



Contents lists available at ScienceDirect

Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology

journal homepage: www.ap-smart.com

Original Article

Arthroscopic management of anterior labrum periosteal sleeve avulsion (ALPSA) lesions: A case series with improved clinical outcomes using a modified technique

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ARTICLE INFO

Article history:

Received 11 May 2020

Received in revised form

22 June 2020

Accepted 7 July 2020

Keywords:

Shoulder arthroscopy

Anterior labrum periosteal sleeve avulsion

Instability

ABSTRACT

Introduction: Anterior labrum periosteal sleeve avulsion (ALPSA) is the avulsion of the labrum and of the non-disrupted periosteum with the subsequent healing of the labrum in a medialized nonfunctional position on the glenoid neck.

Objective: In this study, a modified technique for arthroscopic repair of ALPSA lesions is presented, along with post operative clinical results and follow up.

Method: 72 patients who underwent this procedure were included in this study. Patients with multi-directional instability, more than 20% of glenoid bone loss, and bony Bankart lesions were excluded.

Results and conclusion: It was concluded that with this modified technique, a lower recurrence rate post arthroscopic repair of ALPSA lesions was seen with only 4 patients having postoperative recurrence of glenohumeral dislocation which amounts to 5.6%. Moreover, the data also showed a statistically significant improvement of 35.23% between the pre- and postoperative ASES scores.

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Introduction

The glenohumeral joint is the most commonly dislocated joint in the body with the anterior direction of dislocation being the most frequent one.¹ The loss of the static and dynamic stabilizers after the event of a shoulder dislocation has been widely recognized in previous studies.^{2,3} One of the main lesions to occur post traumatic anterior shoulder dislocation is the detachment of the anterior labrum, this detachment can occur in several patterns. An obvious separation of the antero-inferior labrum with disruption of the capsule represents the Bankart lesion.⁴ A labral avulsion with an intact periosteum and no displacement is termed the Perthes lesion.⁵ An ALPSA tear (anterior labrum periosteal sleeve avulsion) is the avulsion of the labrum and of the non-disrupted periosteum

with the subsequent healing of the labrum in a medialized nonfunctional position on the glenoid neck.⁶ Whereas a GLAD lesion (glenoid articular rim disruption) is a detachment of the glenoid cartilage and labrum.⁷

The pathogenesis of the ALPSA lesion is still unclear, with some authors considering it a progressive Perthes lesion occurring secondary to multiple dislocations,^{2,8} whereas other studies have reported that the incidence of ALPSA lesions in first time dislocations was in the range of 7.9% to 39%.^{6,9,10}

The gold standard of treatment of anterior shoulder instability has been the open Bankart procedure, however series of arthroscopic repair has yielded equal results with the advantage of less pain and a more accurate detection of intra-articular pathologies.^{11–13}

Previous studies have yielded a recurrence rate after arthroscopic repair of ALPSA lesions ranging from 8.3% to 19.2%, which corresponded with approximately double the rate of recurrences of the Bankart lesions that were operated upon in the same studies.^{8,14,15} These recurrences were associated with an increasing size of the Hill-Sachs lesions as well as to the presence of engaging Hill-Sachs lesions.¹⁵

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In our study, we presented the clinical results of arthroscopic repair of ALPSA lesions with a technique that was developed by the senior author with the aim of decreasing the rate of recurrence.

Materials and methods

Between March 2007 and July 2017, 76 patients were operated on at our institution for repair of ALPSA lesions. Four patients were excluded from the study because of intra-operative findings of multidirectional instability, so we were left with 72 patients. The mean patient age was 25.29 (range 17–37) years. We had 13 females and 58 males; the number of dislocations ranged from 1 to 18 dislocations. No associated lesions were found in 33 patients, 32 patients had a Hill-Sachs lesion (of which 8 were engaging lesions), 10 patients had SLAP lesions, rotator cuff tears were present in 4 patients, 4 patients had loose bodies and 3 patients had osteoarthritis. These lesions were diagnosed pre-operatively by the use of MRI and MRA (MR Arthrogram), and confirmed intra-operatively by arthroscopy. In some patients there was more than one pathologic finding. None of the patients in this study underwent previous shoulder surgeries. Exclusion criteria were multidirectional instability, more than 20% of glenoid bone loss, and bony Bankart lesions.

