The Latarjet procedure for the treatment of recurrence of anterior instability of the shoulder after operative repair: a retrospective case series of forty-nine consecutive patients

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Abstract: BACKGROUND: Recurrence of anterior shoulder instability after operative repair is an uncommon but disabling condition for which treatment options have been insufficiently studied. Coracoid transfer as described by Latarjet is a highly successful primary operation for recurrent anterior shoulder instability. The purpose of this study was to verify the hypothesis that this procedure is also effective for treating recurrent glenohumeral instability after previous operative repair. METHODS: Forty-nine consecutive patients with either one (n = 32), two (n = 12), or at least three (n = 5) previous stabilizations other than a Latarjet procedure and recurrence of anterior glenohumeral instability associated with a lesion of the anterior aspect of the glenoid rim had revision with a coracoid transfer as described by Latarjet. Clinical outcomes at a mean of thirty-eight months postoperatively included the subjective shoulder value, the Constant-Murley score, and glenohumeral stability. Standardized anteroposterior and axial radiographs before and after the Latarjet revision were used to grade the degree of glenohumeral osteoarthritis. RESULTS: The results in all forty-nine patients were reviewed. No shoulder redislocated, subluxations recurred in two patients, and five patients reported slight, unspecified shoulder symptoms. No revision surgery was needed. Forty-three shoulders (88%) were subjectively graded as excellent or good; three, fair; and three, poor. Dissatisfaction was associated with persistent pain, and patients with preoperative pain had a twentyfold higher probability of having postoperative pain. The mean subjective shoulder value increased from 53% preoperatively to 79% at the time of follow-up ($p < 0.001$), and the Constant-Murley score remained high (80% preoperatively and 85% at the time of follow-up; $p = 0.061$). Optimal graft placement was obtained in thirty cases and was related to better clinical outcome and less progression of osteoarthritis than was suboptimal graft placement. CONCLUSIONS: Coracoid transfer as described by Latarjet can effectively restore anterior glenohumeral shoulder stability if previous operation(s) have failed to do so. If recurrence is associated with chronic pain, the pain is likely to persist and compromise the subjective outcome.

DOI: https://doi.org/10.2106/JBJS.K.00380

retrospective case series of forty-nine consecutive patients. Journal of Bone and Joint Surgery. American Volume, 94(11):e75.
DOI: https://doi.org/10.2106/JBJS.K.00380

The Latarjet Procedure for the Treatment of Recurrence of Anterior Instability of the Shoulder After Operative Repair

A Retrospective Case Series of Forty-nine Consecutive Patients

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Background: Recurrence of anterior shoulder instability after operative repair is an uncommon but disabling condition for which treatment options have been insufficiently studied. Coracoid transfer as described by Latarjet is a highly successful primary operation for recurrent anterior shoulder instability. The purpose of this study was to verify the hypothesis that this procedure is also effective for treating recurrent glenohumeral instability after previous operative repair.

Methods: Forty-nine consecutive patients with either one (n = 32), two (n = 12), or at least three (n = 5) previous stabilizations other than a Latarjet procedure and recurrence of anterior glenohumeral instability associated with a lesion of the anterior aspect of the glenoid rim had revision with a coracoid transfer as described by Latarjet. Clinical outcomes at a mean of thirty-eight months postoperatively included the subjective shoulder value, the Constant-Murley score, and glenohumeral stability. Standardized anteroposterior and axial radiographs before and after the Latarjet revision were used to grade the degree of glenohumeral osteoarthritis.

Results: The results in all forty-nine patients were reviewed. No shoulder redislocated, subluxations recurred in two patients, and five patients reported slight, unspecified shoulder symptoms. No revision surgery was needed. Forty-three shoulders (88%) were subjectively graded as excellent or good; three, fair; and three, poor. Dissatisfaction was associated with persistent pain, and patients with preoperative pain had a twentyfold higher probability of having postoperative pain. The mean subjective shoulder value increased from 53% preoperatively to 79% at the time of follow-up ($p < 0.001$), and the Constant-Murley score remained high (80% preoperatively and 85% at the time of follow-up; $p = 0.061$). Optimal graft placement was obtained in thirty cases and was related to better clinical outcome and less progression of osteoarthritis than was suboptimal graft placement.

