Clinical and radiological outcomes after arthroscopic Latarjet procedure: a systematic review of the literature

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Purpose: Arthroscopic techniques are becoming the gold standard in the treatment of glenohumeral instability with glenoid bone loss. The purpose of this systematic review is to present the clinical and radiological outcomes following arthroscopic Latarjet procedure. Methods: A comprehensive literature systematic review was performed to identify studies reporting clinical and radiographic results of arthroscopic Latarjet procedure. Results: Nine articles were selected, which described 512 procedures. Study type, complications, radiographic evaluation, preoperative and postoperative functional scores are identified, analyzed and discussed. Satisfactory results are presented by all authors, and significant postoperative satisfaction with a low rate of dislocation, and accurate graft positioning is reported by all the studies. Conclusion: Although high-level evidences are lacking, arthroscopic Latarjet appears to be an effective and safe option to treat glenohumeral instability with bone loss and to provide successful clinical results durable with time. This technique allows accurate graft positioning and satisfactory fusion rate without additional complications compared with open surgery. Level of evidence: Review of level IV and V studies, Level IV.

Keywords: arthroscopic Latarjet; glenohumeral instability; glenoid bone loss; shoulder arthroscopy


Introduction

In 1954, Latarjet described for first a coracoid process transfer to treat anterior glenoid bone loss in which the inferior surface of the coracoid was passed through the subscapularis tendon and fixed on the anterior edge of the glenoid [1]. Bernageau and Patte postulated that this new technique provides stability by the “triple blocking effect”: the sling effect of the conjoint tendon on the subscapularis, the bone effect of the graft, and the ligament effect of the coracoacromial ligament stump [2]. The effectiveness of the Latarjet procedure for the treatment of anterior glenohumeral instability has been extensively reported [3-8]. Since, the description of the original technique by Latarjet, many modifications have been proposed and recently the procedure has been performed arthroscopically and arthroscopically-assisted [6-9].

Actually, arthroscopic surgical management for the treatment of shoulder instability with glenoid bone loss are evolving rapidly, and the number of publications regarding arthroscopic Latarjet increases every year [10-13]. Arthroscopic techniques are becoming the gold standard for treatment of glenohumeral instability with glenoid bone loss, providing similar functional results to open and mini-open surgery, with a decrease in postoperative complications [14-17]. A wide variety of different treatment modalities can be performed arthroscopically, and most publications report satisfactory results. However, there are no systematic review in literature about arthroscopic Latarjet procedure.

The goal of this study is to review systematically the
literature and present results associated with the arthroscopic Latarjet in order to provide clinicians and researchers with an updated standpoint about this technique.

**Materials and methods**

**Search strategy**

This study did not require ethic committee approval. A methodical review of the literature was performed to identify all studies reporting clinical or radiographic results after arthroscopic Latarjet procedure. MEDLINE (2000 to September 2015) was searched by an investigator (R.D’A). The search terms used were “arthroscopic Latarjet” AND “arthroscopy Latarjet” AND “arthroscopic Bristow” AND “Arthroscopic Bristow-Latarjet”. The references of relevant review papers were also searched. The initial search strategy revealed 68 articles for consideration. After a first screening-based exclusion criteria, 19 records remained; of these, 10 were excluded after abstract and full-text review on the basis of eligibility criteria. Nine studies were included in the review (Fig. 1).

**Eligibility and exclusion criteria**

**Types of studies**

All randomized controlled trials and prospective cohort studies (level I and II studies) were included, as well as retrospective comparative trials (level III studies), therapeutic case series (level IV studies) and case report (level V studies). Reviews, meta-analyses, and editorial pieces were excluded. Animal studies, in vitro studies and biomechanical studies on human cadaver specimens were also excluded.

**Subjects, interventions and follow-up**

Studies enrolling human subjects of all ages who underwent arthroscopic Latarjet procedure were eligible for inclusion. Studies investigating open or arthroscopically assisted procedures, were excluded as well.