All patients were followed up for a mean of 6 (range, 2–10) years, and were evaluated pre-operatively for ISIS (instability severity index score). The maximum ISIS score was 6, which corresponds with a risk of less than 10% of recurrence after arthroscopic repair of Bankart lesions.¹⁶ Clinical outcomes were assessed by the use of the ASES (American Shoulder and Elbow Surgeons) score, patients were evaluated pre-operatively as well as post-operatively at the latest follow up.

Surgical technique and rehabilitation protocol

The patient receives an intra-scalene nerve block for better post-operative pain control, followed by general anesthesia which facilitates positioning and maneuvering of the shoulder prior to and during the procedure.

The patient is then positioned in the beach chair position, securing the cervical spine with a cervical collar and head restraint, with adequate support to the trunk from the ipsilateral side.

After ensuring adequate and safe positioning, the shoulder's passive range of motion is examined in anterior elevation, external rotation, and progressive abduction, followed by anterior and posterior drawer tests.

Prepping and draping of the shoulder is done including the whole upper limb, with longitudinal traction of 5 kg applied afterward in a slightly abducted and flexed shoulder.

A posterior portal is placed inferior and medial to the posterolateral corner of the acromion, through which a 30-degree arthroscope is introduced into the glenohumeral joint. Inspection of the intra-articular structures is done including a circumferential inspection of the labrum, articular cartilage, biceps tendon and biceps anchor, subscapularis tendon, as well as the intraarticular parts of the supra- and infraspinatus. The quality of the inferior capsule's tissue is assessed, where poor tissue quality can be a risk factor for recurrence. The anterior labrum is next assessed, identifying the ALPSA lesion with visualization of the medialized antero-inferior capsulolabral tissue. Two anterior rotator interval portals are now established under direct vision, utilizing a spinal needle to locate the entry site followed by serial dilation for facilitating instrument introduction. These two portals are perpendicular to each other, and no cannulas are used for increased freedom in the manipulation of the instruments.

The antero-superior portal is at the superior border of the

rotator cuff interval, just anterior to the supraspinatus and biceps tendon (Fig. 1).

This portal is used for optimal access to the anterior border of the glenoid and capsulolabral complex, followed by assessment of anterior glenoid. This portal facilitates glenoid preparation as well as reaching the 6 o'clock position of the glenoid. Note that patients with anterior glenoid bone loss more than 20% are excluded from this study.

The antero-inferior portal is just superior to the subscapularis tendon and on the humeral side of the rotator cuff interval (Fig. 2).

This portal is helpful for proper anchor placement and tightening of the stitches in a proper angulation.

When lateral traction is needed, it is performed manually by the surgeon's assistant.

A PDS thread is passed through the antero-inferior capsule using a QuickPass suture lasso. This thread is tensioned allowing for easier release of the capsulo-labral complex from the anterior glenoid (Fig. 3).

With the capsulo-labral complex under tension, an arthroscopic elevator is used for adequate release of this complex when it is adhered, complemented by the use of a 90-degree hook probe ablator and of a shaver to debride the underlying soft tissue (Fig. 4).

The release is done through the anterior portals, starting at the inferior rim at the 6 o'clock position and arriving superiorly to the biceps insertion.

The amount of needed capsular release is determined based on degree of pre-operative instability, and is tested intra-op by discontinuing the pump's positive pressure and checking for spontaneous reduction of the capsulo-labral complex to its anatomical position (Fig. 5).

