Original Article

10 Years of Arthroscopic Latarjet Procedure: Outcome and Complications

Abstract

Background: The treatment of anterior glenohumeral instability with a Bankart repair combined with a capsular plication is a frequently used arthroscopic technique. Latarjet created an open bone block procedure in 1954 for the treatment of anteroinferior glenohumeral instability. This procedure has been further developed by Lafosse in 2003 for arthroscopic surgery. The aim of this study is to evaluate the clinical outcome and complications of the latter procedure, most notably infection rate and nerve damage. **Materials and Methods:** 132 shoulders (106 males/19 females, 68 right/64 left) were included in this retrospective study. Patients were included if treatment was performed for anterior instability and if the patient's instability severity index score was at least 4, or if a revision procedure was performed after a prior unsuccessful arthroscopic or open capsule and labral repair. Treatment included the arthroscopic transfer of the coracoid process for the anterior stabilization of the shoulder joint. The disabilities of the arm, shoulder, and hand score were evaluated postoperatively in 76 patients and compared with the results found in the literature. Mean followup was 20.1 [±14.09] months. **Results:** The rate of recurrent glenohumeral instability which needed revision surgery after the arthroscopic Latarjet procedure was 6.1% (n = 8). There were no severe neurovascular complications seen in our cohort. In 32 cases, re-operation was performed due to subjective discomfort because of screw impingement or postoperative shoulder stiffness. **Conclusion:** The all-arthroscopic Latarjet procedure developed by Lafosse is a valid and reliable method for the treatment of shoulder instability. Our favorable results indicating that this procedure can prevent chronic shoulder luxation are repeatable, and the rate of postoperative recurrence is low.

Keywords: *Bankart lesion, glenohumeral instability, Latarjet procedure, shoulder arthroscopy*

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Introduction

The incidence of anterior glenohumeral instability is about 24/100,000 persons per year. This can be caused by trauma or genetic predisposition.[1] Soft-tissue lesions are most commonly connected to traumatic dislocations. Concomitant bony lesions to the glenoid rim or humeral head can amplify the degree of shoulder instability.[2-4]

If there are no bony lesions found in the setting of anterior glenohumeral instability, conservative treatment is recommended.[5,6] If patients are young and active, or conservative treatment failed, patients are at high risk of recurrent dislocations.[7] Glenohumeral stability can be achieved through the classic Bankart repair.[8]

An anatomic intraarticular procedure-like a Bankart repair might not be suitable when dealing with glenoid rim fractures as the risk of recurrence rises related to the size of the bony lesion.[9,10] Sugaya[11] included into his study100 consecutive shoulders after unilateral glenohumral luxation and evaluated the glenoid shape with three-dimensional computed tomography (CT) scans, comparing them to the contralateral healthy shoulder. He found bony fragments in 50 cases and compression or loss of normal configuration of the glenoid rim in 40 cases.

Biomechanic studies clearly show a failure of so-called "glenoid track" when 20%–25% of the glenoid surface is torn, and bone block procedures to restore glenohumeral stability are advised.[12]

Another reason for the poor clinical results after Bankart repairs are defects of the humeral head. This mostly refers to an engaging Hill-Sachs lesion or a chronic humeral avulsion of the glenohumeral ligament (HAGL). Patients with a high level of physical activity or who participate in contact sports have a higher risk of recurrent glenohumeral instability.[13] Such patients may have failure rates up to 67%

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due to bone defects in combination with high demanding sports activity.[14-17]

With the open bone block procedure, introduced 1954 by Latarjet,[18] and adapted to an arthroscopic approach by Lafosse in 2003, the glenoid's articular surface can be reconstructed and augmented by transferring a section of the coracoid process and the attached conjoint tendon to the anteroinferior glenoid via a subscapularis-split. Especially during the abduction and external rotation of the shoulder, a sling effect by the conjoint tendon can create dynamic stability after transfer.[19-22] Yamamoto[23] found in his cadaveric study that the sling effect is responsible for up to 77% of restored stability in mid- and end-range position in external rotation and abduction.

