# Open Latarjet Procedures Produce Better Outcomes in Competitive Athletes Compared With Recreational Athletes

## A Clinical Comparative Study of 106 Athletes Aged Under 30 Years

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**Background:** In cases of shoulder stabilization for anterior instability, the main goals of the surgery are a rapid and efficient return to sports and excellent long-term outcomes without recurrence of dislocation, particularly in young and competitive athletes.

**Purpose:** To determine whether outcomes of open Latarjet procedure (OLPs) depend on the level of sports practiced by patients and to report clinical scores and complication rates for OLP at a minimum follow-up of 2 years.

**Study Design:** Cohort study; Level of evidence, 3.

**Methods:** A retrospective comparative study was conducted for all patients who underwent OLP by the senior author (J.B.) between July 2007 and December 2012. The indication for OLP at the authors' institution was a minimum of 2 episodes of dislocation and/or subluxation, a positive apprehension test result in the cocking position, an Instability Severity Index Score more than 2, and evidence of anterior instability lesions on computed tomography arthrograms. The 106 included patients (110 shoulders) with a mean follow-up of 46 months were compared in 2 groups depending on sport activities: 57 (54%) competitive athletes and 49 (46%) recreational athletes. The principal outcome measure was evidence of recurrent instability. The secondary outcome measures were clinical scores related to anterior instability and related to sport practice: Rowe score, Oxford Shoulder Instability Score (OSIS), Western Ontario Shoulder Instability Index, and level of satisfaction.

**Results:** Of the 106 patients, 3 reported recurrence of shoulder dislocation: 2 competitive athletes (3.5%; 95% CI, 0.9%-11.2%) and 1 recreational athlete (2%; 95% CI, 0.4%-10.7%) ($P = .684$). The persistent apprehension test result was positive in 7 competitive athletes (11.5%) and in 5 recreational athletes (10%) ($P = .566$). The Rowe scores improved from 56.3 ± 13.2 (range, 30-80) preoperatively to 84.2 ± 16.4 (range, 30-100) postoperatively in competitive athletes and from 55.0 ± 11.0 (range, 35-80) to 69.5 ± 22.0 (range, 15-100) in recreational athletes ($P < .001$). The net improvement in Rowe scores was significantly greater in competitive athletes (27.9 ± 21.7) compared with recreational athletes (14.5 ± 24.4) ($P = .006$). The scores unrelated to sport activity (Oxford Shoulder Instability Score and Simple Shoulder Test) were similar for the 2 groups. All 57 (100%) competitive athletes and 34 (69.4%) recreational athletes resumed their previous sports practice, at the same level or higher than before their injury (respectively, 78.9% and 42.9%; $P = .004$).

**Conclusion:** The OLP could be considered for primary shoulder stabilization, particularly in competitive athletes, who have high functional demands and great risks of redislocation.

**Keywords:** shoulder instability; Latarjet procedure; return to sports; competitive athletes

Anterior glenohumeral dislocation is a frequent shoulder injury in young athletes, especially in collision sports practice.[27] Surgical stabilization is indicated for patients with recurrent shoulder instability, by means of a soft tissue repair such as arthroscopic Bankart, or a bone-block procedure, like the open Latarjet procedure (OLP). Studies have reported the reliability and efficacy of the OLP to prevent iterative dislocations, without compromising long-term outcomes.[22,23,33] The OLP seems to offer greater stability than the arthroscopic Bankart stabilization.[3,9,29,43] However, potentially severe complications have been reported with OLP (eg, postoperative pain, infection, neurologic injury,

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limited shoulder range of motion, and osteoarthritis[21]), which could compromise shoulder function in young athletes.

The Bankart procedure is preferred by the majority of surgeons despite greater risks of recurrence. Arthroscopic soft tissue stabilization was reported to provide a better rate of return to sports compared with the OLP.[10] However, young athletes are particularly exposed to failure in terms of recurrence, and the reported risk factors are age younger than 22 years, male sex, number of preoperative dislocations, off-track Hill-Sachs lesions[29] or glenoid bone loss, shoulder hyperlaxity,[11] and practice of sport at a competitive level.[37] The OLP is therefore a valuable revision option if a Bankart procedure fails, but using the so-called nonanatomic procedure as a primary solution remains controversial.

In cases of shoulder stabilization for anterior instability, the main goals of surgery are a rapid and efficient return to sports and excellent long-term outcomes, without recurrence of dislocation, particularly in young and competitive athletes. The American Academy of Pediatrics classified sports activities as contact or collision, limited contact, and noncontact sports.[31] Careful consideration should therefore be given to young athletes practicing collision or contact sports, which is a major risk factor for recurrence of dislocation after a stabilization procedure.

The purpose of this study was to determine whether outcomes of OLP depend on the level of sports practiced by patients and to report clinical scores and complication rates for OLP at a minimum follow-up of 2 years. We hypothesized that the recurrence rate of dislocation after stabilization with OLP would be higher in competitive athletes compared with a control group of recreational athletes. We also analyzed complication rates, shoulder functional scores, and quality of return to sports, depending on level of sports activity.

## METHODS

With approval of the institutional review board of the Centre Ostéo-Articulaire des Cèdres (COAC IRB #2014-01), a retrospective comparative study was conducted for all patients who underwent OLP by the senior author (J.B.) between July 2007 and December 2012. The indication for OLP at our institution was a minimum of 2 episodes of dislocation and/or subluxation, a positive apprehension test result in the cocking position, an Instability Severity Index Score more than 2, and evidence of anterior instability lesions on computed tomography arthrograms (humeral Hill-Sachs lesion and/or glenoid-sided defects).