Failure of spontaneous reduction dictates the need for additional capsular release, which is done repeatedly until spontaneous reduction is achieved. We separate the capsulolabral complex from the subscapularis, which we believe is helpful by decreasing the tension at the level of the capsule thereby decreasing the tension at the subsequent repair site which allows for better healing. Next, we perform debridement of the anterior glenoid neck using a burr, as a bleeding cortex facilitates healing of the avulsed periosteum, with care not to over-debride the cortex which can result in an iatrogenic

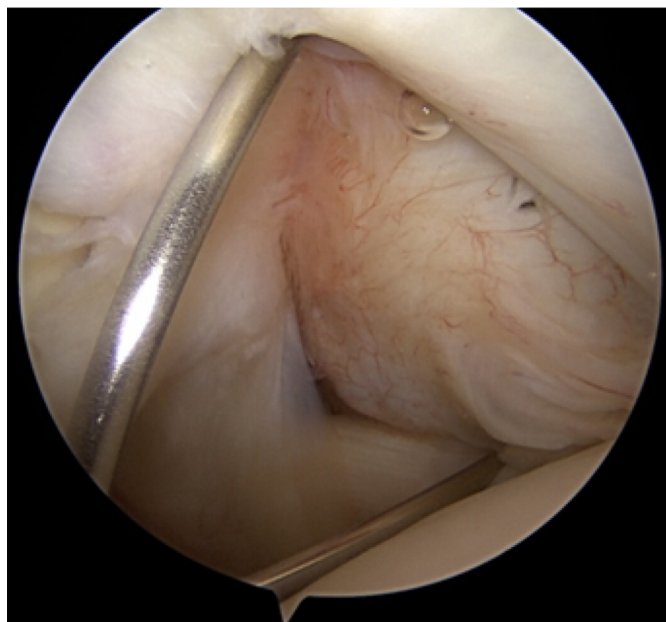


Fig. 1. Anterosuperior and anteroinferior portals seen from the posterior portal.

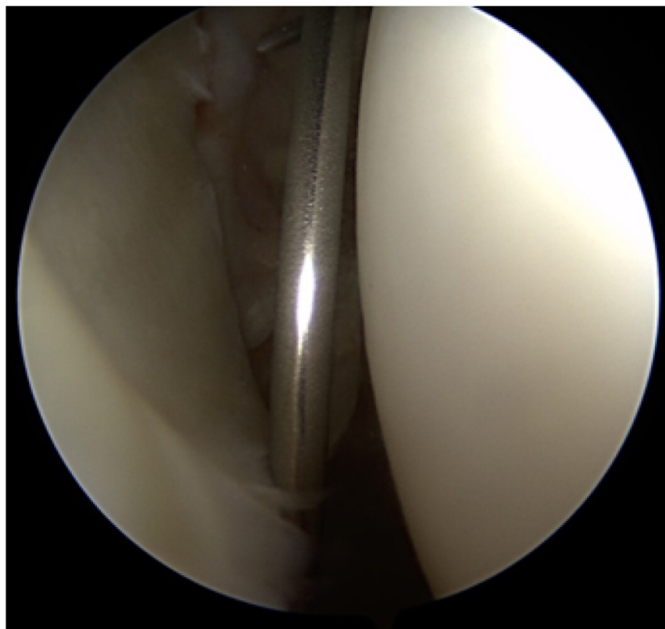


Fig. 2. Access to the antero-inferior capsule through the antero-inferior portal.