An open Latarjet procedure has a complication rate of 30%, and a moderate reoperation rate of around 7%.[24] The most common complications of this procedure include recurrent anterior dislocation, subluxation, and damage to the axillary and suprascapularis nerve. The technique was adapted.

Previous studies illustrate that arthroscopic procedures benefit from a smaller incision, less soft-tissue dissection, and a better repair with improved preservation of the patient's anatomy.[25] The purpose of this study was to document the experiences with the arthroscopic Latarjet repair, discuss the clinical results, evaluate the complications, and compare our findings to those of the open Latarjet procedure.

Materials and Methods

132 shoulders (106 males/19 females, 68 right/64 left) treated with an arthroscopic transfer of the coracoid process for the anterior stabilization of the shoulder joint, operated between September 2008 and December 2014 were included in this retrospective study. The modified technique described by Lafosse[26] using DePuy Mitek (Johnson and Johnson, New Brunswick NJ, USA) instruments were used in all cases. A total of 86.4% (114 shoulders) of all surgeries were performed by the senior author, with the remainder performed by two other experienced shoulder surgeons.

The inclusion criteria were if a procedure to correct anterior shoulder instability was carried out, and they had an instability severity index score (ISIS) ≥4, or if the stabilization was performed after a previous unsuccessful arthroscopic or open capsule and labral repair. Patients were excluded from the study if they had symptoms of multidirectional instability or voluntary instability, had undergone a prior arthroplasty procedure on that shoulder, or were not compliant with the postoperative rehabilitation protocol.

The mean patient age was 27.1 [±8.35] years. Of the 132 shoulders, 38 (28.8%) had previously been operated on for glenohumeral instability. Of these shoulders, 27 underwent arthroscopic Bankart repairs, four had open Bankart procedures, three underwent Neer-procedures, and four had undergone multiple previous surgeries.

Glenoid bone loss and concomitant lesions such as rotator cuff failure were identified with the use of CT or magnetic resonance imaging. Bone loss of the glenoid over 15%, according to the measurement method of Sugaya, was an indication for the arthroscopic Latarjet procedure. Preoperative and postoperative radiographs in three planes were available for all patients.

A total of 125 patients were asked to answer a postoperative disabilities of the arm, shoulder, and hand (DASH) score, and 76 patients answered this request. We compared our results to those found in the literature.

Operative procedure

All patients were placed in the beach chair position and examined under anesthesia to confirm their prior physical examination. In all patients, an additional interscalene block with local anesthesia (Naropin, FresniusKabi, Bad Homburg von der Hohe, Germany) was performed. Intraoperative monitoring of oxygenation of the brain was achieved with a bispectral index monitor in every patient.

Surgery was performed according to the standardized technique and instruments (DePuyMitekLatarjet instability shoulder system, Johnson and Johnson) developed by Lafosse. Additional standard arthroscopic instruments such as the shaver and VAPR (DePuySynthes, Johnson, and Johnson) were employed. Double-Pump systems (fms Duo, DePuySynthes, Johnson and Johnson) and a standard 30° optical scope were used for arthroscopy. Over the course of the study period, technical modifications were developed by the senior author. In the first 36 cases, the mounting of the coracoid was performed using shuttle cables as originally described. After this, we changed the technique, and the mounting of the coracoid was performed "free hand."

Diagnostic arthroscopy was performed through a posterior portal to verify the preoperative diagnosis and the final operative decision was made. Concomitant pathologies such as rotator cuff lesions, superior labral anterior to posterior (SLAP) lesions, HAGL lesions and Hill-Sachs impression fractures were evaluated and addressed by arthroscopic repair, if necessary. Hill-Sachs lesions were evaluated in maximal external rotation in 0° and 90° of abduction to see if there is a sign of engaging.