The inclusion criteria were a minimum of 2 years of follow-up, age 16 to 30 years, and regular practice of a sport activity. The exclusion criteria were previous instability surgery, arthroscopic Latarjet procedure, multidirectional instability, and no sporting activity. Of the original cohort of 183 patients, a total of 125 patients met the inclusion criteria (Figure 1). Of these, 13 (10.4%) patients could not be reached, and 6 (4.8%) declined to participate in the study. The remaining 106 patients were evaluated clinically at a mean follow-up of 46 ±16 months (range, 25-86 months).

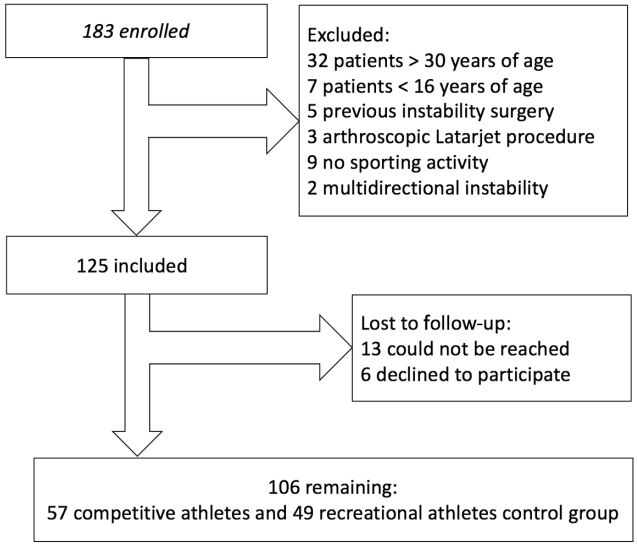


**Figure 1.** Flowchart detailing inclusion and exclusion of patients from the original cohort.

Patients were considered competitive athletes if they fulfilled all 4 of the criteria of Araujo and Scharhag[4]: (1) training in sports aiming to improve their performance; (2) actively participating in sport competitions; (3) formally registered in a local, regional, or national sport federation as a competitor; and (d) having sport training and competition as their major activity or focus of interest. Patients who did not fulfill these criteria were considered recreational athletes.

The competitive athletes group included 57 patients, of whom 39 (68%) were professional or played in a national team and 18 (32%) practiced their sport in an amateur league. The recreational athletes group (control) included 49 patients. For each patient, the sports practiced were classified as "contact or collision," "limited contact," and "noncontact" as per the classification of the American Academy of Pediatrics Committee on Sport Medicine and Fitness (Table 1).

There was no significant difference in either group regarding sex, dominant arm, age at surgery, age at the

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TABLE 1
Sports Characteristics of the Study Patients[a]

| | Competitive Athletes (n = 57, 61 shoulders) | Recreational Athletes (n = 49) | *P* Value |
|---|---|---|---|
| Level of sport activity | | | |
| Professional | 25 (44) | 0 (0) | |
| National team | 14 (24) | 0 (0) | |
| Amateur league | 18 (32) | 0 (0) | |
| Recreational activity | 0 (0) | 49 (100) | |
| Classification of sports from the AAPC[b] | | | |
| Contact/collision | 37 (65) | 28 (58) | .485 |
| Limited contact | 9 (16) | 9 (18) | .343 |
| Noncontact | 11 (19) | 12 (24) | .572 |

[a]Data are presented as number of patients (percentage).
[b]Classification of the American Academy of Pediatrics Committee (AAPC) on Sport Medicine and Fitness.

first dislocation, number of preoperative dislocations, humeral and glenoid bone defects,[30] and mean follow-up (Table 2). The preoperative Instability Severity Index Score,[6] which is correlated with the level of performance, was, as expected, significantly higher for the competitive patients.

The operative technique was consistent throughout the 5-year period: no new equipment or approaches were used. The senior author performed all surgical procedures with the patient under general anesthesia and in the supine position; a small pillow was placed under the medial border of the scapula to both retract the scapula and place the glenoid joint line perpendicular to the table. The surgical technique was the same as the usual open surgery[33] but with a guide-assisted technique using the specific Latarjet guide-assisted system (Arthrex, Inc). A 4-cm vertical deltopectoral approach was used. A self-retaining retractor with 20° nontraumatic paddles was used during exposure (Figure 2A). The coracoacromial ligament was incised 1.5 cm from its insertion, and the pectoralis minor tendon was detached from the coracoid bone. The coracoid osteotomy was performed at the junction between the horizontal and vertical aspects (knee of the coracoid) with a 90° oscillating saw from medial to lateral border, aiming at harvesting a 2.5- to 3-cm graft (Figure 2B).

After decortication of the inferior aspect, the coracoid graft was prepared using a special grasper-coracoid drill guide, allowing 2 parallel 4-mm holes to be drilled (Figure 2C). The guide was positioned perpendicularly and at the center of the prepared coracoid graft surface. The coracoid graft was then left free medially with a suture passed in the first hole, and the subscapularis muscle belly was exposed. The subscapularis muscle split was made at the junction of the superior two-thirds and the inferior one-third. The capsule was detached from the muscle belly to expose the joint line and the anterior glenoid rim by placing a sponge in the subscapularis fossa. The exposure was then facilitated by moving the paddles of the self-retaining retractor in the subscapularis split. A Link retractor was placed on the body of the scapula to retract the medial soft tissues. The capsule was identified, after a meticulous exposure, and incised vertically at the level of the joint line. A mini-Trillat retractor was inserted into the joint to retract the humeral head. The capsulolabral complex remnants were removed, and the anterior glenoid surface was also decorticated to optimize bone contact (Figure 2D).