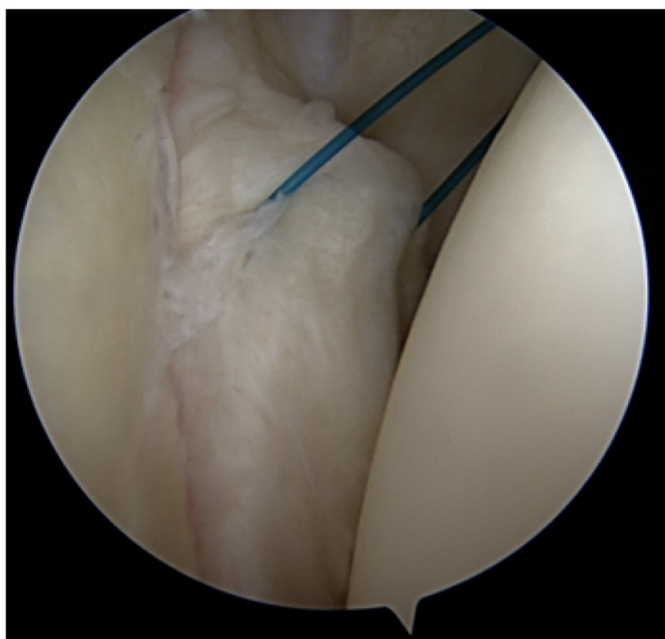


Fig. 3. PDS thread passed through the antero-inferior capsulolabral complex, it is to tension this complex thereby facilitating release.

fracture of the glenoid neck.

After adequate capsular release and debridement of the glenoid neck, we resect 2–3 mm of articular cartilage from the anterior glenoid rim, aiming to promote healing and to further medialize the capsular shift. Three absorbable double loaded anchors (3-mm diameter) are placed in a symmetrically spaced fashion between 2 and 6 o'clock positions over the anterior glenoid rim. We start with placement of the most inferior anchor which is placed in a horizontal direction at the 5 o'clock position, and at 45° to the anterior glenoid plane. The distance of anchor placement from the anterior border depends on how much capsular shift is judged to be needed,

with a more anterior placement resulting in a more significant capsular shift. The remaining anchors are placed in a parallel direction to the initial anchor, at a distance of at least 1 cm from the previous anchor. Using a curved suture-passing device, we grasp the inferior part of the capsulolabral complex (Fig. 6-A) at two locations: inferolateral and lateral (Fig. 6-B).

The inferolateral suture allows capsular shift in a supero-medial direction and the lateral suture allows medialization yielding a supero-medial capsular shift by the use of 2 sutures (Fig. 7).

The more superior anchors are placed using the same technique in order to create a simultaneous medial and superomedial capsular shift. The sliding knot is performed over the suture limb that is farther from the glenoid avoiding knot positioning within the articular surface.¹⁷

Any encountered associated injuries are managed appropriately in addition to treating the ALPSA lesion. When an engaging Hill-Sachs lesion is present, we systematically perform a posterior capsulodesis. This is done by entering the subacromial space and performing a complete bursectomy, which is paramount for facilitating visualization as well as sutures tying later on. An additional posterior portal is created using a spinal needle for direct visualization of the orientation of this portal, which is used for debridement of and proper preparation of the Hill-Sachs lesion for insertion of the anchors. One anchor is placed at the most anterior aspect of the lesion, and a secondary anchor; when needed; is placed 2 cm posterior to the initial one, with a total number of 2–4 stitches which is decided by taking into account the size of the Hill-Sachs lesion as well as capsular laxity. The sutures are passed through the posterior capsule and rotator cuff, afterward we introduce the scope into the subacromial space to prevent any deltoid or soft tissue interposition during suture tying. Finally, we re-enter the intra-articular space to check the integrity of the Hill-Sachs repair and to assess the need for additional repair.

The portal sites are closed with nylon 3-0 sutures, and a sterile dressing is applied. The upper extremity is then placed in a shoulder immobilizer sling.

The shoulder remains immobilized in an abduction brace for 4 weeks postoperatively, during which only pendulum exercises of the shoulder and range of motion exercises for the elbow and wrist are permitted. At 4 weeks postoperatively, progressive passive range of motion exercises are begun, followed by active range of motion exercises. Shoulder muscle strengthening exercises are prohibited for the first 3 months. Sporting activities are permitted at six months postoperatively (Video).

Supplementary video related to this article can be found at <https://doi.org/10.1016/j.asmart.2020.07.001>

Statistical analysis

All data were processed with the use of SPSS 26.0 software. Descriptive statistics were determined for each of the above variables. Statistical significance for tests was set at $p < 0.05$.