**Study selection and data collection**

Information regarding author, data and journal of publication, study design and level of evidence, patient demographics, modality for diagnosis, treatment intervention, follow-up duration, outcomes, complications and failure rates and evidence of tendon healing (either obtained from clinical tests, from histological findings or from imaging techniques) were extracted and entered into a spreadsheet for analysis.

**Results**

Specific data from each of the nine articles that met the inclusion criteria are reported in Table 1. Eight level IV (therapeutic case series), and one level V (case report) studies were selected. Lafosse [18] for first describes the clinical results of the technique that he developed and described. The author reports clinical and radiographic results for the first 100 shoulders underwent to arthroscopic Latarjet procedure. 88% of the patients were involved actively in sports and 38% at a competitive level. All patients had sustained dislocations, consisting of 1 to 3 dislocations in 40%, 4 to 10 episodes in 50%, and more than 10 in 10%; 97% of the dislocations were traumatic. At first follow up at 18-months, 80% of patients were totally satisfied, 18% were partially satisfied, while 2% were disappointed with their outcome. Mean return to work was after 2 months and returned to sports at 10 weeks. At 26 months, patient-reported outcome revealed 91% excellent scores and 9% good in 35 patients. Authors noted a loss of external rotation of 18°. The author reports that 11% of the patients had progressed osteoarthritis one stage only according to Samilson and Prieto [27]. CT-scan used to evaluate coracoid graft position revealed that the graft was flush with the glenoid in 80%, was medially placed in 8%, and was lateral overhang in 12%. Vertical positioning was perfect in 78%, too high in 7%, and too low in 5%. The screw angle in relation to the glenoid face averaged 29°. Perioperative complications included 2 hematomas, 1 intraoperative graft fracture, and 1 transient musculocutaneous nerve palsy. Late complications included 4 cases of nonunion of the graft to the glenoid, Four patients required late arthroscopic screw removal. There were no cases of recurrent dislocation. In the first clinical study about arthroscopic Latarjet Lafosse concludes that is a reliable but difficult technique, with a steep learning curve. Result in mid-term follow-up are excellent, with minimal complications and good graft positioning.
### Tab 1. Specific data from the ten articles included in the review