Conclusions: Coracoid transfer as described by Latarjet can effectively restore anterior glenohumeral shoulder stability if previous operation(s) have failed to do so. If recurrence is associated with chronic pain, the pain is likely to persist and compromise the subjective outcome.

Level of Evidence: Therapeutic Level IV. See Instructions for Authors for a complete description of levels of evidence.

There are various possible options for operative correction of recurrent anterior shoulder instability. These include soft-tissue repairs such as the Bankart procedure[1-4] or repairs that incorporate osseous reconstructions of the anterior aspect of the glenoid such as the Eden-Hybbinette[5,6] or Latarjet[7-11] procedure. Multiple studies have shown restoration of glenohumeral stability with either open or arthroscopic techniques[5-12] in >90% of the affected shoulders. Nevertheless,

Disclosure: None of the authors received payments or services, either directly or indirectly (i.e., via his or her institution), from a third party in support of any aspect of this work. One or more of the authors, or his or her institution, has had a financial relationship, in the thirty-six months prior to submission of this work, with an entity in the biomedical arena that could be perceived to influence or have the potential to influence what is written in this work. No author has had any other relationships, or has engaged in any other activities, that could be perceived to influence or have the potential to influence what is written in this work. The complete **Disclosures of Potential Conflicts of Interest** submitted by authors are always provided with the online version of the article.

glenohumeral instability can recur after repair, and it may be disabling and require further treatment. Few studies have addressed the results of revision surgery for glenohumeral instability, and most of those that have were case series with a limited number of patients[13-15]. The role of the Latarjet procedure[7,9,10] as a revision procedure is not well established.

It was the objective of this study to investigate the role of the Latarjet procedure in the treatment of recurrence after repair(s), other than the Latarjet procedure itself, for anterior glenohumeral instability. The hypotheses were that the Latarjet procedure reliably restores glenohumeral stability after previous failed repair(s), resulting in low rates of redislocation, subluxation, or subjective instability, and that factors for postoperative success can be identified.

Materials and Methods

Between January 2001 and December 2005, forty-nine patients (mean age, twenty-nine years [range, fifteen to fifty-four years]) were treated with the Latarjet procedure for recurrent anterior shoulder instability after at least one previous instability repair. This cohort formed the basis of this retrospective, consecutive case series. The indication for the Latarjet procedure was defined as preoperative clinical findings proving recurrence of anterior shoulder instability and routine computed tomography scans with arthrography (arthro-CT) documenting a lesion of the anterior aspect of the glenoid rim with a craniocaudal extension of at least one-third of the maximal anteroposterior diameter of the glenoid and absence of fatty infiltration of the subscapularis muscle greater than stage II as described by Goutallier et al.[16]. Preoperative arthroscopy was never performed, and there was no instance of a conversion of an attempted arthroscopic stabilization to an open Latarjet procedure.

During the study period, another sixty-nine patients had an arthroscopic revision to address complications of a repair for recurrent anterior shoulder instability not fulfilling the above criteria. They were excluded because their complication was not recurrence of instability, because the recurrence of instability was not associated with loss of bone from the anterior aspect of the glenoid rim with a craniocaudal extension larger than one-third of the maximal anteroposterior diameter of the glenoid, or because they had subscapularis insufficiency evidenced by fatty infiltration of grade III or IV.

Patient Characteristics

There were twelve female (24%) and thirty-seven male (76%) patients. The mean age at the first glenohumeral dislocation was twenty-two years (range, eleven to forty-three years). The reason for the first dislocation was a traumatic event in forty-six cases (94%) and minor trauma in three (6%). The recurrence was on the dominant side in twenty-seven patients and on the nondominant side in twenty-two. The mean age at the first operative repair was twenty-five years (range, twelve to fifty years). The first operation was an open capsulolabral repair in nineteen patients and an arthroscopic Bankart repair in thirty. Twenty cases had originally been treated at our institution. At the time of revision, thirty-two shoulders had undergone one prior operation, twelve had undergone two, and five had undergone three or more. Prior to the Latarjet procedure, forty-four patients (90%) had sustained redislocations and five (10%), recurrent subluxations. Recurrent glenohumeral instability had occurred after a clear traumatic event in twenty-five patients (51%), after minor trauma in fourteen (29%), and without any trauma in ten.