Results

Table 1 summarizes the patients' pre-operative characteristics.

The Kolmogorov-Smirnov test (Table 2) was used to verify the normality of the preoperative and postoperative ASES scores ($n = 72$).

For this test, the degree of significance must be greater than Alpha ($\alpha = 0.05$) to consider the variables as normally distributed. Table 2 shows that pre- and postoperative ASES scores weren't normally distributed ($p < 0.05$). Therefore, the Wilcoxon test was used instead of the paired sample t-test as an alternative test to assess for the presence of a statistically significant difference

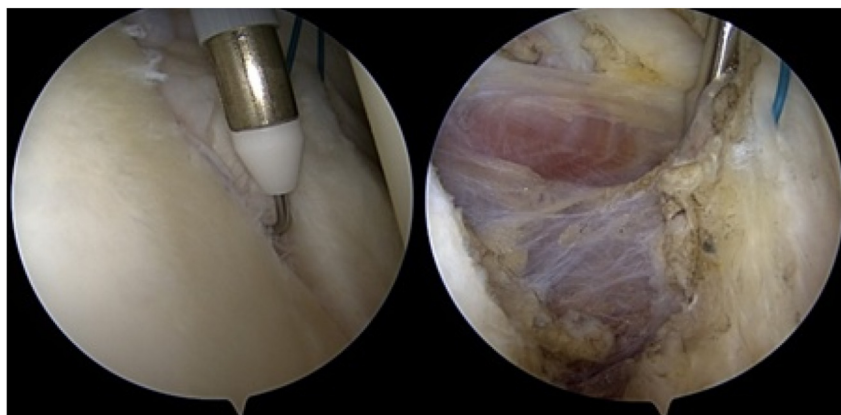


Fig. 4. Capsular release performed with the use of a 90-degree hook probe ablator (left), and of a shaver (right) to debride the underlying soft tissue.

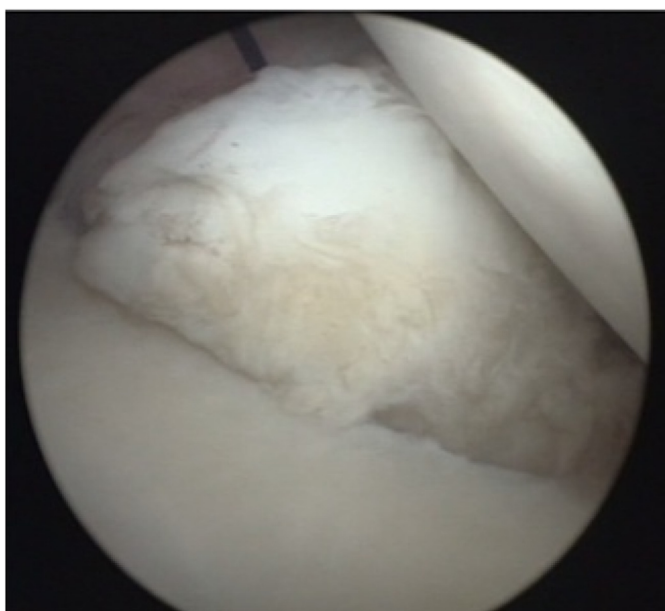


Fig. 5. Spontaneous reduction of the capsulolabral complex to its anatomic position.

between the ASES scores before and after the surgery.

Table 3 shows that the difference between the ASES scores before and after the surgery were statistically significant ($p < 0.01$), with 35.23% of improvement.

However, there was no statistically significant correlation between the number of pre-operative dislocations and the post-op ASES scores (Spearman's rho = 0.222, $p = 0.061$).

The Kruskal-Wallis U test was used to study the effect of type of sports on the number of pre-operative dislocations, while the ANOVA test studied the age, gender, and affected side. All of the above-mentioned factors had no effect on the number of pre-operative dislocations ($p > 0.05$).

