difference in predisposition types according to chronic (n=10) or acute onset of painful condition with trigger (n=11)

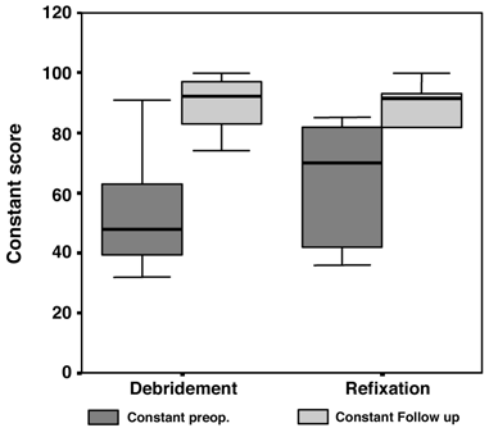


Fig. 3 Pre- and postoperative Constant score in separate therapy procedures (refixation, *n*=11; débridement, *n*=10)

- Range of motion: maximum 40, preoperative 24±13.4, postoperative 36±7.4
- Level of activity in everyday life: maximum 20, preoperative 11±3.3, postoperative 17±2.8
- Strength: maximum 25, preoperative 19±5.2, postoperative 24±3.2

The physical examination of the shoulder was also included in the follow-up. Results of the O'Brian test were positive in three cases. No instability or impingement of the shoulder was found. The median range of motion actively was 170° (145°–180°).

In 11 cases, the labrum was in good condition, and therefore refixation could be performed with an anchor. In two cases two anchors were used for refixation. Otherwise, Corkscrews (*n*=6) or Fastak anchors (*n*=5) were used (Arthrex, USA). In eight cases refixation of the labral lesion was not possible as the labrum was destroyed. In two further cases in which the labrum was in good condition the fixation was not successful. Accompanying injuries were rotator-cuff rupture (*n*=1), osteochondral lesion of the humeral head (*n*=2), and outlet impingement (*n*=5). In patients with labrum refixation there was a significant improvement (*P*=0.043) in the postoperative Constant score (91.5, range 50–100) compared to the preoperative starting score (70, range 36–85). Patients in the débridement group showed an increased Constant score range [48 points, range 32–91) preoperatively vs. 93 (74–100) postoperatively, *P*=0.02; Fig. 3). There was no significant difference between the time of surgery in either surgical procedure (operation time for refixation 52±2.2 min, débridement 49±17 min). There was no correlation between the result of the therapy and the duration of complaints or the age of the patient.

Discussion

Anterosuperior labral lesions without biceps tendon involvement often lead to pain and restriction in the range of motion, as is the case with an existing posterior internal impingement or SLAP lesion [13, 16]. Also, these are typical occurrences in overhead athletes and overhead workers [3, 7, 12, 14]. Some theories as to the development of posterior internal impingement in cases such as these have been presented [5, 12, 16]. Walch et al. [16] were the first to hypothesize that humeral retroversion plays a possible role in this condition [16]. Davidson et al. [5] suggested that a subtle increase in anterior glenohumeral translation could cause internal impingement.

Andrews et al. [1] discussed the pathomechanics of the anterosuperior labral lesion with biceps tendon involvement in 73 baseball players and other overhead athletes. The injury formation was attributed to extreme movement in the elbow and shoulder, causing a heavy strain on the biceps tendon and its insertion into the superior labrum. Snyder et al. [13] classified this lesion into four types. The occurrence of osteochondral defects of the superior humeral head can be explained on the basis of the pathomechanism. Accompanying injuries such as osteochondral lesions, outlet impingements, and rotator-cuff tears are typical [12]. Walch et al. [16] reported about 47% (*n*=17) subjects with cartilage defects in their study population. Morgan et al. [10] reported rotator cuff ruptures in 33% of their patients. In the present study only two patients showed a chondral lesion of the humeral head, and one showed a rupture in the supraspinatus tendon. Habermeyer et al. [6] presented good results in labrum refixation with SLAP lesions in contrast to unsatisfactory results from labrum débridement. The poor débridement and resection results with SLAP lesions are considered attributable to type II and type IV glenohumeral instability. Cases of this type need refixation [7]. If the glenohumeral instability is the cause of the patient's complaints, surgery and therapy should aim at stabilizing the shoulder [9]. A comparable trauma, such as a SLAP lesion, was not considered for this group of patients.

Patients with overhead activity and positive results from the corresponding tests [2, 3] have the typical injury pattern. Clinically, all patients complained of pain in the shoulder, which was extreme for patients involved in overhead activities [13]. Anterior instability of the shoulder was not confirmed in any of the cases. A labral lesion was present only in the anterosuperior quadrant without biceps anchor instability. A predisposition in the patient's history was found in 17 cases in either overhead sport or overhead work.