The coracoid graft placement was facilitated using the Parallel Drill Guide (Arthrex, Inc) without offset (Figure 2, E and F). The pegs of this low-profile guide were inserted in the predrilled holes on the coracoid graft. The coracoid graft was guided visually and placed on the anterior glenoid surface to obtain a "flush position." Two 1.6-mm nonthreaded guide wires were then used to provisionally stabilize the graft. The glenoid was drilled with a 2.75-mm cannulated reamer (starting with the inferior hole), and two 4-mm, low-profile, partially threaded titanium screws of appropriate length were inserted to secure the coracoid (Figure 2G). During drilling, screw positioning, and tightening, the coracoid graft was firmly held with a small periosteal elevator against the glenoid to obtain direct compression during screwing, avoiding excessive torque (to prevent coracoid graft fracture). Finally, the capsule was sutured to the coracoacromial ligament stump, with the arm positioned in full external rotation (Figure 2H).

## Postoperative Rehabilitation

The patient's arm was immobilized for 2 weeks using a sling for analgesic control, and rehabilitation was restricted to pendulum exercises only during this period. After 2 weeks, the patients were allowed to perform exercises daily and active-assisted range of motion exercises (without strengthening). Complete range of motion was expected at 6 weeks, but the strengthening program was permitted only after 3 postoperative months. Return to sports was allowed between 3 and 4 months postoperatively, depending on sports requirements, if the shoulder was pain-free and with complete range of motion, and if the fusion of the coracoid graft was achieved on the Bernageau glenoid view[8] at 3 months.

Clinical and radiographic parameters were collected preoperatively and postoperatively during the systematic follow-up examination at 6 weeks, 3 months, 6 months, and the last follow-up by an independent investigator (L.B.). Shoulder radiographic outcome was performed with the Bernageau and true anteroposterior views to assess graft fusion and to inspect the instability arthropathy according to the Samilson classification.[39] The principal outcome measure at last follow-up was evidence of recurrent instability[12]: (1) anterior apprehension, defined as a fear of dislocation when the arm was positioned in abduction and external rotation; (2) subluxation, sensation of shoulder dislocation immediately followed by a spontaneous reduction; (3) documented redislocation. The secondary outcome measures were clinical scores related to anterior instability and related to sport practice: Rowe score,[24,41] Oxford Shoulder Instability Score, (OSIS),[16] Western

TABLE 2
Characteristics of the Study Patients[a]

| | Competitive Athletes (n = 57) | Recreational Athletes (n = 49) | *P* Value |
|---|---|---|---|
| Mean follow-up, mo (range) | 44 (28-86) | 49 (25-83) | .076 |
| Male sex, n (%) | 51 (84) | 37 (76) | .477 |
| Mean age at surgery, y (range) | 21.7 (16-29.7) | 22.5 (16-29.3) | .302 |
| Surgery on dominant shoulder, n (%) | 45 (74) | 38 (76) | .664 |
| Mean age at first dislocation, y (range) | 18.9 (12-29) | 19.6 (13-27) | .364 |
| Hyperlaxity, n, (%) | 26 (43) | 23 (47) | .721 |
| Humeral bone loss >20%, n (%) | 2 (3) | 1 (2) | .994 |
| Glenoid bone loss >20%, n (%) | 5 (8) | 2 (4) | .466 |
| Shoulder dislocations before surgery, n (range) | 3 (1-7) | 2.8 (1-6) | .221 |
| Instability Severity Index Score, n | 7 | 5 | **<.001** |

[a]Bolded *P* value indicates statistical significance ($P < .05$).