In this case series, 4 (5.56%) cases of recurrence of glenohumeral instability were seen. All of these patients suffered the recurrence as a result of a traumatic fall or while conducting sports activities. They all They all underwent open Latarjet procedures as appropriate surgical treatment of their conditions. Bearing in mind the possibly degraded states of the capsule and labrum that might have resulted due to the surgical procedure and the recurrent shoulder dislocations, as well as the increased risk of failure in revision arthroscopic ALPSA surgeries, the open Latarjet procedure was chosen as treatment of these cases.

From a functional perspective, the mean ASES score improved from 66.44 (range 53–86) preoperatively to 89.85 (range 70–99) at the last follow-up, and it was a statistically significant improvement ($p < 0.01$).

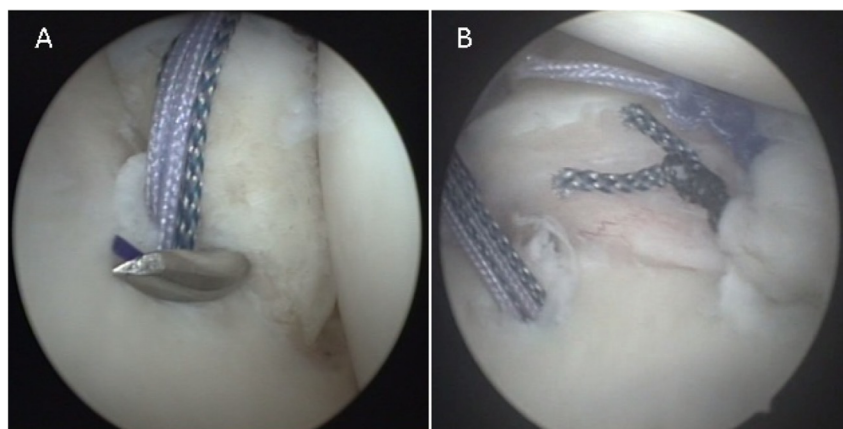


Fig. 6. A: Curved suture-passing device to grasp the most inferior part of the capsulolabral complex. **B:** Inferomedial and medial knots (right) of the most inferior anchor (6 o'clock), the second anchor (left) is placed at the 4 o'clock position.

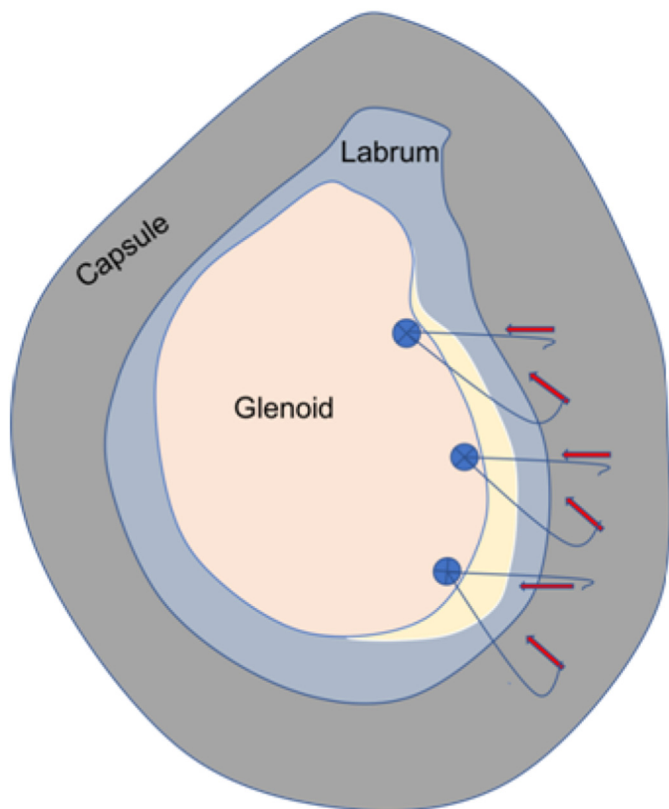


Fig. 7. An illustration of the glenoid with depictions of the labrum and capsule. The sutures of each anchor aim to provide a superomedial as well as a medial capsulolabral shift.