<table>
<thead>
<tr>
<th>Reference</th>
<th>Level of evidence</th>
<th>N. Patient, months [mean range()]</th>
<th>Follow-up</th>
<th>Previous surgery</th>
<th>Surgical technique</th>
<th>Associated intraoperative lesions</th>
<th>Preoperative Functional score and clinical history</th>
<th>Postoperative Functional score</th>
<th>Imaging</th>
<th>Reliability</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lafosse et al. 2010[18]</td>
<td>IV</td>
<td>10 0 26 months</td>
<td>15% bankart repair –</td>
<td>Arthroscopic Latarjet</td>
<td>6% SLAP 1% posterior Bankart</td>
<td>Number of dislocation: 40% 1 to 3 50% 4 to 10 10% &gt; 10 97% Traumatic</td>
<td>91% excellent scores, 9% good Loss of external rotation of 18°</td>
<td>11% OA progressd one stage</td>
<td>Graft positioning: 80% flush 8% medially 12% laterally Vertical positioning: 78% perfect 7% high 5% low. Screw angle: 29°</td>
<td>Non e</td>
<td>Perioperative: 2% hematomas 1% graft fracture 1% musculocutaneous transient palsy Late complications: 4% case of nonunion</td>
</tr>
<tr>
<td>Boileau et al. 2010[19]</td>
<td>IV</td>
<td>47 16 months (6-32)</td>
<td>12% Bankart repair</td>
<td>Arthroscopic Bankart-Bristow-Latarjet</td>
<td>91% Hill-Sachs Lesion</td>
<td>ISIS 5.10 32% patients recurrent dislocations 25.5% recurrent subluxations, 42.5% luxations and dislocations</td>
<td>Rowe score 88 (50-100) Walch Dupay 87.6 (50-100) SSV 87.5% (40-100) Anterior elevation 175° (160°-180°) external rotation (0°-80°) 12.8% apprehension test positive</td>
<td>Horizontal Plane: 91% optimally 6% medially 2% laterally Vertical Plane: 98% optimally 2% judged to be equatorial Screw angle 20.2° (0°-37°)</td>
<td>Non e</td>
<td>17% nonunions 8.5% lysis of the bone block 2% glenoumeral arthritis</td>
<td></td>
</tr>
<tr>
<td>Castricini et al. 2013[20]</td>
<td>IV</td>
<td>30 13 months (6-22)</td>
<td>10% arthroscopic Bankart 3.3% Putti Plate</td>
<td>Arthroscopic Latarjet</td>
<td>80% Hill-Sachs 6.5% SLAP 3.3% posterior Bankart 3.3% partial cuff tear</td>
<td>Rowe (20-30) 27</td>
<td>N.A.</td>
<td>90</td>
<td>N.A.</td>
<td>Postoperative: flexion 70° abduction 60° external rotation 10°</td>
<td>Non e</td>
</tr>
<tr>
<td>Sastre et al. 2014[21]</td>
<td>V</td>
<td>1 Postoperative and at 6 months</td>
<td>Postoperative and reinsertion of the inferior glenohumeral ligament (IGHL) on the humeral side via arthroscopy</td>
<td>Arthroscopic latarjet</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>Postoperative: flexion 70° abduction 60° external rotation 10°</td>
<td>N.A.</td>
<td>1 subluxation 1 recurrent instability 4.7% hematoma 1.5% displaced of the graft 12.5% screws removal 1.5% glenohumeral arthritis and prosthesis implant</td>
<td></td>
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<tr>
<td>Dumont et al. 2014[22]</td>
<td>IV</td>
<td>62 (61.2-10.7)</td>
<td>18.8% arthroscopic Bankart repair</td>
<td>Arthroscopic technique</td>
<td>N.A.</td>
<td>Mean dislocation 5.3 Mean subluxation 4.1</td>
<td>Aggregate WOSI 90.6% WOSI physical symptoms 90.1% Sports/recreatio n/work 90.3% Lifestyle 93.7% Emotions 88.7%</td>
<td>N.A.</td>
<td>N.A.</td>
<td>1 subluxation 1 recurrent instability 4.7% hematoma 1.5% displaced of the graft 12.5% screws removal 1.5% glenohumeral arthritis and prosthesis implant</td>
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A similar article was published by Boileau in the same year showing the preliminary results of the all arthroscopic Bankart-Bristow-Latarjet. Over a 2-year period, 47 were treated for chronic anterior instability associated with bone loss and capsular deficiency. 6 patients reported a failure of a previous arthroscopic anterior Bankart. 15 patients had recurrent dislocations, 12 had recurrent subluxations, and 20 had both subluxations and dislocations. The mean ISIS was 5.10. In addition to glenoid deficiency, 43 patients (91%) had a significant posterosuperior humeral bone defect (Hill-Sachs lesion). The procedure was performed entirely arthroscopically in 41 of 47 patients (88%). Patients were clinically evaluated at a mean follow-up of 16 months. No patient had any recurrence of instability. The mean Rowe score was 88, and the mean Walch-Duplay score was 87.6 All patients were satisfied except for 1 patient who developed glenohumeral arthritis. Subjective Shoulder Value was 87.5%; mean active anterior elevation was 175°; mean external rotation with the arm at the side was 48°. 6 patients reported positive apprehension test. The bone block was optimally positioned in the vertical plane in 98% of the cases. No bone block was over the equator line. In the horizontal plane the bone block was optimally positioned in 91% of the cases; only 1 bone block was positioned too far lateral, whereas 3 grafts appeared 5 mm medial to the joint. One patient reported early postoperative fracture of the bone block. 7 grafts did not heal and/or migrated from their original position, for a total of 8 nonunions. Nonunions were associated with too short and unicortical (too short) in 5 cases; in 4 cases, the screw was considered to be too long. 4 bone graft fracture Postoperative: 1.4% hematoma 1.4% musculocutaneous transient palsy