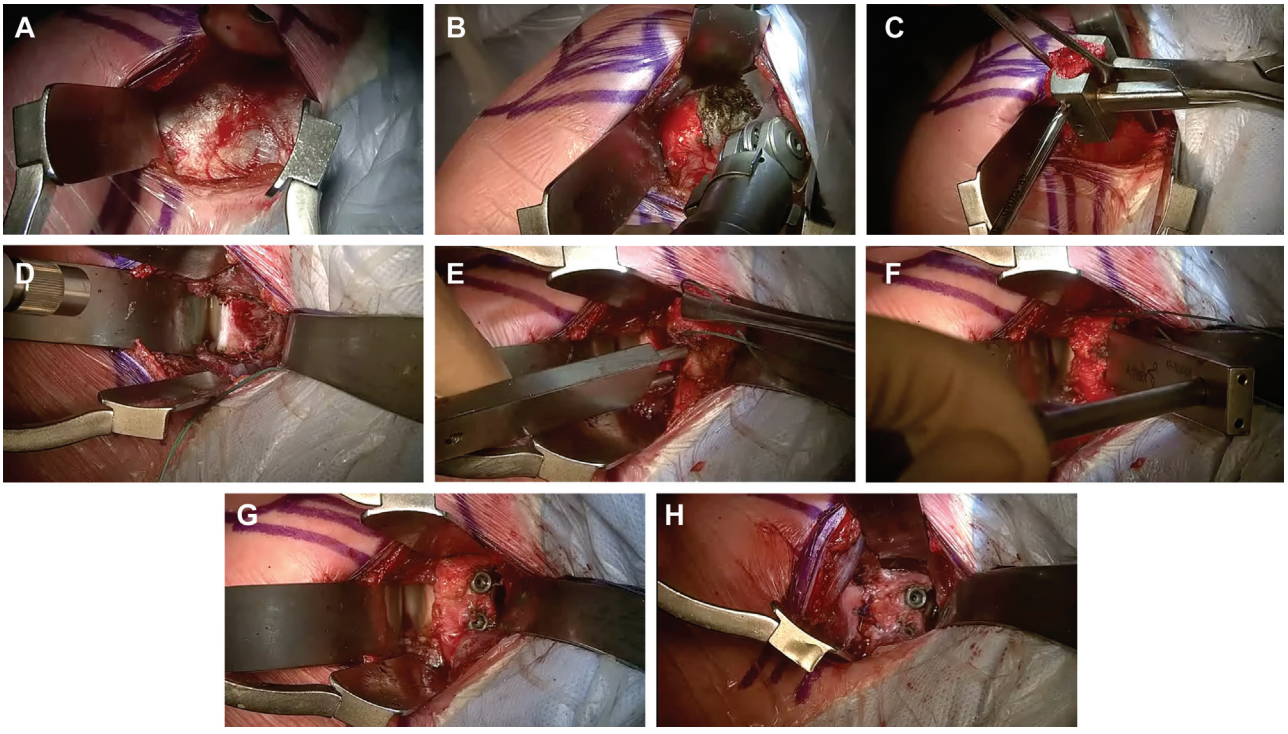


**Figure 2.** (A) Coracoid process exposition. (B) Coracoid process osteotomy. (C) Coracoid process drill guide. (D) Glenoid exposition. (E) Insertion off the parallel drill guide without offset. (F) Glenoid position of the parallel drill. (G) Final aspect of the coracoid graft. (H) Capsule suture.

Ontario Shoulder Instability Index (WOSI),[28] and level of satisfaction (excellent, good, fair, and poor).

### Statistical Analysis

A statistical analysis was performed using JMP 11.0.0 (SAS Institute Inc). A Student *t* test was performed to compare functional outcomes between groups, and CIs were set at 95%. Categorical data were compared with the Fisher exact test. The comparison between pre- and postoperative data was made with the Student paired *t* test. The difference was considered significant at $P \leq .05$ (after Bonferroni correction).

## RESULTS

There was no significant difference in preoperative clinical scores between the 2 groups regarding, on a visual analog scale (VAS), WOSI, and Rowe score (Table 3). The preoperative Subjective Shoulder Value was significantly higher ($P = .003$) for competitive athletes (53 ± 8.9; range, 30-70) compared with recreational athletes (47 ± 9.3; range, 30-65).

TABLE 3
Pre- and Postoperative Clinical Scores of Competitive and Recreational Athletes

| Outcome Measure | Competitive Athletes (n = 57) | Recreational Athletes (n = 49) | *P* Value[a] |
|---|---|---|---|
| Preoperative data[b] | | | |
| Pain, VAS | 0.8 ± 1.4 (0-4) | 1.0 ± 1.8 (0-6) | .335 |
| WOSI[c] | | | |
| A | 422.7 ± 231 (0-1000) | 491.4 ± 281.4 (0-1000) | .172 |
| B | 226.1 ± 102.7 (0-400) | 249.6 ± 102.1 (50-400) | .238 |
| C | 189.9 ± 98.9 (0-400) | 208.1 ± 95.1 (40-400) | .339 |
| D | 204.3 ± 78.3 (10-300) | 204.1 ± 72.3 (60-400) | .992 |
| Total | 1043 ± 444.9 (270-2090) | 1153 ± 500.1 (240-2100) | .232 |
| Subjective Shoulder Value | 52.5 ± 8.9 (30-70) | 47.1 ± 9.3 (30-65) | **.003** |
| SPORTS score | 5.4 ± 0.8 (3.5-7.1) | 5.1 ± 0.7 (4-7) | .326 |
| Rowe score | 56.3 ± 13.2 (30-80) | 55.0 ± 11.0 (35-80) | .587 |
| Postoperative data[b] | | | |
| Pain, VAS | 0.7 ± 0.8 (0-3) | 1.1 ± 1.5 (0-8) | .096 |
| WOSI | | | |
| A | 96.1 ± 90.0 (0-460) | 167.8 ± 180.4 (10-915) | **.014** |
| B | 30 ± 47.7 (0-260) | 71.6 ± 89.1 (0-385) | **.005** |
| C | 31.9 ± 50.1 (0-240) | 61.8 ± 83.7 (0-330) | **.029** |
| D | 37.2 ± 57.3 (0-260) | 56.5 ± 73.0 (0-300) | .134 |
| Total | 196.4 ± 202.5 (0-960) | 357.7 ± (12-1930) | **.012** |
| Subjective Shoulder Value | 91.5 ± 8.3 (70-100) | 86.1 ± 15.7 (2-100) | .072 |
| SPORTS score | 8.5 ± 1.2 (3.7-10) | 6.9 ± 1.7 (1.4-10) | **<.001** |
| Rowe score | 84.2 ± 16.4 (30-100) | 69.5 ± 22.0 (15-100) | **<.001** |
| Net improvement (percentage improvement) | | | |
| WOSI | | | |
| A | 326.6 (340%) | 323.6 (193%) | **.012** |
| B | 196.1 (654%) | 178 (249%) | **.004** |
| C | 158 (495%) | 151.6 (245%) | **.021** |
| D | 167.1 (449%) | 147.6 (261%) | .087 |
| Total | 846.6 (431%) | 795 (222%) | **.007** |
| Subjective Shoulder Value | 39.1 ± 10.0 (79%) | 39.0 ± 14.4 (87%) | .434 |
| SPORTS score | 3.1 ± 1.3 (59%) | 1.8 ± 1.5 (36%) | **.011** |
| Rowe score | 27.9 ± 21.7 (60%) | 14.5 ± 24.4 (32%) | **.006** |