Patient Evaluation

Clinical results were assessed with use of the subjective shoulder value[17]. For this purpose, a completely normal shoulder is considered to be 100%, and the patient subjectively assigns his or her affected shoulder a comparative value as a percentage of normal. Furthermore, working capacity was assessed. In the Swiss health-care system, working capacity—i.e., the patient's ability to work—is defined as a percentage of normal working capacity (100%) by the treating physician or an expert. As an example, if a patient is determined to be able to work only half shifts, his or her working capacity is 50%. Assessment also included use of the Constant-Murley score[18]. Pain was assessed with an unscaled visual analog scale (15 points = no pain, and 0 points = most severe pain imaginable). Active shoulder motion was assessed with a goniometer while the patient was seated, and abduction strength was assessed with an isometric electronic dynamometer (Isobex; Cursor, Bern, Switzerland) with the arm abducted 90°, positioned in the scapular plane. A standard clinical apprehension test was performed on the seated patient. Particular attention was focused on assessment of spinati atrophy and insufficiency of the subscapularis muscle with lift-off or belly-press tests.

At the time of final follow-up, the patients rated the outcome of the treatment of the shoulder as excellent, good, fair, or poor.

Osteoarthritis was assessed on anteroposterior and axial radiographs preoperatively and at the time of follow-up. These radiographs were obtained under fluoroscopy to obtain optimal imaging perpendicular to the joint line. All forty-nine patients underwent arthro-CT of the affected shoulder preoperatively for assessment of the amount of bone loss at the anteroinferior aspect of the glenoid rim and for surgical planning. A Latarjet operation was performed with the technique described by Edwards and Walch[7], which is an adaptation of Latarjet's original descriptions[9,10]. A detailed description of the operative technique is found in the Appendix.

Preoperative Evaluation

The preoperative arthro-CT scan showed an osseous defect of the anterior-inferior aspect of the glenoid rim in forty-eight patients, with an average superoinferior extension of the damage of 17.7 mm (range, 0 to 30 mm). One case showed only a cartilaginous defect of the anterior-inferior aspect of the glenoid rim. A Hill-Sachs lesion[19] was identified in forty-four cases (90%). The presence and size of the Hill-Sachs lesion did not influence the indication for surgery. Preoperatively, seven glenohumeral joints had mild and two had moderate radiographic signs of osteoarthritis according to the classification system of Samilson and Prieto[20].

Follow-up Outcome Assessment

All patients were available for follow-up at an average of thirty-eight months (range, twenty-three to sixty-three months). Forty-one patients underwent a standardized interview as well as physical and radiographic examination. The other eight patients were interviewed by the same examiner over the telephone with regard to pain, stability, return to daily activity, return to work, subjective shoulder value, and overall satisfaction. As there were no differences between groups with regard to any of the subjective parameters, including glenohumeral stability, the group of patients who were personally examined and the group of patients who were only interviewed were considered comparable. The data for all forty-nine patients that were not dependent on physical or radiographic examination were analyzed as one group. Analysis of all of the examiner-dependent parameters was based on the data for the forty-one examined patients.

Statistical Methods

A commercial statistical software package was used for the statistical analysis by a statistician. Data were tested for normal distribution with use of the D'Agostino and Pearson omnibus normality test before utilization of either a paired two-tailed Student t test or a Wilcoxon signed-rank test for normally and not-normally distributed data was applied for intra-sample comparison. Multivariate logistic regression analytic models were employed to identify the three most plausible predictive factors for postoperative pain—namely, preoperative pain, percentage with complications, and number of surgical interventions. The significance level was set at $p < 0.05$.