The same author reported the clinical results of the same surgical technique 4 years later on a wider group of patients
All patients were evaluated at 3, 6, and 12 months after surgery. At a mean follow-up of 35 months, 98% patients had a stable shoulder and only 2% experienced a redislocation. Clinical examination showed that 19% had positive apprehension test. The mean Rowe score was 89.7 and the mean Walch-Duplay score was 90. The mean active anterior elevation was 178°; mean external rotation was 57°. 83% of the patients returned to sports at the preinjury level. Radiographically the bone graft positioning was accurate in 90% of the patients and flush to the glenoid surface in 93%. Bone block resulted healed in 73% of the patients and there was non union in 20% and osteolysis in 7%. The mean inclination angle between the screw and the glenoid surface was 20.4° and no screws violated the articular surface; moreover the screw was bicortical in 83% and unicortical in 17%. According to Samilson and Prieto 
91% of the patients had no glenohumeral osteoarthritis, while 9% had minor or moderate (Grade 1-2) Postoperative complications included an hematoma and a transient musculocutaneous nerve. 6% of the patients with bone block nonunion/migration were reoperated on, between 1 and 2 years after surgery because of pain related to screw pullout from the glenoid. In his patient’s cohort Boileau demonstrates how arthroscopic Bankart-Bristow-Latarjet procedure is reproducible and safe and allows restoration of shoulder stability. Moreover highlights that arthroscopy offers the advantage of providing adequate visualization of both the glenohumeral joint and the anterior neck of the scapula, allowing accurate placement of the bone block and screw.

Always Boileau [26] has recently described a new technique that provides fixation of the coracoid using buttons instead of screw and thereby avoiding the complications due to the fixation device. At a mean follow-up of 14 months none of the 76 patients had redislocation of the shoulder; however, 1 rugby player experienced a traumatic subluxation due to a failed union of the graft. At follow-up, the mean Rowe and Walch-Duplay scores were respectively 95 and 96 , and 93% of the patients returned to sports activity. Coracoid bone graft positioning was congruent in 96% of the patients and only 3 patients reported a lateral positioning. Moreover the graft resulted healed in 91% of the patinets after 6 months, while failed in 9% for fibrous union. No hardware failures and no graft migration were observed. Button fixation can be an alternative to screw fixation, optimizing graft positioning accuracy and obtaining an excellent rate of bone union. Neurologic and hardware complications, classically reported with screw fixation, have not been observed with this guided technique and novel fixation method.

The study with the longest follow-up is described by Dumont [22], showing the clinical results after more than 5 years. A total of 62 patients (64 shoulders) were evaluated at a mean follow-up of 6.4 years. The mean number of dislocations before surgery was 5.3, and the mean number of subluxations before surgery was 4.1. Postoperative participation in sports was reported in 58 of 62 patients. The mean aggregate WOSI was 90.6%; mean WOSI domain scores were as follows: Physical Symptoms 90.1%; Sports/Recreation/Work 90.3%; Lifestyle 93.7%; and Emotions 88.7%. Of 64 patients, 3 were noted to have postoperative hematoma, which resolved spontaneously. In total 15.6% of the patients were re-operated: 1 patient returned for a displaced coracoid graft, which, 8 patients returned to have prominent screws removed, and 1 patient required total shoulder arthroplasty for glenohumeral arthritis. The rate of recurrent instability after arthroscopic Latarjet procedure is low in this series of patients with a minimum 5-year follow-up. Patient outcomes as measured by the WOSI are good.