[a]Significant value (in bold) of pre- and postoperative scores between competitive athletes and recreational athletes. VAS, visual analog scale; SPORTS, Subjective Patient Outcome for Return to Sports score; WOSI, Western Ontario Shoulder Instability score.
[b]Values are expressed as mean ± SD (range).
[c]A lower WOSI is indicative of a better score.

Of the 106 patients, 3 reported recurrence of shoulder dislocation: 2 competitive athletes (3.5%; 95% CI, 0.9%-11.2%) and 1 recreational athlete (2%; 95% CI, 0.4%-10.7%) ($P = .684$). Both competitive athletes with recurrent dislocations practiced collision sports, suggesting a redislocation rate of 5.4% for this sports category (2/37). Their shoulders were reoperated on with an Eden-Hybinette procedure at 9 and 18 months postoperatively, respectively, without any recurrence at the last follow-up. The recreational athlete preferred to stop sport activity without iterative surgery. No subluxations were reported in either group. The persistent apprehension test had a positive result in 7 competitive athletes (11.5%) and in 5 recreational athletes (10%) ($P = .566$).

At the last follow-up, level of satisfaction was excellent or good in 97% and 94% of cases, respectively, for competitive athletes and recreational athletes ($P = .347$). The 3 items in the WOSI score concerning physical symptoms, sports, and recreational activities (WOSI A, B, and C) were significantly better postoperatively for competitive athletes compared with recreational athletes (Table 3). The Subjective Patient Outcome for Return to Sports (SPORTS) and Rowe scores were also significantly better for competitive athletes compared with recreational athletes: 8.5 versus 6.9 and 84.2 versus 69.5, respectively ($P < .001$). The scores unrelated to sport activity, the Oxford Shoulder Instability Score (OSIS) and simple shoulder test (SST) were similar for the 2 groups. Regarding the rate of return to sports, all 57 (100%) competitive athletes and 34 (69.4%) recreational athletes resumed their previous sports practice (Table 4) at the same level or higher than before their injury (78.9% vs 42.9%; $P = .004$).

No acute complications were reported, particularly no nerve injury. Regarding revision surgery, 2 recreational athletes and 1 competitive athlete underwent hardware removal for subscapularis impingement. These patients demonstrated a complete osteolysis of the upper part of the graft at the 6-month control radiograph. Postoperative outcomes were excellent for all these patients. Two other recreational athletes had radiologic abnormalities—graft

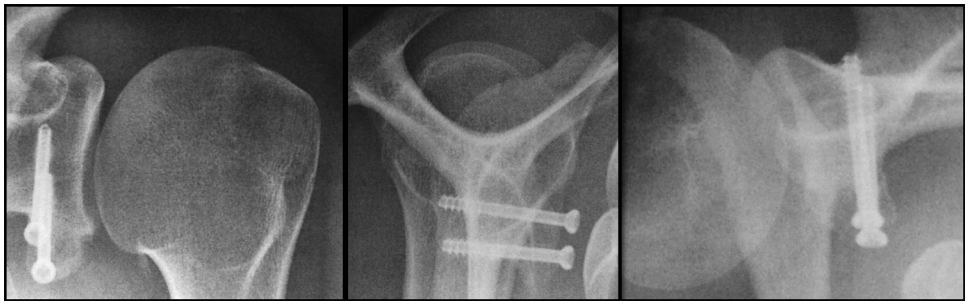

**Figure 3.** Postoperative radiographs.

TABLE 4
Postoperative Sports and Levels of Competition of the Study Population[a]

| | Competitive Athletes (n = 57) | Control Group (n = 49) | *P* Value |
|---|---|---|---|
| Same level | 45 (78.9) | 21 (42.9) | **.004** |
| Lower level | 12 (21.1) | 13 (26.5) | **.018** |
| Change sport activity | 0 (0) | 11 (22.4) | |
| Stop sport activity | 0 (0) | 4 (8.2) | |

[a]Data are presented as number (percentage). Bolded *P* value indicates statistical significance.

fracture for the first and graft nonunion for the second—without any clinical effect or need for revision. On the radiographic assessment at the last follow-up, 94 (89%) competitive athletes and 12 (11%) recreational athletes were classified, respectively, as Samilson 0 and 1 (Figure 3). Progression of osteoarthritis was similar in each group.

## DISCUSSION

Our study confirms that, at a mean follow-up of 4 years, the rate of recurrent dislocation after an OLP does not differ between competitive and recreational athletes, whatever sports were practiced. Therefore, our hypothesis was not confirmed: an increased incidence of recurrence did not occur after an OLP in competitive athletes. Moreover, the greater "at-risk" group practicing collision sports had a low recurrence rate of 5.4%. All functional outcomes significantly improved, and the quality of return to sports was even greater for competitive athletes than for recreational athletes. Furthermore, no nerve injuries were reported, and the overall rate of complications was lower than the usually reported values.[5,19,21,40] Therefore, it can be assumed that the OLP is an efficient and safe primary surgery for all patients, including those practicing sports at a competitive level.