Table 1
Patients' pre-operative characteristics, with the minimum, maximum and the means of each variable.

	Minimum	Maximum	Mean
Age	17	37	25.29
Preop Dislocations	1	18	3.61
Follow Up (years)	2	10	6.00
Preop ASES	53	86	66.44
ISIS	2	6	3.19

Table 2
The Kolmogorov-Smirnov test, which is used to verify the normality of the preoperative and postoperative ASES scores.

	Statistic	Df	Significance
Pre-op ASES	.132	72	.003
Post-op ASES	.105	72	.049

Table 3
Wilcoxon test used to test for the presence of a statistically significant difference between ASES scores before and after the surgery.

	Mean		Z	P
	Before	After		
ASES scores	66.44	89.85	-7.377	0.000 ^a

^a Significant at level 0.01.

Discussion

The ALPSA lesion has been historically recognized by different authors such as Yoneda,¹⁸ however the first to term it as ALPSA was Nevasier in 1993.¹⁹

The pathogenesis of this lesion is still unclear. Habermeyer's study in 1999, concluded that ALPSA develops as a result of recurrent dislocations.²

Yiannakoupolos et al. by comparing 127 shoulders, found that ALPSA lesions exist only in the chronic shoulder dislocations group. They stated that there were no ALPSA lesions identified in the acute group, hence it is a lesion that develops as a result of chronic dislocations.²⁰

In a study done in 2011 by Lee et al., ALPSA lesions had a considerably higher incidence of preoperative dislocations, synovitis, engaging Hill-Sachs lesions and postoperative redislocations.¹⁵

On the other hand, Spastchil et al., in 2005 identified the incidence of ALPSA lesions after arthroscopic evaluation for first time glenohumeral dislocation to be 18%.¹⁰ Antonio et al., in 2007, evaluated the different lesions found in first time shoulder dislocations by MRA complemented by arthroscopic evaluation and they stated that they had identified ALPSA lesions in 39% of their cases.

In our opinion, the ALPSA lesion occurs as a consequence of the severity and pattern of the initial injury, 12.5% (9/72) of our patients had only a single event of dislocation, thus this specific lesion doesn't seem as a result of recurrent dislocations.

Another reason for the discrepancy in the findings of the different studies, might be in our opinion, the absence of a single recognized definition of the ALPSA lesion. Some authors sub-divide ALPSA lesions into free and adherent subtypes. The free type referring to the medially displaced non-adherent labral detachment that is still attached to an intact anterior glenoid periosteum, and the adherent type being the medially displaced labral detachment that is adherent to the anterior glenoid neck.⁶ In our study, after reviewing the operative reports, ALPSA lesions were diagnosed after identifying the adherent type.

It is in our opinion, that the definition of this entity needs to be clarified in order to avoid any future discrepancies in the literature and in order to be able to have a more accurate way of comparing the incidence as well as the surgical results related to this specific lesion.

In the current available literature, the best clinical results after arthroscopic treatment of ALPSA lesions were reported by Kim et al., in 2012, who underwent arthroscopic pleated capsular shift by the use of suture anchors. Capsular shift was performed to create an anterior capsular bumper instead of labral repair due to the advanced degeneration of the labral tissue. Their study included 24 patients who underwent surgical repair of the ALPSA lesion using the above-mentioned technique, of which only 2 (8.3%) had recurrent instability due to traumatic events.¹⁴

In the study conducted by Lee et al., in 2011, 53 shoulders with ALPSA lesions were treated arthroscopically by releasing the adherent labral tissue, including the IGHL, followed by repair of the labrum and of the IGHL with the use of suture anchors. Eight out of fifty-three patients (15.1%) had recurrent postoperative dislocation events, this instability was associated with the presence of engaging Hill-Sachs lesions.¹⁵

Ozbydar et al., in 2008, performed arthroscopic repair of ALPSA lesions in 26 shoulders by using suture anchors, with a suture from the most inferior anchor placed in an inferior and lateral position through the IGHL in order to shift the capsule supero-medially on top of restoring the anatomical position of the capsulolabral tissue.⁸ In their study, there was a 19.2% (5 out of 26 shoulders) rate of recurrence, no associated risk factors were identified except for

poor quality of the soft tissue.