Source of Funding

No external funding was used for this retrospective study.

TABLE I Constant-Murley Scores and Subjective Shoulder Values Before and at the Time of Follow-up After Revision Latarjet Procedure as Treatment for Failure After Operative Treatment of an Anteriorly Unstable Shoulder

	Preoperative*	At the Time of Follow-up*	P Value
Constant-Murley score *(%)*	80.1 (44-100)	84.6 (40-100)	0.061
Subjective shoulder value *(%)*	53.4 (0-100)	78.5 (0-100)	<0.001
Pain *(points)*	11.4 (0-15)	12.6 (3-15)	0.115
Activity level *(points)*	6.4 (0-10)	8.1 (1-10)	<0.001
Flexion *(points)*	9.1 (4-10)	9.6 (4-10)	0.151
Abduction *(points)*	9 (2-10)	9.4 (4-10)	0.21
External rotation *(deg)*	55.4 (10-95)	49.1 (10-80)	0.047
Power *(points)*	13.7 (0-25)	13.3 (2-25)	0.801

*The values are given as the mean with the range in parentheses.

Results

Instability

None of the forty-nine shoulders sustained a glenohumeral redislocation. Two patients (4%) reported having subluxations, but no treatment was considered necessary, and five other patients reported some shoulder apprehension without redislocation or resubluxation, corresponding to a 14% rate of failure of shoulder stabilization (i.e., in seven patients). The apprehension test was positive in 6% of the patients, including one with subjective subluxations and two without subluxations. In the remaining four patients, the subjective instability could not be reproduced with physical examination.

Clinical Outcome

Before the Latarjet procedure, twenty-one shoulders (43%) were subjectively rated as excellent or good; sixteen shoulders (33%), as fair; and twelve shoulders (24%), as poor.

At the time of follow-up, forty-three shoulders (88%) were excellent or good, three shoulders (6%) were fair, and three (6%) were poor. The three patients with a poor result reported continued pain, with Constant-Murley pain scores of 4, 5, and 8 points out of 15 points. The mean subjective shoulder value was 53% (range, 0% to 100%) before the Latarjet operation and 79% (0% to 100%) at the time of final follow-up ($p < 0.001$). The relative Constant-Murley score was 80% before the Latarjet revision and 85% at the time of final follow-up (Table I). Active external rotation decreased by 6° (not significant) after the Latarjet procedure. The lift-off test was weakly positive in five cases preoperatively and in three of these five cases postoperatively. Preoperatively, thirty-one patients (63%) had no or little pain. The average pain score was 11.4 points (range, 0 to 15 points) preoperatively and 12.6 points (range, 3 to 15 points) postoperatively. Thirty-seven patients (76%) were almost pain-free at the time of follow-up (pain score of 11 to 15 points), and twelve patients (24%) reported moderate to severe pain (0 to 10 points) at the time of follow-up; the difference between preoperative and postoperative pain was not significant.

To identify possible reasons for persistent pain, two groups of patients were evaluated (Table II): one consisting of thirty-four patients who had no pain at the time of follow-up (pain score of ≥13 points) and a second group of eight patients with substantial pain (pain score of ≤7 points). The number of previous operations ($p = 0.025$), the level of preoperative pain ($p = 0.004$), and the percentage with postoperative complications ($p = 0.014$) were significantly related to pain at the time of final follow-up. Whereas the influence of previous operations (odds ratio [OR]: 2.6; 95% confidence interval [CI]: 0.4, 10.9) and postoperative complications (OR: 3.7; 95% CI: 0.4, 32) was relatively weak, the presence of preoperative pain increased the odds of having postoperative pain by a factor of more than twenty (OR: 21.4; 95% CI: 3.2, 223) and was the single most important predictor of postoperative pain. The average pain score of the patients with osteoarthritis was 12.2 points, whereas that of the patients without osteoarthritis was 12.3 points ($p = 0.834$); thus, radiographic evidence of osteoarthritis was not a predictor of postoperative pain. The type of previous surgery also did not influence the final pain score. Three patients in the group with a pain score of ≤7 points had had open previous surgery and five had had a previous arthroscopic repair. In the group without pain, thirteen (38%) had undergone previous open and twenty-one (62%), arthroscopic stabilizations.