Another important finding of our study was that the improvement in clinical scores related to sports activity was significantly greater in competitive athletes compared with recreational athletes. To our knowledge, this was the first study to focus on outcomes after a Latarjet procedure in these 2 distinct populations of athletes. The authors of a recent systematic review analyzed clinical and patient-reported outcomes after a Latarjet procedure and Bankart repair.[29] They reported that the Latarjet procedure carried a significantly lower risk of redislocation, without any difference in complication rates, and with better clinical outcomes in the Latarjet group. In our study, the postoperative WOSI, SPORTS, and Rowe scores were significantly better for competitive athletes compared with recreational athletes, although the preoperative scores were equivalent for both groups. This could be because competitive athletes are more disciplined with their rehabilitation programs and/or have better shoulder proprioception and muscular strength.

Return to sports after arthroscopic Bankart procedure for recurrent anterior shoulder dislocation has been well studied.[1,2,20,32,35] These authors reported recurrence rates ranging from 7% to 26% for contact sports athletes and significantly increased rates with long follow-up. The recurrence rate could be due to recurrent damage of the repaired soft tissue over time, particularly in high-risk sport activities. Milchteim et al[32] reported a 6.4% recurrence rate observed in 94 patients at 5 years of follow-up, lower than the usually reported rates; 60% of their patients practiced collision sports, compared with 64% in our study with 4 years of follow-up. Alentorn-Geli et al[1] reported a 10.5% rate of dislocation recurrence after arthroscopic capsulolabral repair using knotless suture anchors in 57 patients practicing soccer and other activities.

It is well documented that Hill-Sachs lesions predispose to recurrent instability after primary Bankart stabilization.[38,42] The remplissage procedure has gained acceptance as a reliable surgical technique to manage humeral bone loss,[36] but controversies still exist regarding the return to sport for competitive patients after this procedure. Garcia et al[18] reported 6 (11.8%) patients with iterative dislocation at the final follow-up (60.7 months) and a mean WOSI score of 79.5%. The clinical outcomes were worse than those reported in our study, and contrary to ours, practicing sports at competitive levels was an exclusion criterion.

Few authors have analyzed the outcomes of the Latarjet procedure depending on patients' sports activities. Beranger et al[7] reported that return to sports after shoulder stabilization with a Latarjet procedure was possible in all competitive and recreational athletes after 6.3 months and for 78.7% patients at their preinjury level or at a better level. Forty-seven athletes were included, but only 18

(38%) practiced sports in competition. Practice of an "overhead'" or a "forced overhead" sport was identified as a risk factor for not returning to a similar or better level after surgery. We preferred using the classification of the American Academy of Pediatrics[31] in our study, which we found more relevant as did other studies.[14,17,25,26,34] Neyton et al[34] retrospectively assessed 34 rugby players (37 shoulders) stabilized with the Latarjet procedure. No recurrence of either dislocation or subluxation occurred during a mean follow-up period of 144 months after the procedure. Our outcomes were similar for a larger cohort, regarding recurrent dislocation and return to sports; however, we were unable to determine if return to sports depends on their extents of overhead, contact, or collision actions.

Blonna et al[10] made a case control–matched comparison between 30 Bankart repairs and 30 Bristow-Latarjet procedures. They found, after a mean follow-up of 5.3 years, that arthroscopic Bankart repair was associated with a better rate of return to sports and a better subjective perception of the shoulder. However, the authors reported a higher rate of recurrent dislocation in the Bankart group. Patients with severe glenoid bone loss, that is, with more severe lesions that increase the risk of recurrence particularly in competition patients, were excluded. In our study, patients were significantly younger, and bone loss was not considered as an exclusion criterion, whereas it is a specific factor related to recurrence of instability. Burkhart et al[12] analyzed the results of 194 consecutive arthroscopic Bankart repairs. There was a 6.5% recurrence rate in contact athletes without significant bone defects, whereas the recurrence rate was 89% for contact athletes with significant bone defects.

We found few complications after the Latarjet procedure, whereas neurologic injuries are the most common adverse events reported, with a complication rate ranging between 3% and 25% according to clinical studies. The OLP is technically demanding, and preventing these complications is possible by (1) protecting the suprascapular nerve and the brachial plexus and artery by using a small periosteal elevator inserted medially toward the base of the coracoid during medial to lateral coracotomy and (2) protecting the musculocutaneous nerve with limited medial release (less than 1.5 cm distally to the tip of the coracoid). The complications seem to decrease after a short learning curve.[15]

The strength of our study was the great number of young (<30 years), competitive athletes analyzed after OLP, compared with a control group of recreational athletes. To our knowledge, no study has ever focused on this parameter. The recurrence rate and functional outcomes were evaluated to assess the quality of return to sports after this procedure. Our study also had some limitations. It was a retrospective study, with a mean follow-up of 3.8 years. More dislocations could have been reported with a longer follow-up. However, the authors of previous studies reported that recurrence of dislocation after a Latarjet procedure occurred more frequently in the year after surgery,[21] contrary to arthroscopic stabilization.[9] These recurrences occur when the bone block is positioned too medially. No evaluation of the coracoid graft positioning was performed since only plain radiographs were available for this study, and Clavert et al[13] have shown that graft positioning was not relevant. Using a computed tomography scan was not suitable for routine follow-up in our study because of irradiation risks. Further limitations of the present study are the proportion of patients lost to follow-up and that few patients had a high degree of bone loss, which is why our results may not apply to such patients. However, the series comprised young patients with professional constraints, which made it difficult to locate and contact many of them.