The most significant finding of our current study was the low recurrence rate post arthroscopic repair of ALPSA lesions. Out of 72 patients, only 4 patients had postoperative recurrence of glenohumeral dislocation which amounts to 5.6%. Previous studies reported the recurrence rate to range from 8.3% to 19.2%. So, in our case series, we obtained the lowest rate of recurrence post arthroscopic repair of ALPSA lesions, and it is also the study that, as per our knowledge, contains the highest number (72 shoulders) of operated ALPSA lesions. Additionally, our data also showed a statistically significant improvement of 35.23% between the pre- and postoperative ASES scores, which is an indicator of clinical and functional improvement after the surgery.

We attribute the good results of our study to several factors. Pre-operatively, a 3D reconstructed Computed-Tomography scan is ordered for patients who exhibit severe glenohumeral instability (dislocations with slight overhead activity or while in their sleep) to assess for glenoid bone loss. Patients who have more than 20% anterior glenoid bone loss underwent the Latarjet procedure. Intra-operatively, the various lesions that were identified were properly addressed. Additionally, engaging Hill-Sachs lesions were systematically repaired by posterior capsulodesis to decrease the risk of recurrence. We believe that the assessment and treatment of the engaging Hill Sachs lesions when present, with the correct application of this modified surgical technique are responsible for the improved results of this study. In previous studies with higher recurrence rates, the Hill Sachs lesions were either neglected or no mention of whether these lesions were treated or not was made.^{8,14,15}

This surgical technique has several advantages. The perpendicular placement of the anterior portals facilitates proper debridement, dissection and placement of the anchors in an optimal position. We opt to exclude the usage of cannulas, in order to have an increased level of freedom while maneuvering the surgical instruments. The adequate dissection of the anterior capsulolabral complex from the subscapularis allows for spontaneous reduction of the labrum to its anatomical position, which leads to better healing by less tension at the repair site. Cartilage resection from the anterior border of the glenoid results in an increased surface of bleeding bone, therefore a better healing potential. The use of double loaded anchors allows a bidirectional capsular shift with a more stable fixation.

However, this technique has disadvantages. It requires more dissection, with increased soft tissue morbidity, hematoma formation and an increased risk of algodystrophy. Furthermore, the medialization of the repair site may result in a decreased range of motion with increased joint stiffness.

For the patients in which a SLAP lesion was found, both SLAP & ALPSA were adequately fixed. As repair of ALPSA without addressing the SLAP lesion could result in residual instability.²¹ Rotator cuff tears were also appropriately repaired when judged to be in need of a surgical repair for optimal clinical results.

Our current study had several limitations. First, it was a retrospective study based on observations of outcomes in a case series of patients who underwent a specific type of surgery. Second, we did not compare our results with those in a control group of patients treated by different surgical techniques. Third, only one functional score was used to document the improvement of clinical outcomes after surgery, the usage of two scores would have been an additional strength as no single score is comprehensive.

Conclusion

As a conclusion, the procedure described is a safe, consistent, and reproducible surgical technique used for treatment of ALPSA

lesions with a very low rate of dislocation recurrence. The post-operative ASES scores showed statistically significant improvement compared with the preoperative score.

Financial disclosure

The authors declared that this study has received no financial support.

Consent

Written informed consents were obtained from each patient for the purpose of this study.

Declaration of competing interest

No conflict of interest was declared by the authors.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.asmart.2020.07.001>.

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