Work Status

Before the Latarjet procedure, forty-one patients (84%) were able to work without any restrictions and continued to do so after the Latarjet procedure. Of the eight other patients, five returned to normal work after the Latarjet revision and three could not return. These three patients had already had a 100% disability pension before the Latarjet procedure. In all three patients, the shoulder was stable but pain persisted. At the time of final follow-up, no new disability pension was attributed and none was requested. The average working capacity of the patients increased from 84.7% preoperatively to 93.9% postoperatively ($p = 0.034$).

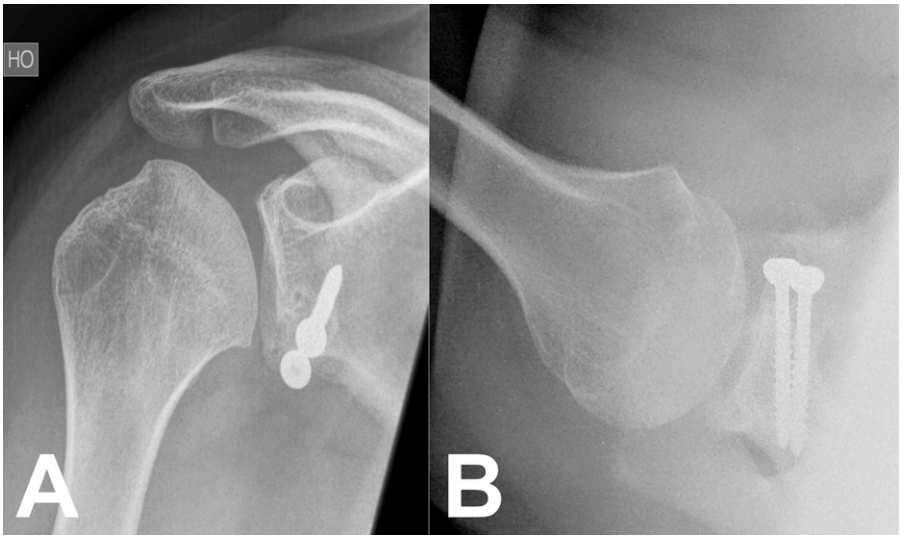

Fig. 1

Anteroposterior (**Fig. 1-A**) and axial (**Fig. 1-B**) radiographs of a shoulder that underwent the Latarjet procedure with a correct position of the bone block flush with the anterior aspect of the glenoid rim.

Osteoarthritis

Eleven shoulders (27%) showed glenohumeral arthritis at the time of final follow-up. Nine of them had had osteoarthritis before the Latarjet revision. Postoperative osteoarthritis was mild in five shoulders, moderate in four, and severe in two according to the classification system of Samilson and Prieto[20]. The difference between the number of shoulders with glenohumeral arthritis before the index revision (nine) and the number (eleven) at the time of follow-up was not significant. The progression of the severity of osteoarthritis, however, was significant ($p = 0.005$). In thirty cases (73%), follow-up radiographs showed that the coracoid process was flush with the glenoid plane (Figs. 1-A and 1-B); in six cases (15%), it was medial to the joint line; and in five cases (12%), it was overriding laterally (Fig. 2-A and 2-B). One case each of newly detected osteoarthritis was in the medial and lateral coracoid-transfer groups. In the thirty cases in which the coracoid process was positioned flush with the glenoid plane, no new development of osteoarthritis was observed and the progression of the glenohumeral arthritis was less (Table III) than that in the other two groups ($p < 0.001$).