## CONCLUSION

At 4-year follow-up, the OLP rendered good outcomes for competitive and recreational athletes, with equivalent redislocation rates in both groups (5%). The clinical scores and rates of return to sports were, however, significantly better for competitive athletes, regardless of the type of sport and level of competition. The OLP could therefore be considered for primary shoulder stabilization, particularly in competitive athletes who have high functional demands and great risks of redislocation.

## REFERENCES


1. Alentorn-Geli E, Alvarez-Diaz P, Doblas J, et al. Return to sports after arthroscopic capsulolabral repair using knotless suture anchors for anterior shoulder instability in soccer players: minimum 5-year follow-up study. *Knee Surg Sports Traumatol Arthrosc*. 2016;24(2):440-446.
2. Alkaduhimi H, van der Linde JA, Willigenburg NW, Paulino Pereira NR, van Deurzen DF, van den Bekerom MP. Redislocation risk after an arthroscopic Bankart procedure in collision athletes: a systematic review. *J Shoulder Elbow Surg*. 2016;25(9):1549-1558.
3. An VV, Sivakumar BS, Phan K, Trantalis J. A systematic review and meta-analysis of clinical and patient-reported outcomes following two procedures for recurrent traumatic anterior instability of the shoulder: Latarjet procedure vs. Bankart repair. *J Shoulder Elbow Surg*. 2016;25(5):853-863.
4. Araujo CG, Scharhag J. Athlete: a working definition for medical and health sciences research. *Scand J Med Sci Sports*. 2016;26(1):4-7.
5. Balestro JC, Young A, Maccioni C, Walch G. Graft osteolysis and recurrent instability after the Latarjet procedure performed with bioabsorbable screw fixation. *J Shoulder Elbow Surg*. 2015;24(5):711-718.
6. Balg F, Boileau P. The Instability Severity Index Score. A simple pre-operative score to select patients for arthroscopic or open shoulder stabilisation. *J Bone Joint Surg Br*. 2007;89(11):1470-1477.
7. Beranger JS, Klouche S, Bauer T, Demoures T, Hardy P. Anterior shoulder stabilization by Bristow-Latarjet procedure in athletes: return-to-sport and functional outcomes at minimum 2-year follow-up. *Eur J Orthop Surg Traumatol*. 2016;26(3):277-282.
8. Bernageau J, Patte D, Debeyre J, Ferrante J. Value of the glenoid profile in recurrent luxations of the shoulder [in French]. *Rev Chir Orthop Reparatrice Appar Mot*. 1976;62(suppl 2):142-147.
9. Bessiere C, Trojani C, Carles M, Mehta SS, Boileau P. The open Latarjet procedure is more reliable in terms of shoulder stability than arthroscopic Bankart repair. *Clin Orthop Relat Res*. 2014;472(8):2345-2351.
10. Blonna D, Bellato E, Caranzano F, Assom M, Rossi R, Castoldi F. Arthroscopic Bankart repair versus open Bristow-Latarjet for shoulder instability: a matched-pair multicenter study focused on return to sport. *Am J Sports Med*. 2016;44(12):3198-3205.
11. Boileau P, Villalba M, Hery JY, Balg F, Ahrens P, Neyton L. Risk factors for recurrence of shoulder instability after arthroscopic Bankart repair. *J Bone Joint Surg Am*. 2006;88(8):1755-1763.