After the bone graft position on the glenoid neck was determined, the labrum was detached and the anterior joint capsule was opened to expose the subscapularis muscle. The rotator interval was then opened. At that time, the coracoid undersurface was exposed with preservation of the conjoint tendon, and the coracoacromial ligament was released. The lateral side of the conjoint tendon was released from the deltoid fascia as far as the pectoralis major insertion. The arthroscope was then moved to an anterolateral portal and the coracoid was prepared using a subdeltoid approach. We used a deep anteromedial portal, which is medial to the conjoint tendon and is defined under visualization with a needle using the anterolateral portal for the scope. Tenotomy of the pectoralis minor was then performed exposing both upper and inferior sides of the muscle after recognition of the musculocutaneous nerve, while keeping the VAPR close to the coracoid bone to preserve the nerve. Then, the subscapularis tendon split was performed at a point marked two-thirds of the way superiorly on the muscle at the same level as the future graft location. Two holes were predrilled via the superior (so-called "H") portal by using the coracoid drill guide after marking the target with two k-wires through the coracoid followed by the insertion of two special washers ("top hats"). An arthroscopic osteotomy of the coracoid at its base using a curved osteotome through a superior portal was performed, and the coracoid was mounted to a coracoid cannula. The undersurface of the coracoid was then smoothed with a burr to create the future fixation site of the glenoid. The coracoid/conjoint tendon was manipulated through the subscapularis split after confirming the correct position with a switching stitch inserted from the posterior portal parallel to the glenoid surface. The size of the split was found satisfactory, if full external rotation in 0° could be performed under anesthesia without limitation with the graft in the right position. It is very important at this point to avoid "overhanging" (lateralization) of the graft. If the positioning is not congruent with the glenoid surface, early onset of osteoarthritis due to screw impingement might be a consequence. Furthermore, medialization should be avoided, as this makes the graft insufficient in restoring the glenoid rim. The placement of the graft in the vertical plane should be lower than the 3 o'clock position in a right shoulder. The lower screw (alpha) will be placed at the 5 o'clock position. Too high aposition will lead to a limitation of external rotation. Too low a position might lead to malpositioning of the screw under the glenoid. Once the right position was found, the coracoid was temporarily fixed to the glenoid with two k-wires, which should be at a maximum 20-° angle versus the glenoid plane. Drilling was performed over the k-wires with a 3.2-mm drill and through the coracoid positioning cannula. Final fixation was achieved with two 3.5-mm cannulated screws.

A size ten drain was introduced into the joint, and the wounds were closed with absorbable sutures. The patient's arm was placed in a sling before leaving the surgical theatre.

Postoperative management

The shoulder was immobilized with a sling on the first postoperative day and pain-controlled active range of motion without limitation was started on the 2nd postoperative day. Active movement of the shoulder was permitted 2 days after surgery. Sports and overhead activities such as tennis and overhead training with heavy weights were restricted for 3 months.

Patients had to come into the office once before surgery and 3, 6, and 12 weeks after surgery. The last evaluation was generally performed at 10.5 ± 12.53 months (median: 5 months, range 1–62 months) postoperative. Radiographs in anteroposterior plane and outlet view were obtained on the day of surgery as well as 3 and 12 weeks postoperatively. If there was any doubt as to the union of the coracoid block to the glenoid, postoperative CT or magnetic resonance imaging was performed.

In 76 shoulders, a postoperative evaluation with a DASH score was performed with a mean followup of 13.7 ± 14.41 months (median: 8.5 months, range 1–62 months). No preoperative DASH scores were available. Patients were checked for anterior glenohumeral instability using the apprehension test and underwent neurologic testing. A full evaluation of the rotator cuff was performed including internal, external, and abduction force testing along with Gerber's test for subscapularis function, at the time of the final clinical followup. If a patient was diagnosed asymptomatic at the final check-up, he/she was told to come back to the office as needed.

The average length of followup was for 20.1 ± 14.06 months (median: 14 months, range 7–62 months).