Comparable studies have shown a strong correlation between trauma mechanism and clinical symptoms. Snyder et al. [13] reported two distinct mechanisms of injury (*n*=27). The most common mechanism was a compression force applied to the shoulder. This usually occurred as the result of a fall onto an outstretched arm with the shoulder

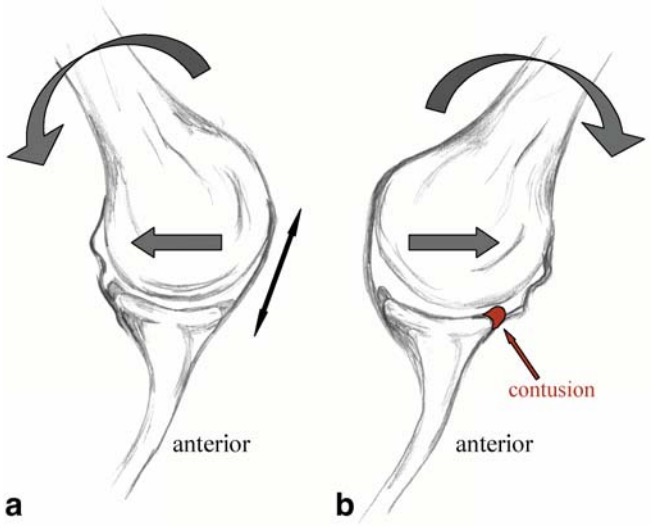
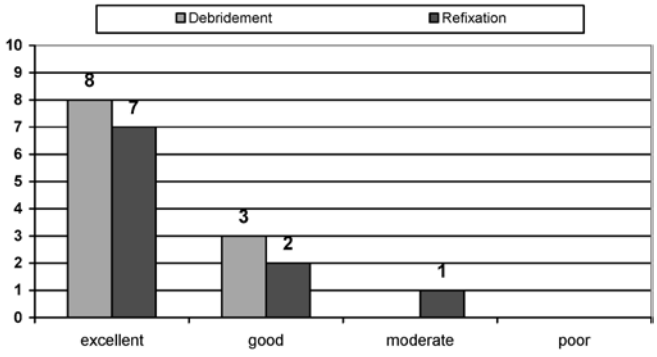


Fig. 4a, b Repeated dynamic contusions to the anterosuperior labrum can result in extreme motion (abducted maximally, externally rotated) in normally glenohumeral translation motions in overhead athletes. *Arrows* Forced posterior (**a**) and anterior (**b**) motion of the humeral head



Rating scale	score
excellent	100 – 85
good	84 – 70
moderate	69 – 50
poor	< 50

Fig. 5 Follow-up score in débridement and refixation

positioned in abduction and slight forward flexion at the time of impact. A second mechanism of injury was due to traction on the arm, either as a result of a sudden pull on the arm, throwing or an overhead sports motion. In ten patients the beginning of shoulder symptoms was insidious, and no mechanism of injury could be determined.

A previous degeneration of the labrum following repetitive microtraumata by an anterosuperior labral lesion without involving the biceps anchor might be an explanation. Repeated dynamic contusions to the anterosuperior labrum can result in extreme motion (abducted maximally, externally rotated) in normally glenohumeral translation in overhead athletes [12]. The humeral head was centered in the glenoid cavity throughout the horizontal plane of motion except when the arm was at its maximum extension and external rotation. In this position, the cocked stage of the throwing motion, the center of the humeral head rested approximately 4 ml posterior to the center of the glenoid cavity. When the arm was flexed or rotated from this cocked position, the humeral head glided anteriorly, producing a shearing stress on the articular surface of the glenoid and labrum [8] (Fig. 4). These repeated microtraumata lead to chronic synovial inflammation as well as long-term degenerative damage of the anterosuperior labrum. The trigger of the condition is often a direct contusion or minor trauma.

The clinical outcome can be assessed objectively using the Constant score result. This was evaluated preoperatively and in the follow-up period. Constant scores were significantly better in the follow-up period than preoperatively. This finding can be compared to the course of SLAP lesion treatment [6]. This is due mainly to pain reduction, leading to improvement in the pain-related movement restriction. Clinically, all patients in this study complained of pain, and most complained of a restricted range of motion. Instability in the glenohumeral joint was not detected in any patient. Consequently, reducing the pain should be the aim of therapy. Refixation of the labrum shows excellent results in the follow-up Constant score, as is the case with débridement and resection of loose labral components. However, the worse initial test results from the débridement group should be taken into account, giving the débridement group a tendentious higher functional improvement increase than the refixation group (comparison between preoperative vs. postoperative; Fig. 5).

Repetitive microtraumata are often the basis of the pathomechanism in anterosuperior labral lesions without biceps tendon involvement. It was possible to distinguish overhead athletes from overhead workers. Athletes showed a better functional result benefit in our study, which is in agreement with the study by Tomlinson et al. [15]. Athletes (n=46) with superior labral lesions without glenohumeral instability were examined in the postoperative follow-up period. Good results were found independently of shoulder laxity, labral lesion location, mechanism of injury, or the presence of a rotator-cuff lesion. A difference in the functional outcome (follow-up Constant score) was found between professional and nonprofessional athletes. Tomlinson et al. [15] proposed that an aggressive, supervised physical therapy in highly motivated individuals could be the most important factor. However, the preoperative Constant score in overhead workers was clearly lower than in overhead athletes. Against this background the overhead workers present a better functional benefit. No correlation between patient age and postoperative functional outcome and between complaint duration and

postoperative outcome were determined by the authors. Consequently the age of the patient and the duration of complaints should not affect the therapy.

Conclusion

Subtle anterior instability is a frequent factor in overhead athletes and overhead workers. SLAP lesions and internal impingement are often associated with anterior instability. The anterosuperior labral lesion without biceps tendon involvement shows the same clinical symptoms. However, this is a separate entity that must be distinguished from other similar injury profiles; glenohumeral joint instability or biceps tendon involvement is never present. The pathology consists of degenerative local labral lesions in the anterosuperior quadrant without glenohumeral joint instability. Following this theory and the results of our study, the refixation of loose labral tears in anterosuperior labral lesions without loss of stability should not be forced. Accompanying injuries require an additional adequate therapy.

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