Complications

Complications were observed in six cases (12%). There were four cases of delayed wound-healing, but afterward the patient was free of complaints. The two other cases included one frozen

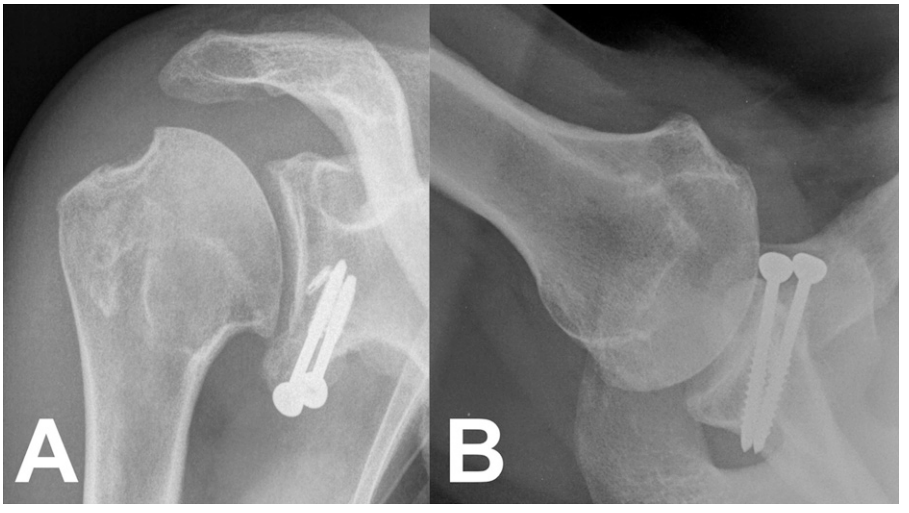

Fig. 2

Anteroposterior (**Fig. 2-A**) and axial (**Fig. 2-B**) radiographs of a shoulder that underwent the Latarjet procedure with a bone block that is lateral to the anterior aspect of the glenoid rim.

TABLE II Comparison Between Patients with No Pain and Those with Substantial Pain at the Time of Follow-up to Identify Possible Reasons for Persistent Pain

	No Pain (≥13 Points)	Substantial Pain (≤7 Points)	P Value
No. of patients	34	8	
Mean no. of previous operations	1.38	2.125	0.025
Mean pain score preoperatively *(points)*	12.7	7.9	0.004
Complications postoperatively *(%)*	6	38	0.014
Reason for preoperative resubluxation*	1.41	1.63	0.281
Dominant shoulder *(%)*	59	63	0.851
Mean age	21	24	0.542

*1 = clear traumatic event and 2 = minor trauma.

TABLE III Association of Graft Position and Development of Osteoarthritis

		Samilson and Prieto[20] Classification*			
Position	No.	Preop.	Postop.	Progression *(%)*	P Value†
Flush	30	0.13 (0-2)	0.17 (0-2)	31	0.18
Medial	6	0.5 (0-2)	0.83 (0-3)	66	0.109
Lateral	5	0.8 (0-1)	1.8 (0-2)	125	0.068

*0 = none, 1 = mild, 2 = moderate, and 3 = severe. †The p values are for the difference between preoperative and postoperative.

shoulder, which resolved with physical therapy, and one malunion of the coracoid to the glenoid rim, which led to increased pain but had no influence on stability. There were no revisions or repeat interventions.

Discussion

The goal of this retrospective analysis was to evaluate the results of the Latarjet procedure for treatment of failed anterior shoulder instability repair. We only treated patients with an associated lesion of the anterior aspect of the glenoid rim and an intact subscapularis muscle. The findings demonstrate that the Latarjet procedure restores stability in most cases. In addition, stability was restored regardless of the presence of a Hill-Sachs lesion. However, chronic pain associated with failed instability repair is likely to persist and compromise the subjective outcome of the Latarjet procedure.

Positioning of the coracoid graft along the glenoid rim is an important technical aspect of the Latarjet repair. Previous reports have documented optimal placement of the coracoid in 41% to 71% of cases[21,22]. Radiographic evaluation showed that optimal placement of the coracoid had been achieved in 73% of the shoulders. Although assessment of graft positioning might be improved with use of CT, assessment based on radiographs alone allowed us to determine that optimal graft placement is associated with less rapid progression of osteoarthritis and no new development of osteoarthritis. Nevertheless, a number of patients had preoperative osteoarthritis and pain, features that are usually absent prior to primary repairs for anterior instability. As our study showed progression of osteoarthritis, albeit without clinical symptoms, over a period of only three years, longer follow-up is necessary to determine the ultimate outcome. In this series, we noted that suboptimal graft placement was associated not only with more rapid progression of osteoarthritis but also with the new development of arthritis.