This study was performed according to the Declaration of Helsinki. The Ethics Committee for Northwest and Central Switzerland issued no ethical concerns against this study.

Statistical analysis

Percentages were computed for categorical variables. Depending on the scaling of the variables, means and standard deviations or medians and ranges were calculated.

Significant differences in DASH scores between patients with and without revisions were evaluated using the *t*-test for independent samples. Normal distribution was checked visually via histograms and q-q plots. The validity of the assumption of a homogeneous variance was established by Levene's test.

To evaluate the impact of age, sex, revision rate, and prior surgeries on the complication rate after the arthroscopic Latarjet procedure, a multivariate linear regression analysis was used. Overall fit was tested with the r-squared statistic. The strength of the independent factors was assessed using standardized beta-coefficients.

A value of $P < 0.05$ was defined as significant for all statistical tests. Statistical analysis was performed using the SPSS 21 software (IBM, Armonk, New York, USA).

Results

Figure 1 shows the descriptive parameters for the patient population of all revisions. Of the 132 shoulders,

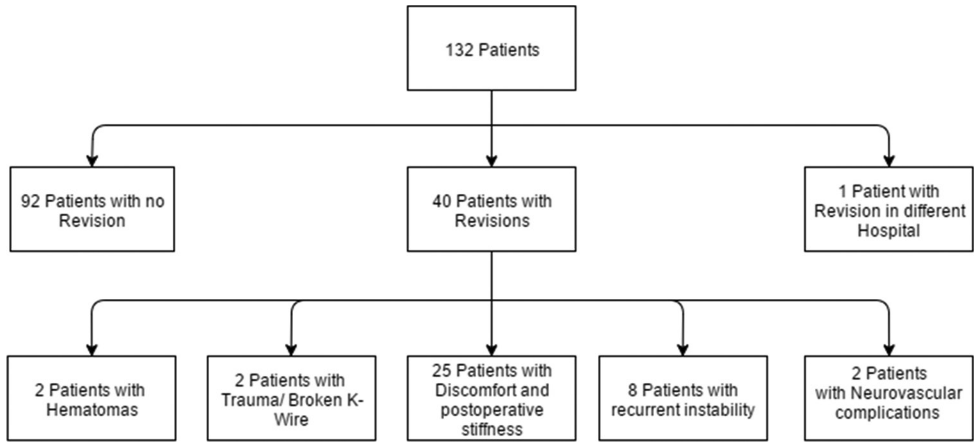

Figure 1: Tree diagram shows reasons for re-surgery

38 (28.8%) had a previous surgery for glenohumeral instability, 27 underwent arthroscopic Bankart repairs, four had open Bankart procedures, 3 had Neer procedures and 4 underwent multiple previous surgeries. Mean followup was 20.1 months [±14.09].

There was no need for an intraoperative conversion to an open procedure in any case. Revision surgery was necessary in 40 shoulders (n = 37, 30.3%). Indications for revision included instability in 8 cases, neuro complications in two cases. Relative indications for re-surgery in 25 cases were ongoing pain and/or stiffness. Our indication for revision in those cases was relative as there were no severe complications occurring. Five were classified as miscellaneous reasons. All revisions were performed during the first 52 months after the first intervention (mean 10.4 ± 11.81 months, median: 6 months, range 1–52 months), and 75% were performed during the first 10 months.

Regression analyses revealed that neither patient age, nor sex or history of previous surgery had statistically significant influence on complication rate.

Miscellaneous

All revisions were conducted using an arthroscopic technique except one, who was operated by our service at another institution and was therefore lost for followup.

There were no intraarticular infections in our cohort. In two cases, revision surgery was performed because of a postoperative hematoma, with good results after arthroscopic lavage. Histologic probes showed no proof of any bacterial infection in the joint. In those cases, patients recovered their shoulder function without any further surgical treatment.