The study of Castricini[20] of the 2003 is the first that, in addition to the clinical results, evaluated the learning curve for arthroscopic Latarjet procedure. 30 patients were evaluated at a mean follow-up of 13 months. Mean pre- and post-operative Rowe were respectively 27 and 90. Clinical outcome was excellent in 70% of the paciente and good in 30%. Operated shoulder showed a loss of 12° in exteme rotation. The mean time until return to work was 30 days, and the mean time until return to sports was 4 months. At 13 months, patient satisfaction with the operation was high, with 70 % very satisfied and 30 % satisfied. All complications concerned about graft fracture in 10% of the patients. Age superior to 40 years was found to be associated with complications. The graft was positioned medially in 7% of the cases, flush with the glenoid 76%; it was too high in 7% and too low in 3% There were no neurological, vascular, or septic complications. Two patients required screw removal after 1 year due to intolerance to fixation devices. There were no cases of recurrent dislocation. As regards the learning curve the author highlights how operative time decreased significantly from 132 min in the first 15 surgical procedure to 99 in the last 15. This study demonstrates that arthroscopic Latarjet procedure is a standardized, hence reproducible technique whose complexity makes it suitable only for surgeons with solid experience in arthroscopy and shoulder surgery.

Two recent studies evaluate the correct positioning of the graft bone in arthroscopic Latarjet. In his study Casabianca [24] assess the positioning of the coracoid graft and the fusion rate on CT scan in the arthroscopic Latarjet procedure. Nineteen patients were included. Radiological assessment was performed 3.1 months
after surgery. In the sagittal view, grafts were positioned between 1:20 and 5:07 h. Mean positioning was 1:52 h to 4:04 h. No overhanging position was noted. In the axial view, 32% of the grafts positioning were considered as flush, 38% as congruent, 30% as medial including only 6% too far medial. No lateral position was noted. Bony union was achieved in 78% of the patients, whereas fibrous union and non-union were noted, respectively, in 11% of the patients patients. The α angle was 19.9° with 27% overangulated screws (α > 25°). Two complications occurred: an intra-operative graft fracture due to an inappropriate coracoid preparation and an early case of osteolysis in a medial-positioned graft. Casabianca concludes that the technique provides a good positioning of the bone graft and fusion rate although remains technically challenging.

Kany [25] instead hypothesized that the arthroscopic Latarjet procedure could be performed with accurate bone block positioning and screw fixation with a similar rate of complications to the open Latarjet procedure. 105 shoulders (104 patients) underwent to arthroscopic Latarjet procedure and bone positioning and screw angulation was evaluated by CT-scan analysis. Also the learning curve was evaluated comparing 2 chronologic periods (30 procedures performed in each period), separated by an interval during which 45 procedures were performed. CT-scan showed that the coracoid graft was accurately positioned relative to the equator of the glenoid surface in 91.5% of the shoulder. Accurate bone-block positioning on the axial view was obtained in 81% of the patients. This procedure was performed in a lateralized position in 7.3% and in a medialized position in 11.6% shoulders. The mean screw angulation with the glenoid surface was 21°. One patient had transient axillary nerve palsy. 2.8% of the cases needed revision for surgery. Evaluation of learning curve highlight that, compared with first surgical procedure, the average surgical time decreased, and the risk of lateralization showed a statistically significant decrease during the last period. Kany, in his retrospective study, substantiates that arthroscopic Latarjet allows an accurate bone-block positioning and screw fixation with a similar rate of complications to the open Latarjet procedure.

The last study of the review is a case report published by Sastre in 2014 [21]. The author reports a clinical case of a twenty-four-year-old male underwent to Latarjet procedure using the arthroscopic technique described by Lafosse. In the immediate post-operative period, the patient presented pain and weakness in the scapular girdle, with active flexion of 70°, active abduction of 60° and external rotation of 10° associated to dysesthesia on the anterior external side of the forearm. CT scan and plain radiographs of the shoulder revealed that the tip of the upper fixation screw was lodged in the suprascapular notch. After 6 months of follow-up, and after checking that the coracoid process was consolidated, the screws were removed and patient’s symptoms subsequently improved and he progressively gained strength in the shoulder.

Conclusions

Literature review shows how arthroscopic Latarjet procedure is a technically challenging surgical procedure that provides accurate graft positioning and satisfactory fusion rate without additional complications compared with open surgery. This technique allows to treat anterior instability with severe glenoid bone loss, to restore shoulder stability, maintained range of motion, to return to sports at preinjury with a low rate of recurrent instability.

Conflict of interest

The authors do hereby certify that there is no conflict of interest with any financial organization regarding the material discussed in this manuscript.

References