12. Burkhart SS, De Beer JF. Traumatic glenohumeral bone defects and their relationship to failure of arthroscopic Bankart repairs: Significance of the inverted-pear glenoid and the humeral engaging Hill-Sachs lesion. *Arthroscopy*. 2000;16(7):677-694.
13. Clavert P, Koch G, Neyton L, et al. Is anterior glenoid bone block position reliably assessed by standard radiography? A cadaver study. *Orthop Traumatol Surg Res*. 2016;102(8S):S281-S285.
14. Colegate-Stone TJ, van der Watt C, de Beer JF. Evaluation of functional outcomes and complications following modified Latarjet reconstruction in athletes with anterior shoulder instability. *Shoulder Elbow*. 2015;7(3):168-173.
15. Dauzere F, Faraud A, Lebon J, Faruch M, Mansat P, Bonnevialle N. Is the Latarjet procedure risky? Analysis of complications and learning curve. *Knee Surg Sports Traumatol Arthrosc*. 2016;24(2):557-563.
16. Dawson J, Fitzpatrick R, Carr A. The assessment of shoulder instability. The development and validation of a questionnaire. *J Bone Joint Surg Br*. 1999;81(3):420-426.
17. Funk L. Treatment of glenohumeral instability in rugby players. *Knee Surg Sports Traumatol Arthrosc*. 2016;24(2):430-439.
18. Garcia GH, Wu HH, Liu JN, Huffman GR, Kelly JD. Outcomes of the remplissage procedure and its effects on return to sports: average 5-year follow-up. *Am J Sports Med*. 2016;44(5):1124-1130.
19. Gartsman GM, Waggenspack WN Jr, O'Connor DP, Elkousy HA, Edwards TB. Immediate and early complications of the open Latarjet procedure: a retrospective review of a large consecutive case series. *J Shoulder Elbow Surg*. 2017;26(1):68-72.
20. Gerometta A, Rosso C, Klouche S, Hardy P. Arthroscopic Bankart shoulder stabilization in athletes: return to sports and functional outcomes. *Knee Surg Sports Traumatol Arthrosc*. 2016;24(6):1877-1883.
21. Griesser MJ, Harris JD, McCoy BW, et al. Complications and reoperations after Bristow-Latarjet shoulder stabilization: a systematic review. *J Shoulder Elbow Surg*. 2013;22(2):286-292.
22. Hovelius L, Sandstrom B, Olofsson A, Svensson O, Rahme H. The effect of capsular repair, bone block healing, and position on the results of the Bristow-Latarjet procedure (study III): long-term follow-up in 319 shoulders. *J Shoulder Elbow Surg*. 2012;21(5):647-660.
23. Hovelius L, Sandstrom B, Sundgren K, Saebo M. One hundred eighteen Bristow-Latarjet repairs for recurrent anterior dislocation of the shoulder prospectively followed for fifteen years: study I—clinical results. *J Shoulder Elbow Surg*. 2004;13(5):509-516.
24. Jensen KU, Bongaerts G, Bruhn R, Schneider S. Not all Rowe scores are the same! Which Rowe score do you use? *J Shoulder Elbow Surg*. 2009;18(4):511-514.
25. Joshi MA, Young AA, Balestro JC, Walch G. The Latarjet-Patte procedure for recurrent anterior shoulder instability in contact athletes. *Clin Sports Med*. 2013;32(4):731-739.
26. Joshi MA, Young AA, Balestro JC, Walch G. The Latarjet-Patte procedure for recurrent anterior shoulder instability in contact athletes. *Orthop Clin North Am*. 2015;46(1):105-111.
27. Kawasaki T, Ota C, Urayama S, et al. Incidence of and risk factors for traumatic anterior shoulder dislocation: an epidemiologic study in high-school rugby players. *J Shoulder Elbow Surg*. 2014;23(11):1624-1630.
28. Kirkley A, Griffin S, McLintock H, Ng L. The development and evaluation of a disease-specific quality of life measurement tool for shoulder instability. The Western Ontario Shoulder Instability Index (WOSI). *Am J Sports Med*. 1998;26(6):764-772.
29. Locher J, Wilken F, Beitzel K, et al. Hill-Sachs off-track lesions as risk factor for recurrence of instability after arthroscopic Bankart repair. *Arthroscopy*. 2016;32(10):1993-1999.
30. Matsumura N, Oki S, Kitashiro M, et al. Three-dimensional quantitative analysis of humeral head and glenoid bone defects with recurrent glenohumeral instability. *J Shoulder Elbow Surg*. 2017;26(9):1662-1669.
31. Medical conditions affecting sports participation. American Academy of Pediatrics Committee on Sports Medicine and Fitness. *Pediatrics*. 1994;94(5):757-760.
32. Milchteim C, Tucker SA, Nye DD, et al. Outcomes of Bankart repairs using modern arthroscopic technique in an athletic population. *Arthroscopy*. 2016;32(7):1263-1270.
33. Mizuno N, Denard PJ, Raiss P, Melis B, Walch G. Long-term results of the Latarjet procedure for anterior instability of the shoulder. *J Shoulder Elbow Surg*. 2014;23(11):1691-1699.
34. Neyton L, Young A, Dawidziak B, et al. Surgical treatment of anterior instability in rugby union players: clinical and radiographic results of the Latarjet-Patte procedure with minimum 5-year follow-up. *J Shoulder Elbow Surg*. 2012;21(12):1721-1727.
35. Petrera M, Dwyer T, Tsuji MR, Theodoropoulos JS. Outcomes of arthroscopic Bankart repair in collision versus noncollision athletes. *Orthopedics*. 2013;36(5):e621-e626.
36. Purchase RJ, Wolf EM, Hobgood ER, Pollock ME, Smalley CC. Hill-Sachs ''remplissage'': an arthroscopic solution for the engaging Hill-Sachs lesion. *Arthroscopy*. 2008;24(6):723-726.
37. Randelli P, Ragone V, Carminati S, Cabitza P. Risk factors for recurrence after Bankart repair: a systematic review. *Knee Surg Sports Traumatol Arthrosc*. 2012;20(11):2129-2138.
38. Robinson CM, Dobson RJ. Anterior instability of the shoulder after trauma. *J Bone Joint Surg Br*. 2004;86(4):469-479.
39. Samilson RL, Prieto V. Dislocation arthropathy of the shoulder. *J Bone Joint Surg Am*. 1983;65(4):456-460.
40. Shah AA, Butler RB, Romanowski J, Goel D, Karadagli D, Warner JJ. Short-term complications of the Latarjet procedure. *J Bone Joint Surg Am*. 2012;94(6):495-501.
41. Skare O, Schroder CP, Mowinckel P, Reikeras O, Brox JI. Reliability, agreement and validity of the 1988 version of the Rowe score. *J Shoulder Elbow Surg*. 2011;20(7):1041-1049.
42. Yiannakopoulos CK, Mataragas E, Antonogiannakis E. A comparison of the spectrum of intra-articular lesions in acute and chronic anterior shoulder instability. *Arthroscopy*. 2007;23(9):985-990.
43. Zimmermann SM, Scheyerer MJ, Farshad M, Catanzaro S, Rahm S, Gerber C. Long-term restoration of anterior shoulder stability: a retrospective analysis of arthroscopic Bankart repair versus open Latarjet procedure. *J Bone Joint Surg Am*. 2016;98(23):1954-1961.