In one case, a revision became necessary because of a traumatic Grade II (Lafosse) rupture of the subscapularis tendon while kitesurfing. It was possible to fix the tendon arthroscopically. After a rehabilitation program based on the postoperative protocol for a standard rotator cuff-repair, the patient did well.

In one case, a k-wire broke off, which was discovered in the first postoperative X-ray. Arthroscopic revision was done on day one after surgery to retrieve the loose wire.

In another case, the bone block dislocated after heavy trauma within 1 month after first surgery. No re-luxation of the glenohumeral joint was observed, and the coracoid tip could be used again for the arthroscopic Latarjet procedure.

All other indications for revision surgery were divided into three categories as follows: recurrent instability, neurovascular problems, and revisions due to subjective discomfort and/or postoperative shoulder stiffness.

Recurrent instability

The overall rate of glenohumeral instability was 6.1% (n = 8), which composed 20% of all revisions. Out of 8 in 6 cases (75%), a failure of bone block fixation was observed [Figures 2-4]. In those cases, a new heavy trauma lead to fractures of the screws through the coracoid process and occurred within the first 14 months after the first operation. Revision surgery was performed immediately after the trauma with the use of an iliac crest bone graft. After this intervention, four patients did well and recovered sufficient shoulder function within 6 months without any further luxation or subluxation. Of the other two patients, one recovered well in the 1st weeks after the revision, but fell on the operated shoulder again and dislocated the iliac crest block, although did not complain of subsequent symptoms of luxation or subluxation of the shoulder joint. We decided to wait, and she did recover with acceptable shoulder function within a few weeks. This patient was under physiotherapist treatment at the time of her last followup.

One patient suffered from a traumatic fracture of the coracoid process within 2 weeks of the second surgery without symptoms of luxation. After 7 months of conservative treatment the patient still had pain, and hence, we decided to remove the screws. It was not possible to reattach the fractured coracoid tip arthroscopically because it was partially resorbed at the time of the revision surgery. The patient still complained of recurrent subluxations 2 months later. In this case, a tricortical iliac crest was used to stabilize the shoulder, and after this, the patient did well.

Two patients reported ongoing episodes of subluxation even after intensive physiotherapy. While magnetic resonance imaging showed no abnormality, a positive apprehension test in one patient and a positive jerk test in the other revealed symptoms of subluxation. After arthroscopic labral rim fixation and capsular plication, these patients did well as of their last clinical followup.

Neurovascular complications

There were no severe neurovascular complications seen in our cohort. Two patients developed a temporary weakness to external rotation. The cause for this might be the screw positioning close to branches of the suprascapular nerve in the suprascapular notch. After removal of the screws, additional arthroscopic neurolysis of the brachial plexus,

Figure 2: X-ray (postoperative): Screw breakage and luxation of the shoulder (anteroposterior view)

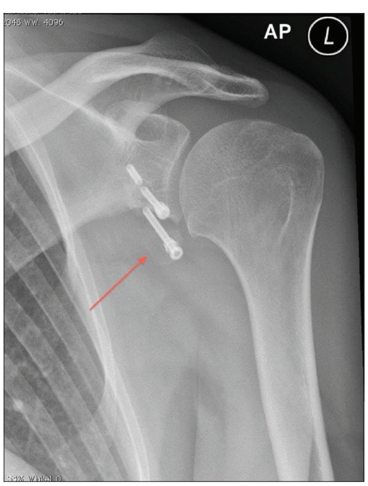

Figure 4: Postop radiographs showing screw breakage and luxation of the coracoid craft (red arrow)

and intense physiotherapy, the symptoms recovered within a couple of weeks.

Discomfort and postoperative stiffness

All other revision cases had a relative indication for re-operation, such as subjective discomfort because of hardware impingement or postoperative shoulder stiffness. Stiffness was defined positive when there was a limitation of external rotation of 10° and flexion of 90° within 3 months after surgery.