Although there was a significant increase in the subjective shoulder value, the Constant-Murley score improved only slightly. The latter finding may be related to the fact that the Constant-Murley score is relatively insensitive to glenohumeral instability as has been previously reported[17]. Clinically relevant loss of shoulder movement was not observed, confirming findings following primary Latarjet operations[21-24], and loss of subscapularis muscle function was not a problem. Subscapularis muscle deficiency has been reported only after Latarjet procedures performed in conjunction with takedown and repair of the subscapularis tendon. The horizontal division of the subscapularis muscle, as we performed this procedure, does not appear to compromise shoulder function to any relevant degree[24,25].

The results of the Latarjet procedure as a revision reconstruction for anterior glenohumeral instability are comparable with reported results of primary repairs. In a prospective long-term study involving 118 shoulders, Hovelius et al.[23] reported redislocations in 3.4% and residual instability in 13.4%

of the patients. Allain et al.[21] reported no redislocation at an average of fourteen years after primary Latarjet repairs in fifty-eight patients, but 12% of the patients had subjective apprehension. Nevertheless, the subjective results in these reports were superior to those reported in our series. In contrast to our experience with revision repair, pain was not a problem either before or after primary instability repair in those studies.

In 2000, a large retrospective multicenter study in France[26] documented that the results of primary Bankart and Latarjet operations are comparable, with a subjectively better long-term outcome after the Latarjet procedure and no difference in the development of osteoarthritis between the groups. Currently, osseous glenoid rim lesions are the primary indication for the use of a bone augmentation procedure such as the Latarjet coracoid transfer.

A few studies have addressed open revision of recurrent glenohumeral instability after anterior instability repair[13-15]. Levine et al.[13] reviewed the results in fifty patients treated with soft-tissue revision procedures. Eleven shoulders (22%) had recurrent instability, with nine of them (18%) having recurrent dislocations, and the rerevision rate was 10%. Meehan and Petersen[14] studied twenty-five patients who had undergone revision with various soft-tissue procedures and reported recurrence of glenohumeral instability in 16%, all of whom required revision surgery; seven (28%) of the twenty-five patients had substantial loss of shoulder motion. Meehan and Petersen reported that preoperative pain was decreased by the soft-tissue revision procedure. The results of the present series regarding restoration of glenohumeral stability compare favorably with the outcomes in those series[13-15].

Our study had a number of limitations. Although the number of subjects is relatively large compared with other reports of revision anterior shoulder instability surgery, the cohort was too small and the follow-up was too short for us to evaluate all of the factors affecting the outcome of treatment. This study did not address the treatment of recurrence of instability associated with insufficiency of the subscapularis tendon and muscle, or patients with voluntary instability. The Latarjet procedure was not compared with other procedures used to restore stability after glenohumeral instability recurrence after previous surgical treatment.

The findings of this study indicate that the Latarjet procedure, as a revision to address recurrence of anterior shoulder instability after previous operative repair associated with defects of the anterior glenoid rim and an intact subscapularis muscle, satisfactorily restores glenohumeral stability. A Hill-Sachs lesion was not an exclusion criterion in this study. We never surgically addressed the Hill-Sachs lesion, and we did not specifically study the potential effect of these lesions on the results. Persistent pain was the main reason for an unsatisfactory outcome. Patients have to be specifically evaluated for the presence and cause of pain before revision, and they need to be informed that pain may not be improved. Although it was not related to pain in this relatively short-term follow-up study, the documented progression of glenohumeral osteoarthritis may ultimately become a factor influencing clinical outcome.

Appendix

eA A description of the operative technique is available with the online version of this article as a data supplement at jbjs.org. ■

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