Of the 40 revision cases, 25 (62%) reported pain at night and when the weather changed, or felt some snapping or scratching in the joint while rotating the arm externally. Radiographs did not show any evidence of screw impingement to the humeral head. These patients were offered conservative treatment such as physiotherapy and corticosteroid injections, but all decided to undergo an arthroscopic screw removal and a capsulotomy [Figure 5]. A concomitant neurolysis of the brachial plexus was performed to release the nerves from scar tissue.

Clinical effect of the revisions

DASH scores could be obtained from 76 patients (61.4% of the total sample). The average overall DASH score was 10.6 (±12.77). Postoperative DASH scores after

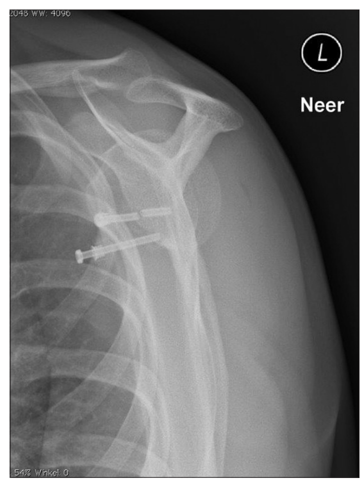

Figure 3: X-ray (postoperative): Screw breakage, outlet view

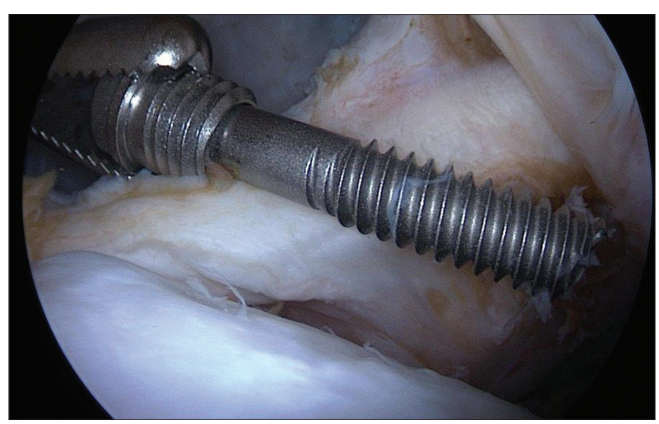

Figure 5: Intraoperative arthroscopic picture of screw removal

14.2 months showed a mean of 13.1 (±18.05) in the revision group and 9.2 (±8.82) without revision [Table 1]. The mean postoperative DASH score in those shoulders that underwent revision surgery was not significantly different from those that did not need a revision [Figure 6]. There were no predictors detected for the complications following the arthroscopic Latarjet procedure (patient age, sex, and history of previous surgery or revision were evaluated).

Discussion

It is absolutely clear that the transfer of the coracoid and the short head of the biceps lead to an excellent clinical outcome and a low recurrence rate. The biggest advantages of the arthroscopic technique are a permanent view of the axillary nerve while splitting the subscapularis tendon and a better view for positioning the bone graft. Mizuno reported long term followup results of the open Latarjet procedure showing incorrect bone block positioning in 20.6% of the cases (7.5% medialized and 13.2% overhang).[27] Lateralization might lead to osteoarthrosis while a more medial position might produce insufficient results leading to re-dislocation. In our cohort, malpositioning of the bone block was observed in one case.

Another big advantage is the concomitant treatment of other soft-tissue pathologies such as SLAP, Pulley or rotator cuff lesions in the same surgery.

Visualization of all anatomical structures is very important during this highly demanding surgery. Perfect anesthesia is a must to achieve accurate blood pressure and relaxation of the muscles. To avoid the risk of ischemia to the brain when lowering the blood pressure, monitoring of cerebral oxygen was measured with near-infrared spectroscopy. Cerebral oxygen saturation was measured by near-infrared spectroscopy and jugular venous bulb oxygen saturation.[28]

We decided to use the instability severity index score (ISIS) more strictly than originally described by Boileau.[29] In a consensus meeting of the French society of arthroscopy in 2015, the advice for bone block procedure was given even with an ISIS of more than 2.

The current study revealed a 30% complication rate that required revision surgery. We included all reasons for re-surgery as a complication, even if a heavy trauma was the cause for recurrent instability. This complication rate is in line with what is described in the literature for an arthroscopic Latarjet procedure thus far. Our complication rate is also similar to what has been reported after open Latarjet procedures, where complication rates up to 25% have been cited.[30] However, the causes of these complications differ in origin. Agneskirchner[20] describes 10 revisions in a retrospective study discussing 50 cases of arthroscopic Latarjet procedures. The indications for a revision are comparable to our cohort, with five recurrences of glenohumeral instability, four cases of screw impingement, and one revision because of a deep infection. There were no infections reported in our cohort, while an infection rate of 1%–6% is generally found in the literature.[31] The neurovascular complication rate after a Latarjet is reported to be 1.4% in a review paper by Griesser *et al.*,[32] which is independent of whether an open or arthroscopic approach was used. In our cohort, one patient had a transient irritation of the suprascapular nerve. The axillary nerve was not involved in our series because permanent visibility of the nerve is allowed by arthroscopic procedures. [Figure 7] Our revision

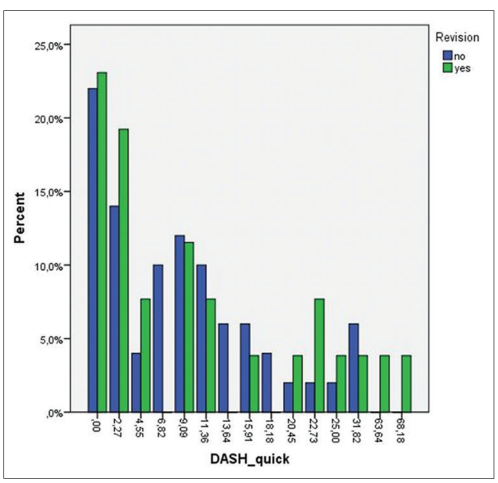

Figure 6: Histogram of the disabilities of the arm, shoulder and hand scores compared between revision and non revision cases

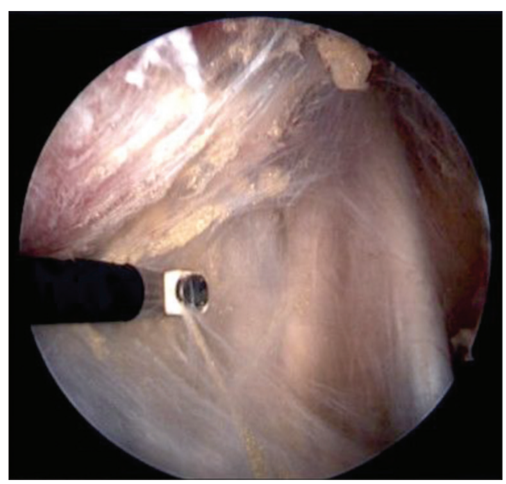

Figure 7: Intraoperative view on the axillary nerve

Table 1: Postoperative disability of the arm, shoulder and hand scores for revisions/non revisions

DASH	All	Revisions (*n*=26 shoulders)	Nonrevisions (*n*=50 shoulders)	*P*
Mean±SD	10.526±12.764	13.11±18.048	9.18±8.820	0.303
Median (minimum–maximum)	7.49 (0-68.18)	6.82 (0-68.18)	7.95 (0-31.82)	0.864

SD=Standard deviation, DASH=Disability of the arm, shoulder and hand rate seems to be quite high and might be explained by our management of hardware problems. In our opinion the screws should be removed when there is evidence of impingement or discomfort, as this might lead to capsulitis and stiffness The hardware removal rate was higher than the 2% mentioned in the literature [Figures 8 and 9]. These revisions had a relative indication, but the patients decided to undergo a repeat shoulder arthroscopy after being offered all alternative options. Altogether, our complication rate is comparable to what we found in the literature for the open Latarjet technique as well as for arthroscopic approaches.

The recurrence rate of glenohumeral instability found in our cohort was 6.1%, which is similar to what we found in the literature. If cases of re-luxation due to heavy trauma are excluded, the recurrence rate is as low as 1.5% of all 132 shoulders.

The reappearance of anterior glenohumeral instability described in the literature after an open Bristow-Latarjet procedure can reach up to a mean of 7%.[33] The rate of recurrence after an arthroscopic Bankart repair varies widely in the literature, ranging from 0 to 30% with a mean of 9%.[34,35]

Postoperative DASH scores were available in 76 patients. There was no significant difference between the DASH scores of revision and non revision cases. In his long term study of the open Latarjet procedure, Hovelius[36] describes a mean postoperative DASH score of 4.3, which is slightly better than what we found in our cohort. This might be explained by the different language of the DASH score used, the differences in the composition of the cohorts and different patient expectations [Figure 10].

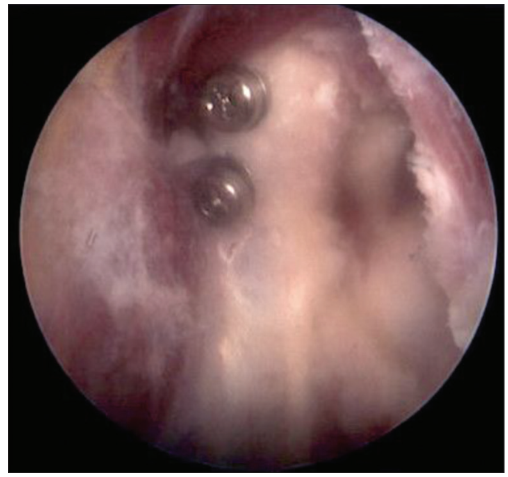

Figure 8: Correct fixation of the graft (intraoperative view)

Figure 9: Postoperative radiograph (anteroposterior view) of correct screw placement

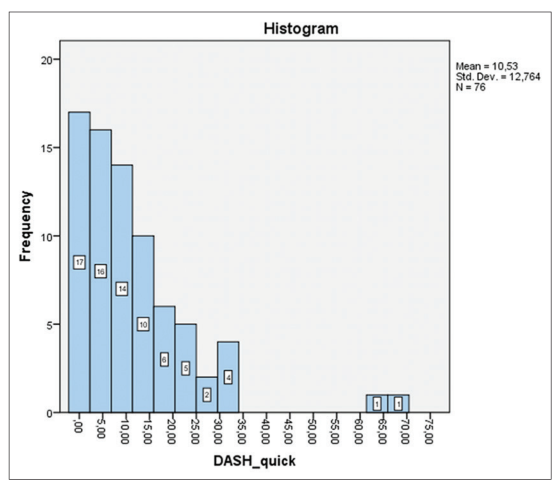

Figure 10: Histogram of the overall disabilities of the arm, shoulder and hand-score rates

Conclusion

Overall, it can be stated that the arthroscopic Latarjet procedure is a reliable method with a lower postoperative complication rate than the open procedure, and better results concerning recurrence of instability than other techniques described in the literature are obtained. Our results indicate that chronic shoulder luxation can be prevented. The procedure is repeatable and the rate of postoperative recurrence is low. We decided to include all re-operations in our study because we believe that removal of screws might be obligatory in many cases as the remodeling of the glenoid will lead to an "overhanging" of the upper screw and might be the reason for discomfort and impingement. This will be avoidable with further development of the surgical technique and instruments to prevent hardware problems. Furthermore, there are indications of flat learning curves with this method.[37] More long term data are also needed to evaluate this surgical technique to assess its rate of osteoarthritis development. Limitations of the study are the retrospective design and that there is no pre-op DASH score available.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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